

CHAPTER THREE

Facility Requirements





Table of Contents

3.1. Chapter Introduction	5
3.2. Critical Design Aircraft	5
3.3. Airside Facilities	6
3.3.1. Runway Requirements	6
3.3.1.1. Runway Dimensions	6
3.3.1.2. Runway Orientation	9
3.3.1.3. Runway Length Analysis	9
3.3.1.4. Runway Safety Area (RSA)	17
3.3.1.5. Runway Object Free Area (ROFA)	19
3.3.1.6. Runway Protection Zone (RPZ)	20
3.3.1.7. Runway Obstacle-Free Zone (ROFZ)	22
3.3.1.8. Inner-Approach OFZ (IA-OFZ)	23
3.3.1.9. Hold Lines	23
3.3.1.10. Runway to Taxiway Separation	25
3.3.2. Taxiway and Taxilane Requirements	26
3.3.2.1. Taxiway Design Group (TDG)	26
3.3.2.2. Taxiway Width and Shoulder Width	27
3.3.2.3. Taxiway Edge Safety Margin (TESM)	27
3.3.2.4. Taxilane Requirements	28
3.3.2.5. Taxiway/Taxilane Safety Area (TSA)	28
3.3.2.6. Taxiway/Taxilane Object Free Area (TOFA and TLOFA)	28
3.3.2.7. Taxiway/Taxilane Geometry and Runway Incursion Mitigation (RIM)	29
3.3.2.8. FAA Hot Spots	31
3.3.2.9. Taxiway/Taxilane and Apron Markings	32
3.3.3. Floodwall	36
3.3.3.1. Airfield Operational Impacts of Floodwall Deployment	36
3.3.3.2. Summary of Initial Findings of the Floodwall Feasibility Study	36
3.3.3.3. Future Flood Mitigation Strategy and Recommendations	37
3.3.4. Airfield Lighting and NAVAIDs	38
3.3.4.1. Airfield Lighting	38
3.3.4.2. NAVAIDS	38
3.3.4.3. Approach Procedures	39



3.4. Airfield Demand and Capacity	40
3.4.1. Airfield Capacity Calculation Factors	40
3.4.1.1. Runway Configuration.....	41
3.4.1.2. Weather.....	42
3.4.1.3. Aircraft Fleet Mix	43
3.4.1.4. Touch-and-Go Operations	44
3.4.1.5. Percent of Aircraft Arrivals	44
3.4.1.6. Location of Exit Taxiways.....	45
3.4.1.7. Runway Occupancy Time	45
3.4.1.8. Average Approach Speeds	46
3.4.1.9. Arrival and Departure Aircraft Separation	46
3.4.1.10. Arrival and Departure Buffers.....	47
3.4.1.11. Average Arrival Deceleration Rate and Departure Acceleration Rate.....	47
3.4.1.12. Length of Common Approach	48
3.4.2. Annual Service Volume (ASV)	48
3.4.2.1. Hourly Capacity.....	49
3.4.3. Capacity Conclusion	50
3.5. Pavement Condition Analysis	54
3.6. Landside Facilities	56
3.6.1. Hangar Requirements	56
3.6.2. Apron Requirements	59
3.6.3. Fuel Facilities	59
3.6.4. Access and Parking	59
3.6.5. Minnesota Army National Guard Facility.....	60
3.6.6. Support Facilities.....	60
3.6.6.1. Fencing and Security	60
3.6.6.2. Maintenance Facilities.....	60
3.6.6.3. Terminal/Administration Building.....	61



List of Figures

Figure 3.1 - 75% of Fleet at 60 or 90% Useful Load 13

Figure 3.2 - 100% of Fleet at 60 or 90% Useful Load 14

Figure 3.3 - Airside Non-Standard Conditions (Standard Configuration) 34

Figure 3.4 - Airside Non-Standard Conditions (Floodwall Configuration).....35

Figure 3.5 - Intersecting Runway Scenarios.....42

Figure 3.6 - Single Runway Configuration Table.....48

Figure 3.7 - Annual Service Volume (ASV) Summary.....53



List of Tables

Table 3.1 -	Critical Design Aircraft Specifications	5
Table 3.2 -	Runway Dimensional Standards – Standard Configuration	8
Table 3.3 -	Runway Dimensional Standards – Floodwall Configuration	8
Table 3.4 -	STP Fleet Mix (2024)	12
Table 3.5 -	Base Runway Length Requirements – Aircraft over 60,000 lbs. MTOW	15
Table 3.6 -	Base Runway Length Requirements – 75% and 100% of Fleet	15
Table 3.7 -	Adjusted Runway Length Requirements	16
Table 3.8 -	Floodwall Configuration Declared Distances Reductions	17
Table 3.9 -	Runway Safety Area (RSA) Dimensional Standards	18
Table 3.10 -	Runway Safety Area (RSA) Deficiencies	18
Table 3.11 -	Runway Object Free Area (ROFA) Dimensional Standards	19
Table 3.12 -	Runway Object Free Area (ROFA) Deficiencies	20
Table 3.13 -	Runway Protection Zone (RPZ) Dimensions	21
Table 3.14 -	Runway Protection Zone (RPZ) Incompatible Land Uses	22
Table 3.15 -	Pattern A Hold Line Separation	24
Table 3.16 -	Pattern C Hold Line Deficiencies	25
Table 3.17 -	Existing and Future Runway-to-Taxiway Separations and APRC / DPRC	26
Table 3.18 -	Taxiway/Taxilane Object Free Area (TOFA and TLOFA) Deficiencies	29
Table 3.19 -	Taxiway/Taxilane Geometric Deficiencies and Runway Incursion Risk	31
Table 3.20 -	Existing FAA Hot Spots at STP	32
Table 3.21 -	Taxiway/Taxilane and Apron Marking Deficiencies	33
Table 3.22 -	Instrument Approach Procedure Inventory	39
Table 3.23 -	Reported Weather Conditions, 2015–2024	43
Table 3.24 -	Fleet Mix Class Percentages	44
Table 3.25 -	Arrival-Arrival Aircraft Separation Standards	47
Table 3.26 -	Projected ASV and Delay by Runway Operating Scenario, AC Method	49
Table 3.27 -	Hourly Capacity by Runway Operating Scenario, AC Method	50
Table 3.28 -	Airfield Capacity Summary, AC Method	51
Table 3.29 -	Airfield Capacity Summary, ACRP Method	52
Table 3.30 -	Pavement Facilities with PCI 21 – 80 (2024)	55
Table 3.31 -	Runway Weight Bearing	56
Table 3.32 -	Storage Space Requirements by Aircraft Type (Square Feet)	57
Table 3.33 -	Forecasted Aircraft Storage Space Requirements	58

3.0 Facility Requirements

3.1. Chapter Introduction

This chapter forms a component of the Saint Paul Downtown Airport (STP or “the Airport”) 2045 Long-Term Plan (LTP) Update that bridges the gap between the Airport’s current capabilities and its projected future needs. The main purpose of identifying facility requirements is to identify what infrastructure and services will be needed to accommodate forecasted aviation demand safely, efficiently, and sustainably.

3.2. Critical Design Aircraft

The critical design aircraft is a foundational concept in airport design and planning. It is not necessarily the largest aircraft that operates at an Airport, but rather the combination of regular-use aircraft types that establish design standards for various runway and taxiway dimensions, pavement strength, separation distances, and safety areas. It also determines the airport’s design group classification, which guides compliance with FAA standards and affects funding eligibility. Accurately defining the critical aircraft ensures that infrastructure is appropriately scaled to meet operational needs while maintaining safety and efficiency.

Based on recent operational activity and the forecast data presented in the preceding chapter, the existing and future critical aircraft for STP is classified with an Aircraft Approach Category (AAC) of C and an Airplane Design Group (ADG) of III. Based on operational activity, the Gulfstream V represents the Airport’s critical aircraft. This aircraft also determines the Airport’s existing Taxiway Design Group (TDG) classification of 2B. However, as MAC intends for its taxiway system at STP to transition toward a future TDG 3 standard to accommodate the existing based Embraer 170, that aircraft is identified as the ultimate critical aircraft for taxiway design considerations. Detailed specifications for both aircraft are provided in **Table 3.1**.

Table 3.1 - Critical Design Aircraft Specifications

Category	Critical Aircraft	Representative Aircraft	Specifications	Specifications	2024 Operations	2045 Operations ^(a)
AAC (Existing and Future)	C	Gulfstream V	Tail Height: 25.8 ft	Wingspan: 93.5 ft	1,479	1,915
ADG (Existing and Future)	III	Gulfstream V	Approach Speed: 136 knots	Approach Speed: 136 knots	1,479	1,915
TDG (Existing)	2B	Gulfstream V	MGW: 16.9 ft	CMG: 43.8 ft	1,314	1,681
TDG (Future)	3	Embraer 170	MGW: 20.5 ft	CMG: 38.8 ft	115	146

Sources:

MAC Noise and Operations Monitoring System (MACNOMS).

FAA Aircraft Characteristics Database, August 2025.

Kimley-Horn, 2025.

Notes:

AAC = Aircraft Approach Category; ADG = Airplane Design Group; TDG = Taxiway Design Group; MGW = Main Gear Width; CMG = Cockpit to Main Gear Distance

(a) 2045 Operations inclusive of all operations in respective categories.

These classifications directly influence the design standards for runways, taxiways, aprons, and safety areas, as well as pavement strength and separation distances. In the following sections, these aircraft characteristics are used to guide the sizing and configuration of airfield infrastructure at STP.

3.3. Airside Facilities

For the purposes of this LTP Update, airside facilities are defined to encompass the runway and taxiway network, safety areas, and associated infrastructure such as airfield lighting, visual guidance systems, and navigational aids (NAVAIDs). While aircraft aprons and storage hangars physically reside within the airfield boundary, they are evaluated as landside components due to their functional relationship with vehicular access and parking.

The following sections assess the capacity of existing airside infrastructure to support current and projected aviation activity and identify facility enhancements necessary to meet demand through the planning horizon of 2045. All recommendations are developed in alignment with applicable FAA airport design standards to ensure regulatory compliance and operational safety.

3.3.1. Runway Requirements

The existing runway system was previously detailed in **Chapter 1 – Inventory of Existing Conditions**. This section identifies the runway infrastructure necessary to meet forecasted demand, including considerations for runway dimensions, pavement strength, crosswind coverage, and safety area requirements.

As part of the facility requirements analysis, a thorough evaluation of the airfield's geometry was conducted to compare current conditions against FAA dimensional standards associated with the planned Runway Design Code (RDC) for each runway. Any discrepancies between existing infrastructure and design standards are noted in the following subsections. Recommended mitigation strategies for identified deficiencies are presented in **Chapter 4 – Alternatives**.

3.3.1.1. Runway Dimensions

Runway and shoulder widths, as well as blast pad dimensions, are determined based on the runway's AAC, ADG, and the lowest applicable visibility minimums. Design standards are outlined in FAA Advisory Circular (AC) 150/5300-13B, Airport Design – Change 1 (referred to throughout this chapter as "13B"). Runway length requirements follow guidance in AC 150/5325-4B, Runway Length Requirements for Airport Design, and are addressed in **Section 3.3.1.3**.

Runway Widths

- **Runway 14/32** is 150 feet wide, meeting FAA design standards for both existing and future critical aircraft.
- **Runway 13/31** is 150 feet wide and exceeds the FAA standard of 60 feet for the runway's existing and future critical aircraft. If the current width is maintained, the excess portion may not qualify for FAA Airport Improvement Program (AIP) funding.

- **Runway 9/27** is 100 feet wide and exceeds the FAA standard of 60 feet for its existing and future critical aircraft. Like Runway 13/31, the excess width may not be eligible for AIP funding if retained.

Runway Shoulders

Runway shoulders help prevent soil erosion, reduce the risk of foreign object debris (FOD) ingestion, and support maintenance and emergency vehicle access. According to 13B, paved shoulders are recommended for runways with an ADG-III critical aircraft and are not required until a runway has an ADG-IV critical aircraft or above. For runways accommodating ADG-I and ADG-II aircraft (such as Runways 13/31 and 9/27), turf or stabilized soil shoulders are recommended.

- **Runway 14/32:** Equipped with 20-foot-wide turf shoulders, meeting FAA standards for its existing and future critical aircraft.
- **Runway 13/31:** Features 10-foot-wide turf shoulders, meeting FAA standards for its existing and future critical aircraft.
- **Runway 9/27:** Also features 10-foot-wide turf shoulders, meeting FAA standards for its existing and future critical aircraft.

Blast Pads

Blast pads mitigate erosion caused by jet blast and propeller wash. For runways serving ADG-I to ADG-III aircraft, blast pads may be unpaved and composed of turf or stabilized soil. All blast pads should be designed to promote proper drainage away from the runway.

- **Runway 14/32:** Blast pads are located at both ends of the runway. The Runway 14 blast pad is 150 feet wide by 500 feet long while the Runway 32 blast pad is 170 feet wide by 342 feet long. These dimensions exceed FAA standards for its existing and future critical aircraft of 140 feet by 200 feet.
- **Runway 13/31:** A paved blast pad is located at the Runway 31 end, measuring 150 feet by 170 feet, exceeding the FAA standard for its existing and future critical aircraft of 80 feet by 60 feet. The excess may not qualify for AIP funding. The Runway 13 end lacks a designated blast pad; however, the area should be designated as a turf blast pad and graded per AC 150/5370-10H standards, if MAC continues to operate Runway 13/31 long-term.
- **Runway 9/27:** Blast pads are located at both ends of the runway. The Runway 9 blast pad is 120 feet wide by 225 feet long while the Runway 27 blast pad is 100 feet wide by 150 feet long. These dimensions exceed FAA standards for its existing and future critical aircraft of 80 feet by 60 feet.

Table 3.2 and **Table 3.3** summarize the current runway dimensional standards as well as standards when the floodwall is deployed, respectively. These dimensions present no current deficiencies.

**Table 3.2 - Runway Dimensional Standards – Standard Configuration**

Design Criteria	Runway 14		Runway 32		Runway 13		Runway 31		Runway 9		Runway 27	
	Existing	Standard	Existing	Standard	Existing	Standard	Existing	Standard	Existing	Standard	Existing	Standard
Runway Design Code (RDC)	C-III-4000	C-III-4000	C-III-4000	C-III-4000	A-I Small-VIS	A-I Small-VIS	A-I Small-VIS	A-I Small-VIS	A-I Small-VIS	A-I Small-VIS	A-I Small-VIS	A-I Small-VIS
Runway Width	150 ft	150 ft	150 ft	150 ft	150 ft	60 ft	150 ft	60 ft	100 ft	60 ft	100 ft	60 ft
Shoulder Width	20 ft	20 ft	20 ft	20 ft	10 ft	10 ft	10 ft	10 ft	10 ft	10 ft	10 ft	10 ft
Blast Pad Width	150 ft	140 ft	170 ft	140 ft	80 ft (Turf)	80 ft	150 ft	80 ft	120 ft	80 ft	100 ft	80 ft
Blast Pad Length	500 ft	200 ft	342 ft	200 ft	60 ft (Turf)	60 ft	170 ft	60 ft	225 ft	60 ft	150 ft	60 ft

Sources:

FAA Airport Data Information Portal (ADIP), August 2025; Kimley-Horn, 2025.

Table 3.3 - Runway Dimensional Standards – Floodwall Configuration

Design Criteria	Runway 14		Runway 32		Runway 13	Runway 31	Runway 9	Runway 27
	Existing	Standard	Existing	Standard	Existing	Existing	Existing	Existing
Runway Design Code (RDC)	C-III-4000	C-III-4000	C-III-4000	C-III-4000	NOTAM'd Closed	NOTAM'd Closed	NOTAM'd Closed	NOTAM'd Closed
Runway Width	150 ft	150 ft	150 ft	150 ft				
Shoulder Width	20 ft	20 ft	20 ft	20 ft				
Blast Pad Width	150 ft	140 ft	None	None				
Blast Pad Length	500 ft	200 ft	None	None				

Sources:

FAA Airport Data Information Portal (ADIP), August 2025; Kimley-Horn, 2025.



3.3.1.2. Runway Orientation

As noted in **Chapter 1**, the FAA recommends that a runway's orientation should provide at least 95% wind coverage for the aircraft that regularly use the airport. Runway designations reflect the magnetic heading at the time of construction (e.g., Runway 14/32 corresponds to headings of 140 and 320 degrees). Over time, the Earth's magnetic lines shift, causing the true runway headings to change while the runway's designation remains the same. Therefore, the wind coverage analysis for existing conditions uses the current true headings. In the example of Runway 14/32, this would be 146 and 326 degrees.

Since the recommended RDCs for all runways remain unchanged from the existing, the wind analysis presented in **Chapter 1** is sufficient for determining facility requirements. All runway configurations at the airport—except for a single Runway 9/27 orientation—meet FAA crosswind coverage standards. Because the MAC does not intend to operate the airport in a single Runway 9/27 configuration, this scenario is excluded from consideration. As a result, STP's runway system is adequate to accommodate existing and future activity.

In April 2025, the FAA published a Reauthorization Program Guidance Letter (R-PGL) 25-01: Runway Projects, that explained and implemented provisions in the FAA Reauthorization Act of 2024 impacting eligibility related to certain runway projects and introduced a new "Legacy Crosswind Runway" designation. This designation may be applicable to those runways that are not parallel to a primary runway when the primary runway alone achieves 95% or greater wind coverage and depicted on an airport's most recently approved Airport Layout Plan. An FAA Airports District Office (ADO) will consider a runway to be eligible and justified Legacy Crosswind Runway if the following three criteria are all met:

1. The primary runway alone has greater than 95% all-weather wind coverage per AC 150/5300-13B;
2. Justification is limited to a single Legacy Crosswind Runway at an airport. However, if an airport already has a Crosswind Runway as identified above, then a Legacy Crosswind Runway is not justified; and
3. The Legacy Crosswind Runway must have received AIP funding for construction, rehabilitation, or reconstruction in prior fiscal years to be justified under this provision.

Based on the FAA's forecast approval letter, Runway 9/27 has "legacy crosswind" status. Runway 13/31 does not have the legacy crosswind status. It should be noted that Primary Runway 14/32 provides 94.91% coverage for the 10.5 knot (A-I small aircraft) crosswind component. However, based on the legacy crosswind status of Runway 9/27, a crosswind runway will be eligible for future FAA funding.

3.3.1.3. Runway Length Analysis

Runway length requirements are influenced by a variety of factors, including aircraft type and performance capabilities, flap settings, maximum takeoff weight (MTOW), airport elevation, runway gradient, and weather conditions such as surface condition and air temperature. Additionally, aircraft seat capacity, the weight of the regular use aircraft in the operational fleet, and the mean daily maximum temperature of the hottest month at the Airport are considered. These requirements are analyzed in accordance with AC 150/5325-4B, Runway Length Requirements for Airport Design (referred to in this



section as “4B”), which outlines three methodologies for determining appropriate runway lengths based on the weight classifications of aircraft expected to use the runway.

Runway length requirements are applicable to both aircraft takeoffs and landings. However, after preliminary analysis of the operational fleet at STP, it was determined that required runway lengths for takeoffs were more demanding in all aircraft categories compared to landings. Therefore, requirements for aircraft takeoffs were applied in this analysis and are summarized in this section.

FAA Guidance

FAA AC 4B outlines three methodologies for determining runway length requirements based on the MTOW of aircraft expected to use the runway. Chapter 2 of 4B addresses aircraft with MTOWs of 12,500 pounds or less, Chapter 3 of 4B covers aircraft with MTOWs between 12,500 and 60,000 pounds, and Chapter 4 of 4B provides guidance for regional jets and aircraft exceeding 60,000 pounds. Since STP routinely accommodates aircraft across all three categories, each chapter was consulted during the analysis.

Additionally, 4B presents a five-step process to determine runway length recommendations for critical design aircraft, regardless of the methodology used.

1. Step one involves identifying the critical aircraft expected to regularly use the runway over the planning period.
2. Step two focuses on selecting aircraft that require the longest runway at MTOW, with different methodologies applied based on whether MTOW is above or below 60,000 pounds.
3. Step three categorizes aircraft by MTOW to determine the appropriate design approach—either by airplane family group or individual aircraft—and directs planners to relevant chapters or manufacturer airport planning manuals (APMs).
4. Step four involves selecting the recommended runway length based on the applicable chapter’s guidance.
5. Finally, Step five applies necessary adjustments, such as for runway gradient, to finalize the recommended length.

Runway 14/32

To determine the recommended length for Runway 14/32, city pair traffic flow management system counts (TFMSC) departures stage data was analyzed for calendar year 2024. This information included stage lengths and the number of flights per aircraft at that stage length. To develop a well-rounded picture of the runway length needs at the Airport, the fleet mix was analyzed from four different perspectives.

1. **Substantial Use Aircraft:** 4B states that a critical design airplane must have at least 500 annual itinerant operations at the airport to be considered for runway length determinations. These operations include both landings and takeoffs, counted separately. The threshold applies to either an individual aircraft or a family grouping of aircraft. Individual aircraft constituting substantial use may also be found in one of the following three categories.
2. **75% of Fleet:** According to Chapter 3 of 4B, the 75% of fleet group refers to the most used aircraft within the weight category of more than 12,500 pounds up to and including 60,000 pounds. 4B provides 75% fleet runway length charts that represent the runway length requirements for the most used aircraft in this weight category, assuming either 60% or 90% useful load.



3. **Top 25% of Fleet:** 4B also identifies the portion of aircraft within the weight category of more than 12,500 pounds up to and including 60,000 pounds that are not included in the 75% fleet curves. This remaining 25% of the fleet (i.e., the top 25%) includes aircraft that are larger, heavier, or require longer runway lengths due to performance characteristics. While these aircraft are typically used less frequently at many general aviation (GA) airports, a significant portion of annual operations at STP are conducted by aircraft in this category.
4. **Other Heavy Aircraft (Over 60,000 pounds MTOW).** To identify runway length requirements for aircraft with a MTOW greater than 60,000 pounds, Chapter 4 of 4B emphasizes the use of aircraft-specific performance data. Takeoff performance charts for these aircraft are gathered from sources such as specific aircraft APMs or manufacturer websites. STP records a high number of operations by aircraft in this category annually.

The 2024 operations by aircraft in these categories are summarized below in **Table 3.4**.



Table 3.4 - STP Fleet Mix (2024)

Aircraft Type	Operations	MTOW (lbs.)
Substantial Use Individual Aircraft^(a)		
C56X - Cessna Excel/XLS	1,117	20,200
GLF5 - Gulfstream V/G500	988	90,500
F2TH - Dassault Falcon 2000	800	42,400
E55P - Embraer Phenom 300	722	17,968
BE40 - Raytheon/Beech Beechjet 400/T-1	641	16,100
C68A - Cessna Citation Latitude	571	30,800
Top 25% of Fleet up to 60,000 lbs.		
H25B - BAe HS 125/700-800/Hawker 800	256	28,000
C750 - Cessna Citation X	244	36,100
CL60 - Bombardier Challenger 600/601/604	219	47,600
GALX - IAI 1126 Galaxy/Gulfstream G200	190	35,650
LJ60 - Bombardier Learjet 60	100	22,750
C650 - Cessna III/VI/VII	90	23,000
75% of Fleet up to 60,000 lbs.		
CL30 - Bombardier (Canadair) Challenger 300	488	38,850
C680 - Cessna Citation Sovereign	384	30,300
CL35 - Bombardier Challenger 300	283	40,600
F900 - Dassault Falcon 900	217	49,000
C560 - Cessna Citation V/Ultra/Encore	209	16,300
LJ45 - Bombardier Learjet 45	160	21,500
FA50 - Dassault Falcon/Mystère 50	156	39,700
LJ40 - Learjet 40; Gates Learjet	98	21,000
C550 - Cessna Citation II/Bravo	89	15,100
Other Heavy Aircraft (Over 60,000 lbs. MTOW)		
GA6C - G-7 Gulfstream G600	189	94,600
GLF4 - Gulfstream IV/G400	173	73,200
FA7X - Dassault Falcon F7X	131	70,000
E170 - Embraer 170	94	79,344
GA5C - G-7 Gulfstream G500	72	79,600
GLF6 - Gulfstream	71	99,600
GLEX - Bombardier BD-700 Global Express	61	99,500

Sources:

MAC Noise and Operations Monitoring System (MACNOMS).
 FAA Aircraft Characteristics Database, August 2025.
 Traffic Flow Management System Counts (TFMSC) for calendar year 2024.
 Kimley-Horn, 2025.

Notes:

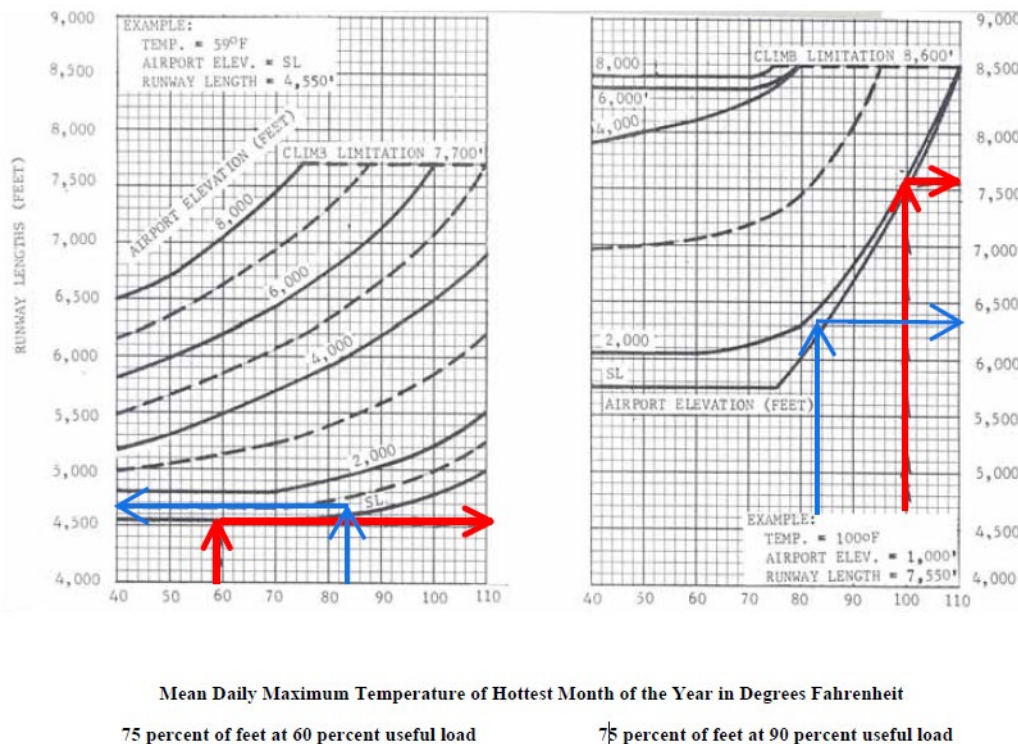
(a) Individual aircraft with at least 500 annual itinerant operations.
 MTOW = Maximum Takeoff Weight.



For each of the aircraft in **Table 3.4**, useful load factors and takeoff weights were calculated based on aircraft characteristics and on stage length information for each recorded flight. This information was used in conjunction with the Airport's airfield elevation of 705.4 feet above sea level (ASL) and the maximum mean day temperature for Saint Paul, MN (83.2° F) to identify recommended runway lengths—assuming dry conditions and zero runway gradient—for each aircraft in the fleet mix through the methodologies discussed below.

- **Aircraft Performance Manuals (APMs):** Where available, APM takeoff performance charts were referenced for each departure by aircraft in the fleet mix. For aircraft over 60,000 pounds MTOW, this methodology was used exclusively. For aircraft in the 75% of fleet or top 25% of fleet whose APM was also available, the runway length recommended by the APM took precedence, as these charts typically provide the most accurate representation of actual takeoff performance.
- **4B Chapter 3 – 75% fleet Methodology:** 4B provides charts to determine runway length to accommodate the aircraft in this category based on airfield elevation and the maximum mean day temperature at the airport at both 60% and 90% useful load. The results of this methodology are shown in **Figure 3.1** below.

Figure 3.1 -75% of Fleet at 60 or 90% Useful Load



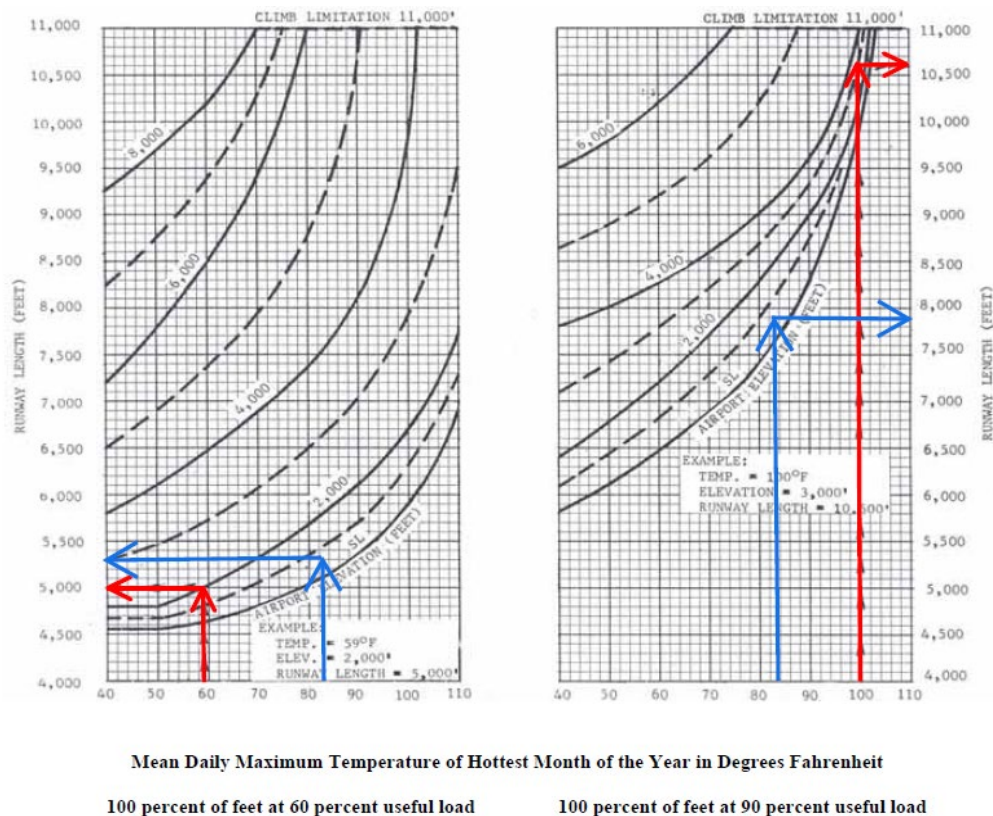
Sources:
FAA Advisory Circular 150/5325-4B, Runway Length Requirements for Airport Design.
Kimley-Horn, 2025.

Legend:
→ STP analysis
→ FAA example



- **4B Chapter 3 – 100% fleet Methodology:** Similarly, 4B includes runway takeoff distance charts that represent the most demanding 25% of aircraft in the fleet. These charts show the runway lengths required for a fleet mix that includes substantial use by one or more of these aircraft, evaluated at both 60% and 90% useful load. The results of this methodology are presented in **Figure 3.2** below.

Figure 3.2 - 100% of Fleet at 60 or 90% Useful Load



Sources:
FAA Advisory Circular 150/5325-4B, Runway Length Requirements for Airport Design.
Kimley-Horn, 2025.

Legend:
STP analysis
FAA example

Using these methodologies, the analysis concluded that aircraft over 60,000 pounds required anywhere between 3,500 feet and 6,500 feet of runway for takeoff depending on the stage length as shown in **Table 3.5**. Aircraft in the 75% of fleet required 4,700 feet of runway for takeoff at 60% useful load and 6,350 feet at 90% useful load. Aircraft in the top 25% of fleet required 5,300 feet of runway for takeoff at 60% useful load, and 7,900 feet at 90% useful load. Results are summarized in the following **Table 3.6**.

**Table 3.5 - Base Runway Length Requirements – Aircraft over 60,000 lbs. MTOW**

Aircraft	Longest Runway Length Required ^(a)	Total Number of Operations
GLEX - Bombardier BD-700 Global Express	6,500 ft.	61
GLF5 - Gulfstream V/G500	5,800 ft.	988
E170 - Embraer 170	5,500 ft.	94
GLF4 - Gulfstream IV/G400	4,200 ft.	173
GLF6 - Gulfstream G650	3,500 ft.	71

Sources:

FAA Advisory Circular 150/5325-4B, Runway Length Requirements for Airport Design.

MAC Noise and Operations Monitoring System (MACNOMS).

FAA Aircraft Characteristics Database, August 2025.

Traffic Flow Management System Counts (TFMSC) for calendar year 2024.

Kimley-Horn, 2025.

Notes:

(a) Based on stage length information from TFMSC.

MTOW = Maximum Takeoff Weight.

Table 3.6 - Base Runway Length Requirements¹ – 75% and 100% of Fleet

Family of Aircraft	60% Useful Load Base Requirement	Number of Takeoffs at 60% Useful Load	90% Useful Load Base Requirement	Number of Takeoffs at 90% Useful Load
75% of Fleet	4,700 ft.	2,101	6,350 ft.	549
100% of Fleet	5,300 ft.	729	7,900 ft.	224

Sources:

FAA Advisory Circular 150/5325-4B, Runway Length Requirements for Airport Design.

MAC Noise and Operations Monitoring System (MACNOMS).

FAA Aircraft Characteristics Database, August 2025.

Traffic Flow Management System Counts (TFMSC) for calendar year 2024.

Kimley-Horn, 2025.

The required base runway lengths for aircraft or aircraft families with substantial use (500 or more operations annually) were subsequently adjusted to account for runway gradient. According to 4B, required runway length increases at the rate of 10 feet for each foot of elevation difference between the high and low points of the runway centerline. At STP, the highest point of Runway 14/32 is 705 feet while the lowest point is 699.9 feet. This results in an adjustment of 50 feet. Additionally, for turbojet airplanes, regulations require that runway lengths from the “60% useful load” and “90% useful load” AC charts be increased by 15% in wet runway conditions, but only up to a maximum of 5,500 feet and 7,000 feet respectively. The resulting values are summarized in **Table 3.7**.

¹ Because the useful load percentage calculation assumes the aircraft retains the non-fuel portion of its maximum takeoff weight, the useful load factor in this analysis is best understood as a planning-level assumption, not an observed operational load factor. The TFMSC records provide flight distance, but they do not provide actual fuel, passenger, baggage, or cargo weights. As a result:

- The values used do not represent actual passenger occupancy.
- The values used do not represent actual takeoff weights.
- The methodology generally produces a conservative planning weight for evaluating runway-length needs.

**Table 3.7 - Adjusted Runway Length Requirements**

Aircraft or Family of Aircraft	Base Requirement	Runway Gradient Adjusted
GLF5 - Gulfstream V/G500	5,800 ft.	5,850 ft.
75% of Fleet at 60% Useful Load	4,700 ft.	4,750 ft.
75% of Fleet at 90% Useful Load	6,350 ft.	6,400 ft.
100% of Fleet at 60% Useful Load	5,300 ft.	5,350 ft.

Sources:*FAA Advisory Circular 150/5325-4B, Runway Length Requirements for Airport Design.**MAC Noise and Operations Monitoring System (MACNOMS).**FAA Aircraft Characteristics Database, August 2025.**Traffic Flow Management System Counts (TFMSC) for calendar year 2024.**Kimley-Horn, 2025.*

After comparing regular use aircraft and family of aircraft adjusted runway length requirements, it is determined that the 75% of fleet family of aircraft at 90% useful load constitutes the most demanding grouping of aircraft that constitutes regular use at the airport. Because the additional wet runway adjusted requirement applies only to landings and landing distance requirements at STP were shorter than takeoff distance requirements, it is determined that a runway gradient adjusted requirement of 6,400 feet applies to Runway 14/32. This runway's existing standard configuration length is 6,491 feet.

Based on these analyses, it was determined that a runway length of 6,400 feet for primary Runway 14/32 is sufficient to accommodate both current and future operational needs in the airfield's standard configuration. However, when the floodwall is deployed, the available runway length is reduced to 5,340 feet, which does not meet existing or projected demand. Due to the temporary and seasonal nature of floodwall deployment, as well as other non-standard conditions identified in this chapter, the alternatives presented in **Chapter 4** attempt to maximize the existing length of Runway 14/32 to the extent possible for both standard and floodwall-deployed conditions.

Runways 13/31 and 9/27

As outlined in **Section 3.3.1.1**, the RDC for Runways 13/31 and 9/27 at the Airport is A-I Small-VIS. This designation reflects the typical aircraft operations on these runways, which primarily involve aircraft with a MTOW at 12,500 pounds or less and approach speeds of 50–90 knots.

Per Chapter 2 of 4B, runway length recommendations for this aircraft category are determined using runway length curve charts. These charts require inputs including:

- Airport community size
- Average number of passenger seats per aircraft
- Airport elevation
- Maximum mean daily temperature

For STP, the average number of passenger seats for aircraft using Runways 13/31 and 9/27 is fewer than 10, and the airport is situated on the fringe of a major metropolitan area. Therefore, the 100% fleet usage chart is applicable. Based on the airport's elevation and maximum mean daily temperature, the analysis yields a recommended runway length of 3,700 feet. For aircraft in this weight category, no additional adjustments to the calculated runway length are necessary per the guidance provided in 4B.



It is recommended that the Airport pursue the 3,700-foot runway length objective for non-primary runways to the extent permitted by their proximity to the Mississippi River and other impediments/infrastructure. At the same time, it is important to note that most A-I (Small) aircraft can typically operate safely on shorter runways than 3,700 feet, and challenges with FAA AIP eligibility may influence the Sponsor's desire to meet this design standard.

Floodwall Configuration

As discussed in **Chapter 1**, STP features a distinctive flood protection system comprising a combination of permanent berms, fixed wall segments, and deployable temporary wall sections. This floodwall is designed to mitigate the risk of flooding from the adjacent Mississippi River, a recurring challenge given the Airport's location within a FEMA Zone AE floodplain. When deployed, the floodwall introduces a second existing condition on the airfield—one that imposes operational constraints across all three runways. Specifically, the presence of the floodwall results in a "closed" NOTAM for Runways 13/31 and 9/27, and reduces the available runway length and declared distances for Runway 14/32 (see **Section 1.4.4 of Chapter 1**), thereby constraining aircraft performance and overall operational flexibility. These limitations to Runway 14/32 are formally identified as deficiencies within the Airport's planning framework and are documented in **Table 3.8** and depicted in **Figure 3.4**. The values found in the "Index #" column of various tables in this section (**Section 3.3 – Airside Requirements**) correspond to the numbered non-standard conditions depicted in **Figures 3.3** and **3.4** at the end of **Section 3.3.2**.

Table 3.8 - Floodwall Configuration Declared Distances Reductions

Index # ^(a)	Facility	Location	Description	Floodwall Configuration		Disposition
				Down	Up	
48	RWY 14/32	RWY 32 Approach End	Lack of full-length runway usability for RWY 32 departures / Limited ASDA, LDA, TORA/TODA for RWY 14 operations		X	Floodwall realignment

Sources:

FAA Airport Data Information Portal (ADIP), August 2025.
Kimley-Horn, 2025.

Notes:

(a) Index number corresponds to non-standard conditions depicted in Figure 3.4.
ASDA = Accelerate-Stop Distance Available
LDA = Landing Distance Available
TORA = Takeoff Run Available
TODA = Takeoff Distance Available

As the Airport continues to evaluate long-term development and flood mitigation strategies, addressing the impacts of this second existing condition (floodwall up) will be essential to maintaining safe and efficient airport operations.

3.3.1.4. Runway Safety Area (RSA)

The Runway Safety Area (RSA) is a designated two-dimensional surface surrounding a runway, intended to enhance operational safety by minimizing the risk of aircraft damage in the event of an undershoot, overshoot, or runway excursion. It also facilitates access for firefighting and rescue vehicles during emergency situations. Per 13B, RSAs must meet the following criteria:

- Graded and cleared to eliminate hazardous surface variations.
- Properly drained through grading or storm sewer systems.
- Capable of supporting the critical aircraft and emergency response vehicles.



- Free of obstacles, except those classified as “fixed-by-function” (those necessary for air navigation or aircraft ground operations) such as runway and taxiway lights, signage, Precision Approach Path Indicators (PAPIs), Runway End Identifier Lights (REILs), and approach lighting systems. These objects must be essential for aircraft ground maneuvering or air navigation and, if present, must also be frangible - designed to break, distort, or yield upon impact.

Importantly, RSA design standards cannot be modified through the FAA’s Modification of Standards (MOS) process. A review of RSA compliance was conducted for each runway at the Airport. Dimensional standards are presented in **Table 3.9**, and any identified deficiencies are presented in **Table 3.10** and illustrated in **Figures 3.3** and **3.4** at the end of Section 3.3.2. Note that the tables group similar non-standard objects by proximity rather than quantity.

Table 3.9 - Runway Safety Area (RSA) Dimensional Standards

Characteristic	Runway 14/32		Runway 13/31		Runway 9/27	
	14	32	13	31	9	27
Runway Design Code (RDC)	C-III-4000		A-I-VIS		A-I-VIS	
RSA Width (Existing / Standard) (ft)	500 / 500		120 / 120		120 / 120	
RSA Length Prior to Threshold (Existing / Standard) (ft)	600 / 600	600 / 600	240 / 240	240 / 240	240 / 240	240 / 240
RSA Length Beyond Departure End (Existing / Standard) (ft)	340 / 340 ^(a)	500 / 500 ^(a)	240 / 240	240 / 240	240 / 240	240 / 240

Sources:

FAA Advisory Circular 150/5300-13B, Change 1 - Airport Design.

FAA Runway Safety Area Determination (RSAD), 2026

FAA Airport Data Information Portal (ADIP), August 2025.

Kimley-Horn, 2025.

Notes:

(a) FAA Advisory Circular 150/5300-13B, Change 1 - Airport Design authorizes this dimension to equal the length between the runway departure end and the end of an installed engineered materials arresting system (EMAS) in lieu of the standard 1,000-foot length required for runway 14/32.

Table 3.10 - Runway Safety Area (RSA) Deficiencies

Index # ^(a)	RWY End Location	Object(s)	Description	Floodwall Configuration		Disposition
				Down	Up	
1	32	River	Southeast corner of RSA extends over property line and river (Nonstandard RSA grading; Barge parking could result in RSA penetration)	X		Shift RWY End / FAA RSAD determination
2	14	Runway 13/31	RWY 13 end intrudes on RSA to the east of RWY 14 and nonstandard RSA gradient at RWY 13 end	X	X	Shift/Remove Runway 13/31
5	14	Localizer Shelter, VSR	Localizer Shelter VSR on RWY 14 end within the RSA	X	X	Relocate Shelter
9	9	VSR	Vehicle service road connected to runway within the RSA	X	X	Removal

Sources:

FAA Advisory Circular 150/5300-13B, Change 1 - Airport Design.

FAA Runway Incursion Mitigation (RIM) Program.

Kimley-Horn, 2025.

Notes:

(a) Index number corresponds to non-standard conditions depicted in Figures 3.3 and 3.4.

EMAS = Engineered Materials Arresting System



3.3.1.5. Runway Object Free Area (ROFA)

The Runway Object Free Area (ROFA) is a two-dimensional rectangular zone centered on the runway surface. Its primary function is to provide wingtip clearance and protect aircraft in the event of a runway excursion by maintaining an area free of above-ground objects that extend beyond the nearest point of the RSA. While the ROFA must remain clear of obstructions, exceptions are made for objects that are fixed-by-function, provided they meet frangibility requirements.

Aircraft are permitted to taxi and hold within the ROFA. However, non-fixed-by-function objects such as parked aircraft and other permanent installations are not allowed within this area. The dimensions of the ROFA are determined by the runway's AAC and ADG, as outlined in 13B.

For Runway 14/32 at STP, which currently and in the future is designated as C-III, the ROFA measures 800 feet in width. It extends 500 feet beyond the departure end of Runway 14 and 340 feet beyond the departure end of Runway 32. Although the standard calls for a 1,000-foot extension beyond the departure end, 13B allows this dimension to equal the length between the runway departure end and the end of an installed engineered materials arresting system (EMAS). Since an EMAS is installed at both ends of Runway 14/32, the current ROFA dimensions are compliant with FAA design standards. ROFA dimensional standards and any identified deficiencies are detailed in **Tables 3.11** and **3.12**, respectively. Deficiencies are also illustrated in **Figures 3.3** and **3.4** at the end of **Section 3.3.2**.

Table 3.11 - Runway Object Free Area (ROFA) Dimensional Standards

Characteristic	Runway 14/32		Runway 13/31		Runway 9/27	
	14	32	13	31	9	27
Runway Design Code (RDC)	C-III-4000		A-I-VIS (SMALL)		A-I-VIS (SMALL)	
ROFA Width (Existing / Standard) (ft)	800 / 800		250 / 250		250 / 250	
ROFA Length Prior to Threshold (Existing / Standard) (ft)	600 / 600	600 / 600	240 / 240	240 / 240	240 / 240	240 / 240
ROFA Length Beyond Departure End (Existing / Standard) (ft)	340 / 340 ^(a)	500 / 500 ^(a)	240 / 240	240 / 240	240 / 240	240 / 240

Sources:

FAA Advisory Circular 150/5300-13B, Change 1 - Airport Design.

FAA Airport Data Information Portal (ADIP), August 2025.

Kimley-Horn, 2025.

Notes:

(a) FAA Advisory Circular 150/5300-13B, Change 1 - Airport Design authorizes this dimension to equal the length between the runway departure end and the end of an installed engineered materials arresting system (EMAS) in lieu of the standard 1,000-foot length required for runway 14/32.



Table 3.12 - Runway Object Free Area (ROFA) Deficiencies

Index # ^(a)	RWY End Location	Object(s)	Description	Floodwall Configuration		Disposition
				Down	Up	
2	14	RWY 13/31	RWY 13 end intrudes on ROFA to the east of RWY 14	X	X	Remove or shorten RWY 13/31
3	32	River	Southeast corner of ROFA extends over property line and river (Barge parking could result in ROFA penetration)	X		Shift RWY End
4	14	Fence	Northwest corner of ROFA extends over fence	X	X	MOS to be requested
4	14	Airport Road	Northwest corner of ROFA extends over Airport Road	X	X	MOS to be requested
6	14	Localizer Shelter	Localizer Shelter on the RWY 14 end	X	X	Relocate
6	14	VSR	VSR on the RWY 14 end	X	X	Relocate
6	14	Fence	Fence on the RWY 14 end	X	X	MOS to be requested
7	14	Glideslope Shelter	Glideslope shelter within ROFA	X	X	Evaluate ^(b)
8	32	Glideslope Antenna	Glideslope antenna located within the ROFA to east of RWY 32	X	X	Evaluate ^(b)
9	9	VSR	VSR connected to runway within the ROFA	X	X	Removal
47	32	Floodwall	Floodwall within the ROFA to east of RWY 32		X	Resubmit MOS for approval ^(c)

Sources:

FAA Advisory Circular 150/5300-13B, Change 1 - Airport Design.

FAA Runway Incursion Mitigation Program.

Kimley-Horn, 2025.

Notes:^(a) Index number corresponds to non-standard conditions depicted in Figures 3.3 and 3.4.^(b) Space constraints may necessitate locating a GS facility within a ROFA. An aeronautical study must be conducted to determine mitigation.^(c) 2016 Approved ALP denotes pending approval of MOS for floodwall to remain within Runway 14/32 ROFA. MAC seeks formal approval of this application.

DME = Distance Measuring Equipment

EMAS = Engineered Materials Arresting System

MOS = Modification of Standard

VSR = Vehicle Service Road

3.3.1.6. Runway Protection Zone (RPZ)

Runway Protection Zones (RPZs) are FAA-designated trapezoidal areas located beyond runway ends, intended to protect people and property on the ground. RPZs must remain free of incompatible land uses such as residential buildings, churches, fuel storage, public roads, and recreational facilities. These areas are ideally controlled by the airport sponsor through fee-simple acquisition, easements, or zoning restrictions to ensure safety and regulatory compliance. RPZ dimensions are based on the RDC. Their primary function is to protect ground-level safety, distinguishing them from RSA and ROFA, which focus on aircraft safety. Each runway end has two RPZs:

- **Approach RPZ:** Begins 200 feet before the landing threshold.
- **Departure RPZ:** Begins 200 feet from the end of the declared Takeoff Run Available (TORA).



At STP, Runways 13, 31, 9, and 27 have collocated approach and departure RPZs. Runway 14/32 features displaced thresholds, resulting in offset RPZs. **Table 3.13** provides specific RPZ dimensions. The Runway 13 RPZ lies entirely within Airport property, while others extend beyond the boundary. Ownership or easement-based control is preferred for managing land use. Public roads bisect the RPZs for Runways 14 and 9. These roadways are listed among other known incompatible land uses summarized in **Table 3.14** and depicted in **Figures 3.3** and **3.4** at the end of **Section 3.3.2**.

Table 3.13 - Runway Protection Zone (RPZ) Dimensions

Characteristic	Runway 14/32		Runway 13/31		Runway 9/27	
	14	32	13	31	9	27
Runway Design Code (RDC)	C-III-4000		A-I-VIS		A-I-VIS	
RPZ Inner Width (Approach / Departure) (ft)	1,000 / 500		250 / 250		250 / 250	
RPZ Outer Width (Approach / Departure) (ft)	1,510 / 1,010	1,510 / 1,010	450 / 450	450 / 450	450 / 450	450 / 450
RPZ Length (Approach / Departure) (ft)	1,700 / 1,700	1,700 / 1,700	1,000 / 1,000	1,000 / 1,000	1,000 / 1,000	1,000 / 1,000

Sources:

FAA Advisory Circular 150/5300-13B, Change 1 - Airport Design.

FAA Airport Data Information Portal (ADIP), August 2025.

Kimley-Horn, 2025.

**Table 3.14 - Runway Protection Zone (RPZ) Incompatible Land Uses**

Index # ^(a)	RWY End Location	Object(s)	Description	Floodwall Configuration		FAA Coord.
				Down	Up	
42	14 Apch RPZ	Industrial Structure	Northern edge of RPZ	X	X	N/A
	14 Apch RPZ	Industrial Structure	Northwest corner of RPZ	X	X	N/A
	14 Apch RPZ	Bayfield/Filmore Intersection	Northwest corner to the southeast corner of RPZ	X	X	N/A
	14 Apch RPZ	Airport Road	Southwest corner of RPZ	X	X	N/A
	14 Apch RPZ	Ridder Circle	Northern end of RPZ	X	X	N/A
	14 Apch RPZ	Railway	Western half of RPZ	X	X	N/A
	14 Apch RPZ	Railway	Northeast corner of RPZ	X	X	N/A
43	32 Dep RPZ	Industrial Structure	Northeast corner of RPZ	X	X	N/A
	32 Dep RPZ	Industrial Structure	Western edge of RPZ	X	X	N/A
	32 Dep RPZ	Bayfield Street	Southern end of RPZ	X	X	N/A
	32 Dep RPZ	Airport Road	Southwest corner of RPZ	X	X	N/A
	32 Dep RPZ	Ridder Circle	Northern end of RPZ	X	X	N/A
	32 Dep RPZ	Railway	Western half of RPZ	X	X	N/A
	32 Dep RPZ	Railway	Northeast corner of RPZ	X	X	N/A
44	32 Apch RPZ	Childs Road	Southeast corner of RPZ	X		N/A
45	14 Dep RPZ	Childs Road	Southeast corner of RPZ	X		N/A
46	9 Apch; 27 Dep RPZ	Airport Road	Eastern half of RPZ	X	X	N/A
	9 Apch; 27 Dep RPZ	Railway	Eastern half of RPZ	X	X	N/A
	9 Apch; 27 Dep RPZ	East Lafayette	Northern half of RPZ	X	X	N/A
	9 Apch; 27 Dep RPZ	Highway 52	Southwest corner of the RPZ	X	X	N/A

Sources:

FAA Advisory Circular 150/5300-13B, Change 1 - Airport Design.
Kimley-Horn, 2025.

Notes:

(a) Index number corresponds to non-standard conditions depicted in Figures 3.3 and 3.4.

Although several incompatible land uses are located within the RPZs, no mitigation is proposed as part of the LTP. These existing land uses may remain; however, under FAA Grant Assurance 21, the airport sponsor is expected to take proactive measures to prevent or mitigate the introduction of new incompatible land uses within the RPZ. On the Runway 14 end RPZ, the Airport holds aviation easements over the majority of parcels within the RPZ, excluding public rights-of-way, providing a mechanism to help control future development. On the Runway 32 end RPZ, the Airport holds permanent easements with the Port Authority along the shores of the Mississippi River; however, no easements are in place for the remaining portions of the river within the RPZ. Any future development or operational change that would introduce new incompatible land uses into an RPZ would require an Alternatives Evaluation and coordination with the FAA.

3.3.1.7. Runway Obstacle-Free Zone (ROFZ)

The Runway Obstacle-Free Zone (ROFZ) is a defined three-dimensional airspace centered along the runway centerline, extending 200 feet beyond each runway end. Its elevation corresponds to the



nearest point on the runway centerline, and its width is determined by the critical design aircraft, specifically considering aircraft weight classifications and visibility minimums. At STP, the ROFZ widths are 250 feet for Runways 13/31 and 9/27, and 400 feet for Runway 14/32.

Similar to the RSA, this zone must remain free of all objects except those essential for air navigation or aircraft ground operations. In accordance with FAA safety standards, penetration into the ROFZ is prohibited, with the exception of frangible NAVAIDs that are required to be located within the zone due to their operational function. Acceptable installations include runway and taxiway lighting, signage, PAPIs, REILs, and glide slope antennas. These installations are presumed to be mounted on frangible couplings, thereby conforming to ROFZ requirements.

However, certain components, such as PAPI power control units (PCUs), are not fixed-by-function and must be relocated outside the ROFZ to maintain compliance. Additional REIL equipment beyond the flasher light power units should also be repositioned outside the zone. At STP, there are no known violations of the ROFZ. It should be noted that the Runway 13 end sits within the Runway 14/32 ROFZ and the Runway 14 end is within the Runway 13/31 ROFZ, however, these are not considered non-standard conditions and are mitigated by standard hold markings and operational control from the ATCT.

3.3.1.8. Inner-Approach OFZ (IA-OFZ)

The Inner-Approach Obstacle Free Zone (IA-OFZ) represents a protected volume of airspace located along the approach path and is applicable only to runways equipped with an Approach Lighting System (ALS). This zone is designed to ensure that no objects, whether fixed or mobile, penetrate the critical airspace required for safe aircraft operations during final approach.

The IA-OFZ begins at a point 200 feet from the runway threshold, aligned with the threshold elevation. From this point, the surface rises at a 50:1 slope, extending outward to a location 200 feet beyond the last light fixture in the ALS. This geometry provides a clear and unobstructed corridor for aircraft transitioning from instrument flight to visual landing.

At STP, only Runway 14 is equipped with an ALS, making it the sole runway where IA-OFZ standards apply. All other runways rely on visual aids such as PAPIs and do not require these specific protected surfaces. Any applicable obstructions will be memorialized on the Airport Layout Plan (ALP).

3.3.1.9. Hold Lines

Runway hold lines are visual markings on airport pavements designed to prevent aircraft from inadvertently entering protected areas such as active runways or navigational surfaces. These markings consist of four yellow lines (two solid and two dashed) painted across taxiways at designated holding positions.

The solid lines are positioned on the taxiway side, indicating where aircraft must stop and await clearance from ATC before proceeding. The dashed lines are on the runway side, signifying the boundary of the protected area. This configuration ensures that pilots have a clear visual cue to hold short of the runway unless explicitly authorized to cross.



Their placement and visibility are governed by FAA standards, including those outlined in AC 150/5340-1M, Standards for Airport Markings and 13B, which specify marking dimensions, location criteria, and maintenance requirements. There are three patterns of hold lines: Pattern A, Pattern B, and Pattern C.

Pattern A

Pattern A runway hold lines are the most common configuration and consist of the standard four-line marking (two solid lines paired with two dashed lines) applied at taxiway or runway intersections. Commonly referred to as runway hold lines, this pattern is used to direct aircraft to stop prior to entering or crossing an active runway, as well as during land and hold short operations (LAHSO), where aircraft must stop before an intersecting runway or taxiway after landing. The location of Pattern A markings relative to the runway centerline is established based on the critical design aircraft and the runway's visibility minimums to ensure adequate clearance from protected surfaces. At towered airports, pilots must receive explicit air traffic control clearance prior to crossing these markings, reinforcing their role as a primary control point for runway entry.

Table 3.15 presents the Pattern A runway hold line separation standards and existing separation at STP. There are no deficiencies noted in Pattern A hold lines.

Table 3.15 - Pattern A Hold Line Separation

Runway	Runway Design Code (RDC)	Standard Separation	Existing Separation
14/32	C-III	250 ft.	250 ft.
13/31	A-I (SMALL)	125 ft.	200 ft./250 ft. ^(a)
9/27	A-I (SMALL)	125 ft.	125 ft./200 ft. ^(b)

Sources:

FAA Advisory Circular 150/5300-13B, Change 1 - Airport Design.
Kimley-Horn, 2025.

Notes:

- (a) All holding position markings prior to Runway 13/31 are 250 ft. from the runway centerline apart from the holding position markings on Taxiways D, G, and H which are 200 ft. from the runway centerline.
(b) All holding position markings prior to Runway 9/27 are 200 ft. from the runway centerline apart from the holding position markings on Taxiways W and H which are 125 ft. from the runway centerline.

It is important to note that the runway hold lines present on Taxiway D between Runways 14/32 and 13/31 are unusually placed due to overlapping RSAs. Rather than constituting a non-standard condition, these hold line placements are an area of Runway Incursion Mitigation (RIM) concern and constitute an FAA identified hot spot that is discussed further in **Section 3.3.2.7**.

Pattern B

Pattern B hold lines are distinguished by two parallel solid transverse lines connected by shorter perpendicular segments, creating a ladder-like configuration that enhances visibility and recognition. This pattern is used to indicate holding positions that protect critical navigational areas, such as the Instrument Landing System (ILS) sensitive area or the Precision Obstacle Free Zone (POFZ), where aircraft presence could interfere with approach guidance or required clearances. Pattern B markings instruct pilots to stop and hold short of these protected surfaces until clearance is received, even though a runway may not be immediately visible. They are typically applied at locations where taxiway geometry or airfield operations necessitate additional protection of instrument procedures.



Pattern B hold lines are present along the north ends of Taxiways A and E, protecting the Runway 14 glideslope and Instrument Takeoff Obstacle-Free Zone (IT-OFZ), as well as the south ends of Taxiways A and H protecting the Runway 32 glideslope and IT-OFZ. There are no deficiencies in the location of the Pattern B hold lines.

Pattern C

Pattern C hold lines are identified by a series of transverse dashed yellow lines extending across the taxiway surface. Commonly referred to as intermediate hold line markings, this pattern is used at taxiway-to-taxiway intersections or other locations where aircraft may need to pause or sequence for operational purposes. Unlike Patterns A and B, Pattern C does not protect a runway or navigational surface, but instead provides a visual cue for pilots to hold short at designated points on the taxiway system to support efficient ground movement and traffic management.

There are several Pattern C (intermediate) hold position markings located throughout the airfield; however, as summarized in **Table 3.16**, three locations do not meet current marking standards and require restriping. The identified deficiencies are described below:

- **Taxiway E (between the 3M and Momentum Aeronautics aprons):** An intermediate hold line is not present on the ingress/egress taxiway connecting Taxiways D and E to the apron area. An intermediate hold line should be installed at this location to provide appropriate control of aircraft movements between the apron and the Taxiways.
- **Taxiway E (South of Riverside Hangars):** A continuous taxiway edge marking currently separates Taxiway E from the adjacent apron pavement to the north, indicating that the apron is not intended for routine aircraft use. In practice, however, this apron is regularly used by jet aircraft for refueling and engine run-up activities. To better reflect actual operations and improve surface delineation, the existing edge marking should be replaced with an intermediate hold line to define the operational boundary between the apron and Taxiway E.

Table 3.16 - Pattern C Hold Line Deficiencies

Index # ^(a)	Facility	Location	Description	Floodwall Configuration		Disposition
				Down	Up	
20	TWY D	RWY 13/31 ↔ GA Apron	Missing Pattern C hold line	X	X	Repaint marking
24	TWY E	TWY P ↔ TWY N	Non-standard taxiway edge marking between Taxiway E and apron	X	X	Repaint marking

Sources:

FAA Advisory Circular 150/5300-13B, Change 1 - Airport Design.
 FAA Advisory Circular 150/5340-1M, Standards for Airport Markings.
 Kimley-Horn, 2025.

Notes:

(a) Index number corresponds to non-standard conditions depicted in Figures 3.3 and 3.4.
 GA = General Aviation

3.3.1.10. Runway to Taxiway Separation

Runway-to-taxiway separation refers to the minimum required distance between the centerline of a runway and the centerline of a parallel taxiway. The standards for this separation are defined by 13B



and are based on several factors: the RDC (AAC, ADG, plus visibility minimums), as well as the Approach Reference Code (APRC) and Departure Reference Code (DPRC).

APRC and DPRC are FAA-defined codes that describe the current operational capabilities of a runway and its adjacent taxiways without operational constraints. They are used to assess whether aircraft can operate on a runway, and whether taxiing aircraft can also occupy an adjacent parallel taxiway simultaneously. Since the APRC is dependent on a runway's lowest visibility minimums, different separation standards can apply depending on the runway configuration in use.

The APRC is dependent on the visibility minimums of the runway and sets separation standards as it relates to operating conditions without restrictions. This means that different separation standards can apply based on the type of aircraft on approach and the weather conditions at the time of the approach. As noted in **Table 3.17**, there are no deficiencies in the runway to taxiway separations.

Table 3.17 - Existing and Future Runway-to-Taxiway Separations and APRC / DPRC

Runway	Parallel Taxiway	Standard Separation (ft)	Existing Separation (ft)	RDC	APRC	DPRC
14	A	400	400	C-III-4000	D-V-4000	D-V
32	A	400	400	C-III-5000	D-V-4000	D-V
13	P	150	450	A-I(SMALL)-VIS	D-V-4000	D-V
31	P	150	450	A-I(SMALL)-VIS	D-V-4000	D-V
9	D	150	250	A-I(SMALL)-VIS	B-II-4000	B-II
27	D	150	250	A-I(SMALL)-VIS	B-II-4000	B-II

Sources:

FAA Advisory Circular 150/5300-13B, Change 1 - Airport Design.
Kimley-Horn, 2025.

Notes:

APRC = Approach Reference Code
DPRC = Departure Reference Code

3.3.2. Taxiway and Taxilane Requirements

This section presents taxiway requirements for STP, including safety areas and separation standards, and a review of the existing taxiway layout against current taxiway design guidelines found in 13B.

3.3.2.1. Taxiway Design Group (TDG)

Taxiway and taxilane design standards are determined by a combination of ADG and TDG. While ADG is based on aircraft wingspan and tail height, TDG is defined by the main gear width and the distance from the cockpit to the main gear. These dimensions are critical in establishing appropriate taxiway and taxilane widths and fillet geometry. It is important to note that various areas of the Airport may require distinct TDG classifications, and FAA guidance allows for the critical aircraft for TDG to differ from what is used for RDC planning.

As outlined in **Chapter 2 – Aviation Activity Forecast**, the current and projected critical aircraft at the airport align with a TDG 2B classification. However, two TDG 3 aircraft are currently based at the Airport and frequently operate on the southern portion of the airfield. FAA eligibility will likely remain as TDG 2B, but the airfield will continue to support TDG 3 standards in applicable areas.



3.3.2.2. Taxiway Width and Shoulder Width

Taxiway width is a key design parameter governed by TDG classification, which reflects the operational needs of the airport's critical aircraft. At STP, the current TDG 2B standard prescribes a minimum taxiway width of 35 feet. However, all taxiways on the airfield are maintained at a width of 50 feet, exceeding the requirements of TDG 2B and aligning with the specifications for TDG 3. This proactive approach ensures that STP's taxiway infrastructure is capable of accommodating future operational needs without requiring significant modifications. If this 50 foot width is maintained, the excess portion may not qualify for FAA Airport Improvement Program (AIP) funding.

Taxiway shoulders are meant to support aircraft operations by providing lateral clearance and structural support adjacent to the taxiway pavement. STP's existing standard of TDG 2B requires 15-foot-wide shoulders which the Airport presently maintains as unpaved. This configuration is compliant because paved shoulders are not mandated for airports serving ADG III aircraft. That taxiways exceed the FAA's TDG 2B standard also provides an added level of safety by providing lateral clearance.

For future conditions at STP to fully meet a TDG 3 standard, the shoulders will need to be maintained at 20 feet in width as either paved or unpaved (turf). Paving of these shoulders would only be required if the critical aircraft designation increases above ADG III—a change that is not anticipated based on current aviation activity forecasts. No deficiencies are identified related to taxiway width and taxiway shoulder width at the Airport.

3.3.2.3. Taxiway Edge Safety Margin (TESM)

The Taxiway Edge Safety Margin (TESM) is a design element in airfield geometry that ensures aircraft remain safely on pavement engineered to support their weight. Specifically, TESM refers to the lateral distance between the outermost edge of an aircraft's landing gear, when the cockpit is aligned over the taxiway centerline, and the edge of the taxiway pavement. This buffer accounts for minor deviations in aircraft tracking during taxi operations, helping to prevent gear from straying onto potentially unsupported surfaces.

TESM standards are governed by TDG classification assigned to each taxiway. These standards are outlined in 13B, which prescribes dimensional requirements for both straight segments and turning movements. To maintain compliant TESM throughout turns, taxiway fillets (curved pavement transitions at intersections) must be designed to accommodate the full range of aircraft expected to use the taxiway. Proper fillet geometry ensures that TESM is preserved without excessive pavement.

At STP, current taxiway intersections once met FAA standard, but do not meet the latest TESM-related fillet design standards. Instead of the FAA-recommended² multi-tangent fillet geometry, STP's intersections are constructed with single-radius corner fillets. In some areas, this legacy design approach may not adequately support the turning movements of TDG 2B aircraft. For TDG 3 aircraft, which are becoming more frequent at STP, may also not be meeting current standards. Future taxiway reconstructions should incorporate standard TDG 3 fillets with a minimum TESM of 10 feet, as required by 13B. This upgrade will ensure that aircraft operating at STP can safely navigate taxiway intersections without compromising pavement integrity or operational safety. Conformance to TESM will be evaluated

² FAA standards must be met, or an MOS must be approved by the FAA for projects granted federal funding.



on a case-by-case basis of the taxiway pavement at the time of reconstruction, as has been historical practice at MAC airports.

3.3.2.4. Taxilane Requirements

Taxilanes at STP are not uniformly maintained to the future TDG 3 standard applied to taxiways. While the Airport intends to maintain and upgrade taxiways to meet TDG 3 criteria to accommodate larger aircraft that frequently operate at the airport and allow for unrestricted movement across the airfield, taxilanes are instead evaluated and maintained based on the aircraft that routinely use them to access adjacent aprons and hangar areas. As a result, design standards applied to taxilanes vary across the airfield. Alternatives for hangar and apron development presented in **Chapter 4** will consider potential improvements to apron ingress/egress taxilanes and apron taxilanes to provide enhanced access for TDG 3 aircraft where warranted. Identified deficiencies and non-standard conditions associated with taxilanes, including improperly located boundary markings, are documented in **Tables 3.18** and **3.19**, with additional detail provided in the following sections.

3.3.2.5. Taxiway/Taxilane Safety Area (TSA)

The Taxiway and Taxilane Safety Area (TSA) is a buffer zone flanking the centerline of taxiways and taxilanes, designed to safeguard aircraft operations and support emergency response access. Defined by 13B, the TSA must span the wingspan of the largest ADG expected to use the surface. In the case of STP, this equates to 118 feet for ADG III aircraft. This area must be free of obstructions, properly graded to eliminate hazardous surface variations, and capable of draining effectively to prevent water accumulation. The surface must remain clear of non-frangible objects unless functionally required and properly mounted.

At STP, a thorough review using topographic modeling and aerial imagery confirms that all taxiway and taxilane TSAs meet current standards, with no penetrations or non-standard conditions identified. Continued monitoring is recommended to ensure compliance, particularly as future development may alter TSA boundaries or introduce new design considerations.

3.3.2.6. Taxiway/Taxilane Object Free Area (TOFA and TLOFA)

Taxiway and Taxilane Object Free Areas (TOFA and TLOFA) are components of airfield design providing the necessary horizontal and vertical clearance for aircraft wingtips during ground movement. These zones, which extend symmetrically from the centerline of taxiways and taxilanes, are wider than the corresponding safety areas and are intended to remain free of objects that could interfere with aircraft operations. According to FAA standards, the required widths for TOFA and TLOFA at facilities serving ADG III aircraft are 171 feet and 158 feet, respectively.

At STP, all taxiways are intended to accommodate ADG III aircraft, and thus the TOFA standards apply uniformly across the airfield. Navigational objects in these areas are considered permissible if they meet FAA requirements for frangibility and height. However, a detailed review of the Airport's geometry using topographic mapping and aerial imagery has revealed objects identified as non-standard within the TOFA boundaries including a roadway adjacent to Taxiway C, non-movement area boundaries near Taxiways B and E, and the floodwall along Taxiways A and B.



Similarly, the TLOFA analysis identified standard permissible objects such as taxiway lighting and directional signage, which should be confirmed to meet FAA frangibility and height criteria. However, one notable deficiency was observed along Taxilane W, where a non-movement area boundary encroaches into the TLOFA.

To maintain compliance with FAA design standards and ensure safe aircraft operations, STP should prioritize the removal or mitigation of these intrusions. **Table 3.18** outlines the specific objects and their locations, while **Figures 3.3** and **3.4** at the end of **Section 3.3.2** visually depict these conditions. As the airport moves forward with future development and taxiway modifications, these areas should be reevaluated to ensure that TOFA and TLOFA boundaries remain clear and compliant.

Table 3.18 - Taxiway/Taxilane Object Free Area (TOFA and TLOFA) Deficiencies

Index # ^(a)	Taxiway	Taxiway Segment	Description	Floodwall Configuration		Disposition
				Down	Up	
12	TWY A	TWY B ↔ TWY A4	Floodwall penetrates the TOFA (ADG III)	X		Floodwall realignment
15	TWY B	TWY A3 ↔ TWY A	Floodwall penetrates the TOFA (ADG III)	X		Taxiway realignment
16	TWY B, E	Various	Non-movement area boundaries within the TOFA (ADG III)	X	X	Repaint boundary
17	TWY C	TWY C ↔ TWY B	Roadway penetrates the TOFA (ADG III)	X	X	MOS with ADG III (92' maximum wingspan) or lower to ADG II
31	TL CHARLIE	Southwest corner	Object within TLOFA (ADG III)	X	X	Remove/Relocate
34	TL ROMEO	North and south	Hangar to the north and to the south both in TLOFA	X	X	Remove or restrict allowed wingspan
35	TL SIERRA	South	Portion of hangar to the south within the TLOFA	X	X	Remove or restrict allowed wingspan
36	TL WHISKEY	TWY W ↔ TWY L	Non-movement area boundaries within the TLOFA	X	X	Repaint boundary

Sources:

FAA Advisory Circular 150/5300-13B, Change 1 - Airport Design.
Kimley-Horn, 2025.

Notes:

(a) Index number corresponds to non-standard conditions depicted in Figures 3.3 and 3.4.

ADG = Airplane Design Group

MOS = Modification of Standard

TLOFA = Taxilane Object Free Area

TOFA = Taxiway Object Free Area

3.3.2.7. Taxiway/Taxilane Geometry and Runway Incursion Mitigation (RIM)

AC 13B underwent a comprehensive update to airport design standards from its previous version, synthesizing years of research and operational data to address runway safety. Drawing from analysis conducted by the FAA's Runway RIM Program, 13B identifies specific airfield geometries that have historically contributed to surface incidents and runway incursions. The following airfield characteristics are recognized as contributing factors to runway incursions:



- **Direct Access from Aprons to Runways:** Taxiways leading straight from apron areas to runways can cause pilots to enter runways without adequate situational awareness. Preferred designs include parallel taxiing followed by perpendicular entry to the runway threshold.
- **High-Energy Runway Crossings:** Crossings in the middle third of a runway—where aircraft are least maneuverable—pose elevated collision risks and should be avoided.
- **Acute-Angled Runway Crossings:** Non-perpendicular intersections reduce pilot visibility and increase the chance of misjudging runway occupancy.
- **Acute-Angled Runway Entrances:** These configurations limit a pilot's field of vision and can lead to confusion due to excessive pavement width and misplaced visual cues.
- **Acute-Angled Taxiway Intersections:** To improve visibility and reduce complexity, turns should be designed at the preferred angle of 90° whenever possible. If perpendicular intersections are not feasible, other preferred angles include 30°, 45°, 60°, 90°, 120°, 135°, and 150°.
- **Dual Use of Pavement:** Mixing runway and taxiway functions can lead to operational confusion. Each surface should serve a single, distinct purpose.
- **Complex Intersections:** Intersections with more than three directional options complicate signage and markings, increasing the likelihood of pilot error. The “three-path concept” is recommended in which a pilot has no more than three choices at an intersection—left, right, and forward.
- **Wide Expanse of Pavement:** Large open areas can dilute visual cues, placing signs and markings outside a pilot's immediate field of vision.
- **Excessive Runway Crossings:** Reducing the number of runway crossings lowers the probability of human error and improves overall safety.

As part of this LTP Update, the existing airfield layout of STP was evaluated against these FAA design principles. Several non-standard conditions were identified and are documented in **Table 3.19** and depicted in **Figures 3.3** and **3.4** at the end of **Section 3.3.2**.

**Table 3.19 - Taxiway/Taxilane Geometric Deficiencies and Runway Incursion Risk**

Index # ^(a)	Facility	Location	Description	Floodwall Configuration		Disposition
				Down	Up	
10	RWY 9/27	RWY 9 Approach End	Lack of runway entrance/exit taxiway	X	X	Relocation of TWY C1
11	RWY 13/31	RWY 13 Approach End	Potential pilot misalignment and wrong surface events due to RWY 13 and RWY 14 end alignment	X	X	Relocate/shorten RWY 13/31
14	TWY A & A1	Conjunction of Taxiways	Non-standard holding bay geometry	X	X	Geometry Modification
18	TWY C1	TWY C1 ↔ RWY 9	Acute-angle runway entry	X	X	Relocation
19	TWY D	GA Apron ↔ RWY 14/32	Direct apron to runway access	X	X	Geometry modification
21	TWY E	TWY E ↔ RWY 14	Acute-angle runway entry	X	X	Geometry modification
22	TWY E	TWY E ↔ RWY 27	Acute-angle runway entry	X		Geometry modification
23	TWY E & P	TWY E & P	Non-standard taxiway connection angle	X	X	Geometry modification
25	TWY G	TWY G ↔ RWY 27	Acute-angle runway entry	X		Geometry modification
26	TWY G	TWY G ↔ RWY 31	Acute-angle runway entry	X		Geometry modification
27	TWY H	TWY H ↔ RWY 31	Acute-angle runway entry	X		Geometry modification
28	TWY H	TWY H	Non-standard taxiway angle	X		Geometry modification
30	TL BRAVO	Entirety	Taxilane width deficiency	X	X	Geometry modification
32	TL LIMA	Entirety	Taxilane width deficiency	X	X	Geometry modification
33	TL MIKE	Entirety	Taxilane width deficiency	X	X	Geometry modification
48	RWY 14/32	RWY 32 Approach End	Lack of runway entrance/exit taxiway		X	Add entrance/exit

Sources:

FAA Advisory Circular 150/5300-13B, Change 1 - Airport Design.
Kimley-Horn, 2025.

Notes:

(a) Index number corresponds to non-standard conditions depicted in Figures 3.3 and 3.4.
GA = General Aviation

3.3.2.8. FAA Hot Spots

An FAA Hot Spot is a designated location on an airport surface where there is an increased risk of collision or runway incursion. These areas are identified based on historical incident data, pilot reports, and operational complexity, and are typically marked on airport diagrams to alert pilots and ground personnel to exercise heightened vigilance. Hot spots often occur at complex intersections, areas with confusing signage or markings, or locations where aircraft paths frequently converge. The FAA uses these designations to promote situational awareness and encourage proactive safety measures, such as improved signage, lighting, and procedural changes. While a hot spot does not necessarily indicate a current safety deficiency, it signals a location where extra caution is warranted due to the potential for



operational errors. The FAA publishes the hot spots in the Airport Facility Directory (AFD) and Airport Diagrams.

There are three FAA hot spots at STP. **Figures 3.3** and **3.4** at the end of **Section 3.3.2** show the current hot spots and **Table 3.20** describes the locations and descriptions of the three hot spots at the Airport. All three hot spots are also identified in the airport diagram on **Figure 1.4** in **Chapter 1**. While the presence of an ATCT aids safety concerns regarding military activity on the airfield, development alternatives will consider mitigation of Hot Spots 2 and 3.

Table 3.20 - Existing FAA Hot Spots at STP

Index # ^(a)	Hot Spot	Location	Description	Floodwall Configuration		Disposition
				Down	Up	
39	HS 1	TWY A1 ↔ TWY L	National Guard helicopter landings on TWY A	X	X	None
40	HS 2	RWY 13/31 ↔ RWY 14/32	Unusual placement of RWY holding position markings due to overlapping RWY Safety Areas	X	X	Geometry modification
41	HS 3	TWY C ↔ TWY A2	General aviation helicopter landings on TWY B	X	X	Geometry modification

Sources:

FAA Advisory Circular 150/5300-13B, Change 1 - Airport Design.
Kimley-Horn, 2025.

Notes:

(a) Index number corresponds to non-standard conditions depicted in Figures 3.3 and 3.4.

3.3.2.9. Taxiway/Taxilane and Apron Markings

Taxiway, taxilane, and apron markings are important visual aids that guide aircraft movement on the ground, promoting safe and efficient operations across the airfield. These markings provide pilots with spatial orientation, delineate movement areas, and help prevent runway incursions and ground collisions. They are designed in accordance with FAA guidance such as AC 150/5340-1M, Standards for Airport Markings, which standardize the color, width, and placement of markings to ensure consistency across airports.

On taxiways and taxilanes, centerline markings help pilots maintain alignment, while edge markings define the boundaries of usable pavement. Enhanced centerlines and surface-painted holding position signs further reinforce awareness near runway intersections. Apron markings guide aircraft to parking positions and delineate safety zones for ground personnel and equipment.

In low visibility conditions, during night operations, or at complex airfields, these markings serve as the primary navigational reference for pilots. Non-standard or degraded markings can lead to confusion, miscommunication with air traffic control, and increased risk of incidents. Therefore, maintaining clear, compliant, and well-documented markings is important for airfield safety management.

A thorough review of the airfield at STP has identified several non-standard conditions related to taxiway, taxilane, and apron markings. These conditions are listed below in **Table 3.21** and depicted in **Figures 3.3** and **3.4** at the end of **Section 3.3.2**. To maintain compliance with FAA marking standards and uphold safe aircraft movement across the airfield, STP should prioritize the routine maintenance, timely updating, and correction of non-standard markings.



Table 3.21 - Taxiway/Taxilane and Apron Marking Deficiencies

Index # ^(a)	Facility	Location	Description	Floodwall Configuration		Disposition
				Down	Up	
13	TWY A	TWY L ↔ TWY A1	Non-standard taxiway edge marking between Taxiway A and apron	X	X	Remove or repaint
20	TWY D	RWY 13/31 ↔ GA Apron	Missing Pattern C hold line	X	X	Repaint marking
24	TWY E	TWY P ↔ TWY N	Non-standard taxiway edge marking between Taxiway E and apron	X	X	Repaint marking
29	TWY H	Holding Bay	Lack of holding bay markings	X		Remove holding bay
37	TWY W	TWY D ↔ TWY L	Non-standard taxiway edge marking between Taxiway W and apron	X	X	Repaint marking

Sources:

FAA Advisory Circular 150/5300-13B, Change 1 - Airport Design.

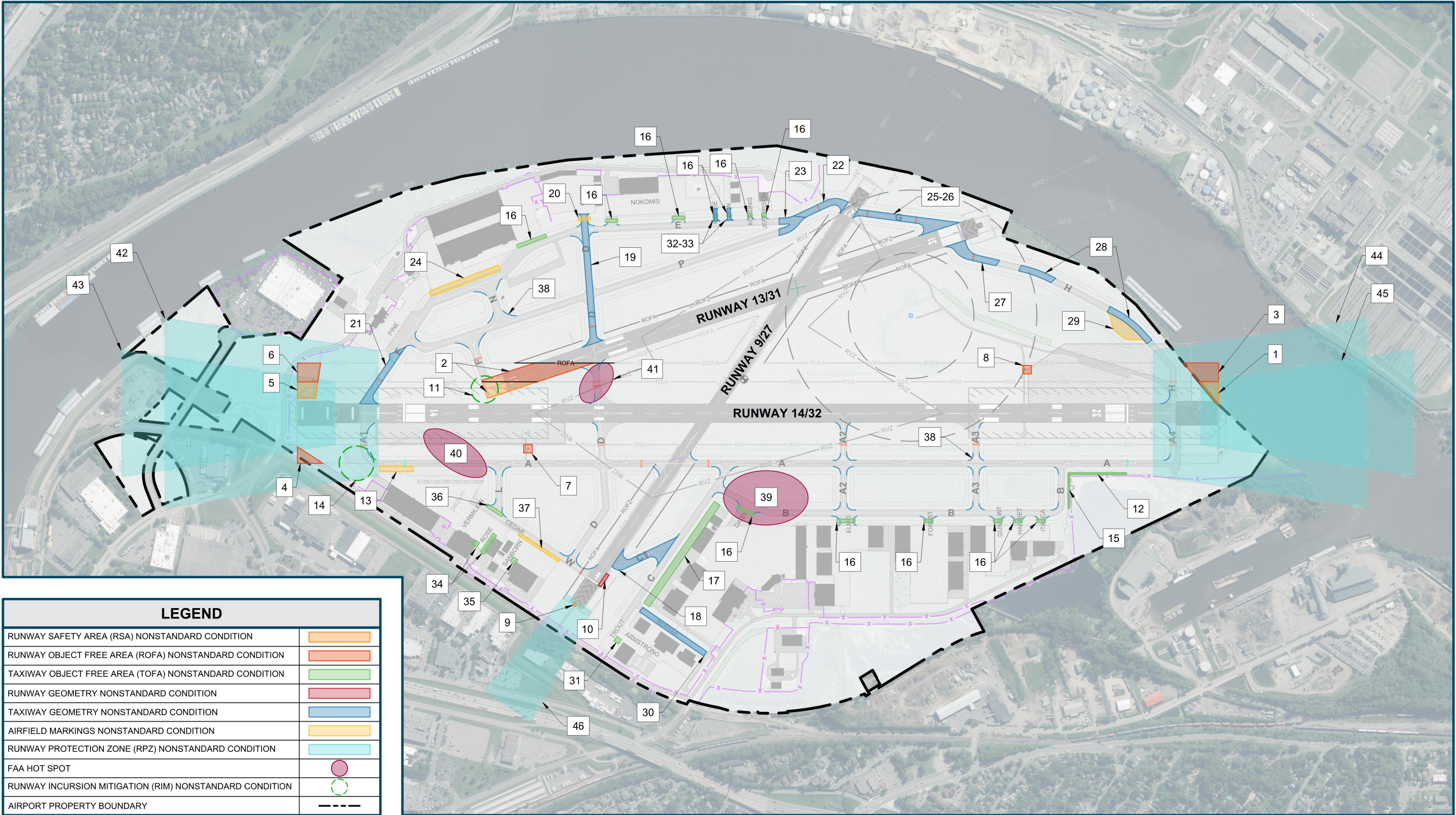
FAA Advisory Circular 150/5340-1M, Standards for Airport Markings.

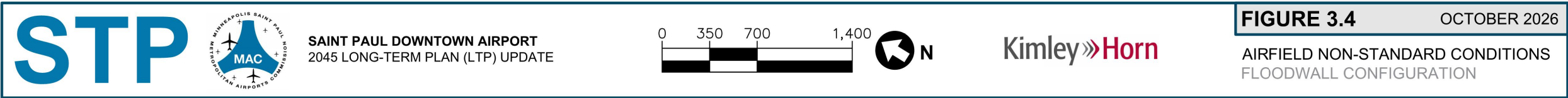
Kimley-Horn, 2025.

Notes:

(a) Index number corresponds to non-standard conditions depicted in Figures 3.3 and 3.4.

GA = General Aviation





3.3.3. Floodwall

As initially described in **Chapter 1**, the Airport is situated within the Mississippi River floodplain, necessitating the use of a deployable floodwall system to protect critical infrastructure during flood events. While this system has proven effective in safeguarding the Airport, its deployment introduces significant operational limitations that must be addressed in the long-term planning horizon.

3.3.3.1. Airfield Operational Impacts of Floodwall Deployment

When the temporary floodwall is activated, several key components of the airfield experience restricted functionality. Most notably, the usable length of Runway 14/32 is shortened from 6,491 feet to 5,340 feet. Additional Runways 13/31 and 9/27 are also reduced to 2,960 feet and 3,165 feet, respectively, and are closed during floodwall deployment, further limiting the Airport's capacity to accommodate varying wind conditions and aircraft types. While taxing is allowed across Runway 9/27 while the runway is NOTAM'd closed, no other portions of Runways 9/27 and 13/31 are operable for active aircraft. When the floodwall is up, ancillary taxiways are also closed and limit airfield accessibility in the current airfield layout. Additionally, airfield lighting and NAVAIDs, such as the existing ILS infrastructure, are impacted by the floodwall.

These limitations have tangible impacts on airport users. Feedback from stakeholders indicates that some hangars remain vacant when the floodwall is up due to concerns about flooding, while others relocate aircraft to alternative facilities. Fuel sales decline, and certain operators report reduced stage lengths due to takeoff weight restrictions, necessitating additional fuel stops. These disruptions underscore the need for a more resilient and operationally efficient flood mitigation strategy.

3.3.3.2. Summary of Initial Findings of the Floodwall Feasibility Study

Flood fight operations at the Airport require significant airfield reconfiguration to maintain limited functionality while ensuring safety and compliance with flood protection protocols. As a part of this LTP Update, a Floodwall Feasibility Study was conducted to evaluate the feasibility of extending the existing floodwall for more permanent flood protection at the Airport. The full report is found in **Appendix A – Floodwall Feasibility Study**. As a part of the study, two primary operational scenarios have been identified, each with distinct impacts on runway availability and airfield capacity.

- **Scenario 1: Runway Closures with Reduced Threshold Operations:** In this configuration, Runways 09/27 and 13/31 are closed, and Runway 14/32 operates with a reduced threshold when the floodwall is up. This limits aircraft operations to those compatible with the reduced runway length. Taxiways H and G are rendered mostly inoperable, as they lie outside the perimeter dike and are subject to inundation.
- **Scenario 2: Partial Runway Operations:** This alternative assumes that Runways 09/27 and 13/31 remain operational, albeit with reduced thresholds. This configuration allows for greater operational flexibility but still requires significant coordination and temporary modifications to airfield infrastructure and lighting systems.

In both scenarios reconfiguring the airfield for flood fight operations involves a series of coordinated actions taking no less than two weeks to complete. Following the flood event, the airfield must be

restored to its standard configuration through a process of reversing all the steps taken prior to the flood event.

To determine potential future conditions of the flood wall, hydraulic modeling (HEC-RAS) was used to assess existing and proposed flood protection scenarios. The model incorporates as-built data for levees and floodwalls and spans approximately 1.68 miles of the Mississippi River, from the 3M Hangar to the Saint Paul Police Department Impound Lot. Two primary geometries were analyzed:

- **“Existing” Geometry:** Represents pre-excavation conditions.
- **“Proposed” Geometry:** Reflects post-excavation channel modifications and revised floodway boundaries.

To ensure accuracy, the model was calibrated using record drawings dated December 4, 2009, LiDAR data, and aerial imagery. Both non-deployed and fully deployed floodwall scenarios were simulated under 100-year flood conditions to assess airfield inundation and barrier performance.

The modeling demonstrated that the flood protection system provides robust defense against the 100-year flood event. Water Surface Elevations (WSEs) were consistently below the top-of-barrier elevations across all cross sections when the floodwall was fully up. Minor discrepancies exist between model results and FEMA’s Flood Insurance Study (FIS) due to differences in vertical datums and rounding, but overall protection levels are consistent. These results confirm that the floodwall system meets its design intent of protecting the airfield from inundation during a 1% annual chance flood event.

Two development scenarios are, therefore, identified:

- **Constrained Development:** Minor or no floodwall improvements; site remains in Zone AE, requiring compliance with City of Saint Paul and FEMA/Army Corps of Engineers floodplain regulations. Permitted uses and standards for airport facilities and accessory structures are detailed, including floodproofing requirements.
- **Unconstrained Development:** Major floodwall improvements and levee accreditation could reclassify the site to Zone X, reducing regulatory constraints and enabling broader redevelopment opportunities.

The full findings of this LTP Update’s Floodwall Feasibility Study can be found in **Appendix A**.

3.3.3.3. Future Flood Mitigation Strategy and Recommendations

Recognizing the importance of maintaining operational continuity, the MAC has expressed a strong interest in mitigating the adverse impacts associated with the floodwall temporarily being up. A key objective is to preserve the operational norms of primary Runway 14/32, including its length, taxiway access, and associated NAVAIDs, even during flood events.

To attempt to achieve this goal, hydraulic modeling will be used to guide allowable development options for a permanent floodwall around the Runway 32 end of the airfield. Such a solution should be designed to maximize primary runway usability across all seasons while minimizing encroachment into the floodplain and adhering to regulations. Preliminary discussions have considered concepts that aim to reduce the frequency and severity of closures and enhance the airport’s resilience to future flood events.

If a permanent/accredited floodwall alignment is determined to not be feasible due to cost, impacts of up-river surge during flood conditions, or major impacts to existing Airport infrastructure, development



alternatives will aim to utilize a combination of permanent and temporary floodwall modifications to protect the length and operational efficiency of primary Runway 14/32 to the extent possible during both when the floodwall is down and up.

To support this strategic direction, a range of alternatives addressing floodwall design and placement is presented and evaluated in **Chapter 4**.

3.3.4. Airfield Lighting and NAVAIDs

Aligning airfield lighting and NAVAIDs with the operational needs of an airport is necessary for ensuring safety, efficiency, and regulatory compliance. The following outlines the Airport's facility requirements regarding these systems.

3.3.4.1. Airfield Lighting

All airfield lighting systems at STP are currently operable and in good condition, meeting applicable FAA standards for the existing runway design codes. However, Runway 13/31 is primarily used by A-I aircraft and, as detailed in **Chapter 1**, is equipped with High Intensity Runway Lights (HIRLs). HIRLs are required only for runways supporting precision or non-precision instrument approaches, such as CAT I, II, or III ILS operations. Runway 13/31 is not equipped with either precision or non-precision instrument approaches. Therefore, HIRLs represent a safety enhancement that exceeds what is required for Runway 13/31.

When the floodwall is up, the PAPIs for Runways 32, 31, and 27 as well as the REILs on Runways 32, and 31 become inoperable. This temporary loss of visual aids is managed through established flood fight protocols and NOTAM issuance. The airfield lighting system is reconfigured to "FLOOD" mode, and alternate lighting and signage procedures are implemented to maintain safe operations under constrained conditions.

Runway 13 currently operates under an approved MOS (2027-AGL-885-NRA) for the PAPI installation. The MOS permits a reduced baffle angle of 5 degrees, rather than the standard 10 degrees, to maintain clearance of the obstacle clearance surface (OCS).

No upgrades to the airfield lighting systems are recommended at this time. However, potential relocation of systems such as PAPIs and REILs may be necessary depending on the outcomes of the runway length and airfield configuration alternatives being evaluated in **Chapter 4**. Any such modifications will be designed to maintain compliance with FAA standards and ensure continued operational safety and efficiency.

3.3.4.2. NAVAIDS

Both ends of Runway 14/32 at STP are equipped with Category-I ILS approaches. These systems include associated localizer antennas, glide slope antennas, and Distance Measuring Equipment (DME) shelters that support precision approach capabilities. When the floodwall is up, the localizer and glideslope for Runway 32 become inoperative.

A siting analysis of the navigational aids revealed that the DME shelter and glide slope shelter located at the Runway 14 end are situated within the ROFA. Additionally, the glide slope antenna serving the Runway 32 end is also located within the ROFA, positioned east of the runway centerline. These

conditions warrant further evaluation to ensure long-term compliance with FAA design standards and to mitigate potential operational or safety concerns. Development alternatives should include proper relocation of these facilities or realignment of safety areas to achieve full compliance with FAA criteria under both standard and floodwall configurations.

3.3.4.3. Approach Procedures

Table 3.22 presents an inventory of all currently published instrument approach procedures serving STP. These procedures are organized by runway end and categorized by approach type, including associated visibility minimums and decision altitudes. The minimums shown reflect an AAC of C, consistent with the airport's critical design aircraft.

For each procedure, the lowest published straight-in minimums are identified. Based on a detailed review of these procedures, STP is equipped to support instrument operations in meteorological conditions as low as 250 feet above ground level (AGL) and $\frac{3}{4}$ statute mile visibility. These minimums are sufficient to accommodate the operational needs of the critical aircraft under Instrument Meteorological Conditions (IMC).

It is important to note that the lowest permissible visibility minimum for Category-I ILS operations is $\frac{1}{2}$ statute mile. This indicates that STP retains the potential to publish lower minimums without requiring upgrades to Category-II ILS equipment. As such, the current infrastructure provides adequate capability, and no additional instrument approach enhancements are recommended at this time. Any future changes to approach minimums or equipment siting should be evaluated in the context of broader airfield configuration alternatives.

Table 3.22 - Instrument Approach Procedure Inventory

Runway	Approach Type	Decision Altitude or Minimum Descent Altitude (AGL)	Visibility Minimums (Category C)
14	ILS	250	$\frac{3}{4}$ Mile
14	LOC	515	1 Mile
14	RNAV (GPS)	250	$\frac{3}{4}$ Mile
32	ILS	326	1 Mile
32	LOC	756	2 Miles
32	RNAV (GPS)	327	1 Mile
All	Circling ⁽¹⁾	875	2 $\frac{1}{2}$ Mile

Sources:

FAA Airport Data Information Portal, August 2025.

Notes:

AGL = Above Ground Level

ILS = Instrument Landing System

LOC = Localizer

RNAV (GPS) = Area Navigation Global Positioning System

(1) Circling available to all runway ends including Runways 13/31, 9/27, and 14/32

3.4. Airfield Demand and Capacity

This section evaluates the Airport's ability to accommodate projected aircraft demand and activity levels, as outlined in **Chapter 2**, without incurring excessive delays. The analysis follows methodologies established in AC 150/5060-5, Airport Capacity and Delay as well as ACRP Report 79, both of which assess airfield capacity as the number of aircraft operations (hourly or annually) that can be supported by the existing airfield infrastructure while maintaining acceptable delay levels. Delays typically occur when demand approaches or exceeds capacity. Enhancing airfield layout and traffic flow efficiency can help mitigate delays.

Airfield capacity and delay are measured using:

- **Hourly Capacity:** Maximum number of operations the airport can safely accommodate per hour.
- **Annual Service Volume (ASV):** Maximum number of annual operations without significant delays.
- **Delay:** Expected delay per operation based on peaking characteristics, airfield geometry, and other influencing factors.

The FAA's standard metric for estimating annual airfield capacity is ASV. ASV is calculated using peak hourly capacity figures and demand ratios (annual-to-monthly and daily-to-hourly) to produce a realistic estimate of annual operational capacity. Two primary methodologies are used to estimate hourly capacity for ASV calculations:

1. **AC 150/5060-5 Methodology:** This official method identifies the airport's geometric layout from a set of representative configurations provided in the AC. It incorporates factors such as:
 - Meteorological conditions
 - Aircraft fleet mix
 - Percentage of touch-and-go operations
 - Number and location of runway exit taxiways
2. **ACRP Report 79 Methodology:** This alternative approach uses a spreadsheet model with similar inputs but adds flexibility to account for runway occupancy time, arrival/departure buffers, operational configurations, arrival and departure aircraft separation, and approach speeds. This model often shows more conservative results than the AC 150/5060-5 method.

This analysis uses both methodologies to evaluate forecasted operations against calculated ASV. Inputs used in the ASV calculation are detailed in the following subsections.

3.4.1. Airfield Capacity Calculation Factors

Airfield capacity is shaped by a combination of physical characteristics and operational procedures. Each of these elements below contributes to how efficiently aircraft can be accommodated and how delays may be mitigated. The following assessment examines how these specific factors influence capacity at STP.



3.4.1.1. Runway Configuration

An airfield's capacity is primarily determined by the number and orientation of its runways under varying operating conditions. These configurations can change based on weather, time of day, and the type of available approach procedures.

Utilizing combinations of STP's three runways, three operating scenarios were evaluated using the AC method:

- Single-runway operation (Runway 14/32)
- Dual-runway operation (Runways 14/32 and 13/31)
- Intersecting-runway operation (Runways 14/32 and 9/27)

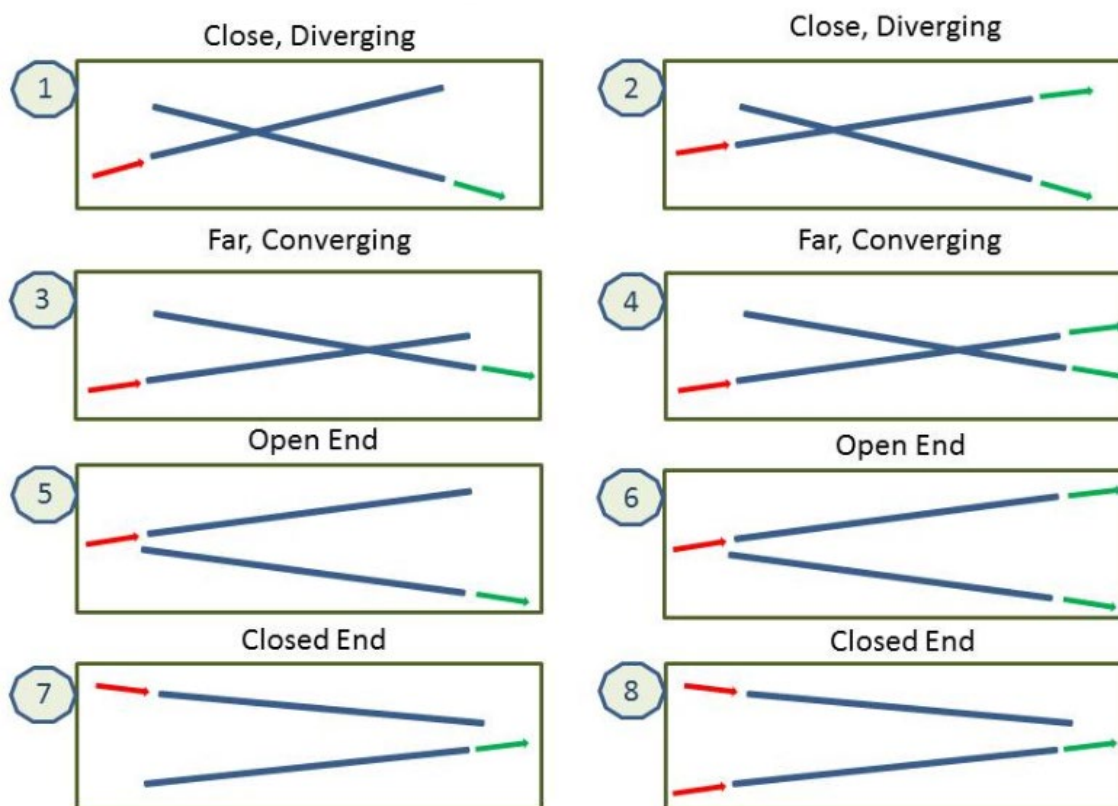
The results of these analyses are summarized in **Sections 3.4.2** and **3.4.3**.

For the ACRP method, eight intersecting runway scenarios are provided as shown in **Figure 3.5**. The model for this method allows the user to change runway configurations and operational procedures such as choosing which runway will handle arrivals, departures, or mixed operations. For this method, three operating scenarios were evaluated:

- Single-runway operation (Runway 14/32)
- Dual-runway operation with runway 14/32 having mixed operations and runway 13/31 having departures only (Scenario 6)
- Intersecting-runway operation with runway 14/32 having mixed operations and runway 9/27 having departures only (Scenario 4)

The results of these analyses are summarized in **Sections 3.4.2** and **3.4.3**.

Figure 3.5 - Intersecting Runway Scenarios



3.4.1.2. Weather

Meteorological conditions significantly influence runway utilization and overall airfield capacity. Reduced visibility and low cloud ceilings typically require aircraft to operate under Instrument Flight Rules (IFR), which increases spacing requirements and decreases capacity. The distribution between Visual Meteorological Conditions (VMC) and IMC directly affects operational efficiency due to these spacing constraints.

Data from the Airport's Automated Surface Observing System (ASOS) were reviewed for the period from 2015 through 2024. This dataset indicates that IFR conditions—defined as a cloud ceiling below 1,000 feet or visibility less than 3 miles—occur approximately 15% of the time annually. During these conditions, only Runway 14/32 is equipped with the necessary instrumentation and published approach procedures to support operations. Dual runway operations and intersecting-runway operations are, therefore, only allowed during VMC. **Table 3.22** summarizes this analysis.

Table 3.23 - Reported Weather Conditions, 2015–2024

Observation	Number of Observations	Percentage
VFR	94,489	85%
IFR	16,295	15%
TOTAL	110,784	

Sources:

Automated Surface Observing System (ASOS) data for Saint Paul Downtown Airport (STP), 2015-2024.
Kimley-Horn, 2025.

Notes:

VFR = Visual Flight Rules
IFR = Instrument Flight Rules

3.4.1.3. Aircraft Fleet Mix

For the capacity calculations, aircraft are categorized into four classes based on their maximum certified takeoff weight. These weight-based classifications differ from the FAA’s Aircraft Approach Categories (A through D) and from the ARC, which relates to airport design standards. The four classes of aircraft based on MTOW are:

- Class A: 12,500 lbs. or less, single engine
- Class B: 12,500 lbs. or less, multi-engine
- Class C: 12,500 to 300,000 lbs., multi-engine
- Class D: Over 300,000 lbs., multi-engine

The aircraft fleet mix refers to the proportion of each weight class operating at STP. Heavier aircraft require greater separation during approach and departure to mitigate wake turbulence, which can reduce overall airfield capacity.

To quantify the fleet mix, AC 150/5060-5 defines a fleet mix index using the formula:

$$\text{Mix Index} = (\text{Percentage of Class C aircraft}) + 3 \times (\text{Percentage of Class D aircraft})$$

For 2024, operational data from the MAC Noise and Operations Monitoring System (MACNOMS) was reviewed under the assumption that current aircraft classifications will remain consistent. Aircraft operations were categorized by weight, and no Class D aircraft operations were recorded during the base year. As a result, the fleet mix index is equal to the percentage of Class C aircraft operations relative to total airport operations, yielding a mix index of 12.8%. This mix index is a factor in determining ASV in **Section 3.4.2**.

A summary of aircraft categories and fleet mix analysis is presented in **Table 3.23**.

**Table 3.24 - Fleet Mix Class Percentages**

Classification	Percent of Operations
A & B	75.1%
C	12.8%
D	0%
Helicopters	10.6%
Unknown	1.4%

Sources:

MAC Noise and Operations Monitoring System (MACNOMS).
Kimley-Horn, 2025.

ACRP Report 79 also uses fleet mix percentages for its analysis and uses the FAA categories as mentioned above. The only difference is that Class C aircraft have multiple subcategories, which include:

- Small +: Between 12,500 pounds and 41,000 pounds, mixed engines
- Large Turbo Prop (TP): Between 41,000 pounds and 255,000 pounds
- Large Jet: Between 41,000 pounds and 255,000 pounds
- Large 757: Between 255,000 pounds and 300,000 pounds, Boeing 757 series

3.4.1.4. Touch-and-Go Operations

Touch-and-go operations involve an aircraft landing and immediately taking off without coming to a full stop or exiting the runway. These operations are typically associated with flight training and are more time-efficient than separate arrivals and departures. Each touch-and-go counts as two runway operations (one landing and one takeoff) even though the maneuver occupies the runway for a shorter duration. As a result, airports with a high proportion of touch-and-go activity generally experience greater airfield capacity due to reduced runway occupancy times.

At STP, MACNOMS data indicates that approximately 25% of local operations are touch-and-go maneuvers. This proportion is expected to remain consistent throughout the 20-year planning horizon. In accordance with AC 150/5060-5, this data was used to determine the touch-and-go factor (T) for hourly capacity calculations.

3.4.1.5. Percent of Aircraft Arrivals

According to AC 150/5060-5, the percentage of aircraft arrivals is defined as the ratio of landing operations to total operations at an airport. A lower arrival percentage generally increases hourly airfield capacity, as arriving aircraft require slower speeds and additional time to exit the runway via taxiways, whereas departing aircraft are typically ready for immediate takeoff upon entering the runway. For the purposes of this analysis, it is assumed that arrivals account for 50% of total operations.

For the ACRP method, the percentage of arrivals is calculated within the spreadsheet model based on the defined inputs and varies for each scenario.

3.4.1.6. Location of Exit Taxiways

Efficient movement of aircraft to and from the runway system is essential to maximizing airfield capacity. One of the key factors influencing this efficiency is runway occupancy time, which is directly affected by the number and location of exit taxiways. Longer runway occupancy times reduce capacity, as aircraft take more time to clear the runway, delaying subsequent operations.

Runway capacity is optimized when the airfield includes:

- Full-length parallel taxiways
- Adequate and strategically placed exit taxiways
- No active runway crossings

These features help minimize the time aircraft spend on the runway after landing, thereby enhancing throughput.

For the AC 150/5060-5 method, exit taxiway configurations were evaluated for each of the three runway operating scenarios described in **Section 3.4.1.1**. Each configuration provided at least four exit options (N) meeting the spacing criteria outlined in AC 150/5060-5 for arriving aircraft. The exit factor (E) was then calculated using the fleet mix index and the number of exits (N). The resulting exit factors (E) used in the capacity analysis were:

- 1 for multi-runway operations
- 0.94 for single-runway operations under Visual Flight Rules (VFR) conditions
- 0.95 for single-runway operations under IFR conditions

For the ACRP method, exit taxiway configurations were also evaluated for each of the three runway operating scenarios described in **Section 3.4.1.1**. Within the model, four options are provided for taxiway configurations which are:

- Excellent (4 or more exits)
- Good (2-3 exits)
- Poor (1 exit)
- Insufficient (no exits)

3.4.1.7. Runway Occupancy Time

Knowing how long an aircraft occupies the runway during its operation can help refine an airport's capacity. Runway occupancy time (ROT) as defined in ACRP Report 79 is the duration of time an aircraft occupies the runway which is typically expressed in seconds. For arrivals, it represents the time from when an aircraft crosses the runway threshold until it has cleared the runway and exited the RSA. For departures, it represents the time from when an aircraft enters the active runway, defined as entering the RSA, until it clears the departure end. ROT can vary between classes of aircraft. Arrival ROT was only used in the ACRP Report 79 method. For this analysis Arrival ROT was not available, so estimates were made for each aircraft category:

- Class A: 32 seconds
- Class B: 40 seconds
- Class C



- Small +: 42 seconds
 - Large Turbo Prop: 45 seconds
 - Large Jet: 46 seconds
 - Large 757: 51 seconds
- Class D: 55 seconds

3.4.1.8. Average Approach Speeds

The ACRP method analyzes approach speeds. Aircraft size, weight, and engine performance influence typical final approach speeds. Final approach speed directly affects airfield capacity, as higher speeds can increase throughput; however, significant variations in approach speeds within the fleet can reduce capacity, as controllers must maintain appropriate separation between aircraft to compensate for different aircraft approach speeds. Approach speeds are only used in the ACRP Report and typical approach speeds were not available, so the default values were used, which are:

- Class A: 90 Knots
- Class B: 100 Knots
- Class C
 - Small +: 120 Knots
 - Large Turbo Prop: 130 Knots
 - Large Jet: 135 Knots
 - Large 757: 140 Knots
- Class D: 150 Knots

3.4.1.9. Arrival and Departure Aircraft Separation

The ACRP method also integrates arrival and departure aircraft separation. Aircraft separation is established by air traffic control procedures, primarily based on aircraft weight classifications. The main concern with aircraft separation is wake turbulence which is a byproduct generated by lift from the wings of aircraft and produces trailing vortices that pose a hazard to following aircraft, particularly those of smaller size. As a result, separation distances increase when lighter aircraft follow heavier aircraft to mitigate wake effects. Separation standards are also influenced by the accuracy of surveillance systems and the precision of aircraft navigation. Higher positional accuracy and path control can support reduced spacing, while lower precision, especially in instrument conditions, requires increased separation.

These separation distances are only used for the ACRP method. However, these distances were not available for STP. Therefore, the default values were used which simulate the minimum separation requirements. The values used in the analysis are shown in **Table 3.24**. These values show the distance needed between the different aircraft classifications and combinations of trailing and leading aircraft.

**Table 3.25 - Arrival-Arrival Aircraft Separation Standards**

Trailing Aircraft	Leading Aircraft	VMC Separation Requirements (Nautical Miles)	IMC Separation Requirements (Nautical Miles)
Class A—Class D	Class A, Class B	1.9	3.0
Class A—Class D	Small+	1.9	3.0
Class A—Small+	Large TP, Large Jet	2.7	4.0
Large TP—Class D	Large TP, Large Jet	1.9	3.0
Class A—Small+	Large 757	3.7	5.0
Large TP—Class D	Large 757	2.7	4.0
Class A—Class B	Class D	4.6	6.0
Class C	Class D	3.6	5.0
Class D	Class D	2.7	4.0

3.4.1.10. Arrival and Departure Buffers

The ACRP model incorporates arrival and departure buffers into its analysis. The Report states that additional spacing buffers are applied beyond minimum separation standards to reduce the risk of loss of separation and associated operational errors. These buffers are implemented during both arrival and departure operations and are typically expressed in time.

For arrivals, controllers apply spacing buffers to manage sequencing and to balance the mix of arrivals and departures, allowing sufficient opportunities for departures between inbound aircraft. For departures, a hold buffer is added to runway occupancy time or minimum departure intervals, creating an additional time constraint before a subsequent departure can be initiated. Similar buffering is applied to arrivals, often expressed in distance rather than time.

This parameter was applied only for the ACRP method. Using data provided by the airport, an arrival gap spacing buffer of 14 seconds and a departure hold buffer of 10 seconds were assumed for single runway operations. For the dual and intersecting models, a 0.4 nautical mile (nm) buffer was applied for arrivals with a 1.5nm buffer being applied for diagonal separation allowed. The

3.4.1.11. Average Arrival Deceleration Rate and Departure Acceleration Rate

Average arrival deceleration rates and departure acceleration rates are aircraft performance parameters which are used in the ACRP method. This data represents how quickly aircraft clear the runway after landing and during takeoff. The arrival deceleration rate governs how quickly an aircraft slows from touchdown to the runway exit, while the departure acceleration rate governs how quickly an aircraft reaches takeoff speed and becomes airborne. These parameters directly affect runway occupancy time, which is identified as a primary determinant of runway capacity. Higher deceleration and acceleration rates reduce arrival and departure runway occupancy times, allowing the runway to be cleared more quickly for subsequent operations.

In the ACRP model, typical default planning values were applied due to the absence of airport-specific data for acceleration and deceleration rates at STP. The values used consist of 5.3 feet per second squared for average arrival deceleration and 8.0 feet per second squared for departure acceleration.

3.4.1.12. Length of Common Approach

The length of common approach is defined as the segment of the final approach path extending from the point at which an aircraft is established on final approach to the runway threshold. This distance represents the portion of flight where successive arrivals share the same approach path, during which variations in aircraft speed may cause changes in spacing between aircraft. Typical values for this distance generally range from approximately 5 to 10 nautical miles.

The length of this shared approach segment directly affects arrival sequencing and overall airfield performance. Longer distances require aircraft to maintain separation for a greater duration, reducing arrival throughput and limiting opportunities to interleave departures. In contrast, shorter distances allow for later sequencing adjustments, improving spacing efficiency and increasing achievable service volume at a given level of delay.

For the ACRP model, the default value of 7 nautical miles was used.

3.4.2. Annual Service Volume (ASV)

Based on some of these factors influencing airfield capacity at the airport, methodologies outlined in AC 150/5060-5 were used to determine both peak hour capacity and ASV. The AC provides standardized hourly and annual capacity estimates for various runway configurations.

For example, as illustrated in **Figure 3.6**, a single-runway configuration with a fleet mix index between 0 and 20% has a standard hourly capacity of 98 operations under VFR and 59 operations under IFR. This configuration applies to STP when only Runway 14-32 is in use.

Figure 3.6 - Single Runway Configuration Table

NO.	Runway-use Configuration	Mix Index % (C+3D)	Hourly Capacity Ops/Hr		Annual Service Volume Ops/Yr
			VFR	IFR	
1.		0 to 20	98	59	230,000
		21 to 50	74	57	195,000
		51 to 80	63	56	205,000
		81 to 120	55	53	210,000
		121 to 150	51	50	240,000

Source: FAA Advisory Circular 150/5060-5, Airport Capacity and Delay, 1983.

These standardized estimates were evaluated for each of the three STP runway operating scenarios producing the results summarized in **Table 3.25** below. The table also includes the determination of annual aircraft delay for each runway operating scenario. Delay is calculated based on the ratio of

annual demand to ASV. As this ratio was relatively small in all three scenarios, annual delay does not exceed 2.1 hours throughout the planning period.

Table 3.26 - Projected ASV and Delay by Runway Operating Scenario, AC Method

Year	Forecast Annual Operations ^(a)	VFR Hourly Capacity	IFR Hourly Capacity	ASV	Ratio	Average Delay per Aircraft	Annual Delay
Runway 14/32							
2024	42,476	98	59	230,000	0.18	0 min	0 min
PAL 1 (2030)	45,755	98	59	230,000	0.20	0.05 min	38.1 min
PAL 2 (2035)	47,128	98	59	230,000	0.20	0.1 min	78.6 min
PAL 3 (2045)	50,031	98	59	230,000	0.22	0.15 min	125.1 min
Runways 14/32 and 13/31							
2024	42,476	132	59	260,000	0.16	0 min	0 min
PAL 1 (2030)	45,755	132	59	260,000	0.18	0 min	0 min
PAL 2 (2035)	47,128	132	59	260,000	0.18	0 min	0 min
PAL 3 (2045)	50,031	132	59	260,000	0.19	0.05 min	41.7 min
Runways 14/32 and 9/27							
2024	42,476	98	59	230,000	0.18	0 min	0 min
PAL 1 (2030)	45,755	98	59	230,000	0.20	0.05 min	38.1 min
PAL 2 (2035)	47,128	98	59	230,000	0.20	0.1 min	78.6 min
PAL 3 (2045)	50,031	98	59	230,000	0.22	0.15 min	125.1 min

Sources:

MAC Noise and Operations Monitoring System (MACNOMS).
 FAA Advisory Circular 150/5060-5, Airport Capacity and Delay.
 Metropolitan Airports Commission (MAC) Annual Reports (2019-2024).
 Kimley-Horn, 2025.

Notes:

(a) Total forecast annual demand for the airfield.
 ASV = Annual Service Volume
 VFR = Visual Flight Rules
 IFR = Instrument Flight Rules
 PAL = Planning Activity Level

3.4.2.1. Hourly Capacity

Peak hour capacity refers to the maximum number of aircraft operations an airfield can accommodate within a one-hour period. This metric is calculated separately for both VFR and IFR conditions.

To refine hourly capacity estimates, the AC analysis incorporates:

- The percentage of touch-and-go operations, which typically require less runway occupancy time.
- The number and placement of runway exit taxiways, which influence how quickly landing aircraft can vacate the runway.

These factors help produce a more accurate representation of the airfield's operational efficiency under varying conditions. The hourly capacities for the three runway operating scenarios were calculated using AC 150/5060-5 methodology and are summarized in **Table 3.27** below. Hourly capacity is not refined further in the ACRP method.

**Table 3.27 - Hourly Capacity by Runway Operating Scenario, AC Method**

Conditions	Hourly Capacity Base (C)	Touch & Go Factor (T)	Exit Factor (E)	Hourly Capacity
Runway 14/32				
VFR	86	1.2	0.94	97
IFR	57	1	0.95	54
Runways 14/32 and 13/31				
VFR	127	1	1	127
IFR	57	1	1	57
Runways 14/32 and 9/27				
VFR	125	1.08	1	135
IFR	57	1	1	57

Sources:

MAC Noise and Operations Monitoring System (MACNOMS).
 FAA Advisory Circular 150/5060-5, Airport Capacity and Delay.
 Kimley-Horn, 2025.

Notes:

VFR = Visual Flight Rules
 IFR = Instrument Flight Rules

3.4.3. Capacity Conclusion

As outlined in **Chapter 2**, the forecasted annual demand at STP for 2045 is 50,031 operations. This represents 36% of the AC method's 60% ASV threshold (138,000 operations) for a single-runway scenario and 32% of the 60% ASV threshold (156,000 operations) for a dual-runway scenario, as shown in **Table 3.28** and **Figure 3.7**. Additionally, peak hour operations are not expected to exceed 27 operations per hour across the planning horizon. This demand falls short of both the VFR and IFR hourly capacities for all three scenarios.

These values indicate that the Airport is well positioned to accommodate projected demand without exceeding capacity limits in any runway operating scenario.

Table 3.28 - Airfield Capacity Summary, AC Method

Year	Forecast Annual Demand ^(a)	Annual Service Volume	80% ASV	60% ASV	Peak Hour Operations	Hourly Runway Capacity	
						VFR	IFR
Runway 14/32							
2024	42,476	230,000	184,000	138,000	23	97	54
PAL 1 (2030)	45,755	230,000	184,000	138,000	24	97	54
PAL 2 (2035)	47,128	230,000	184,000	138,000	25	97	54
PAL 3 (2045)	50,031	230,000	184,000	138,000	27	97	54
Runways 14/32 and 13/31							
2024	42,476	260,000	208,000	156,000	23	127	57
PAL 1 (2030)	45,755	260,000	208,000	156,000	24	127	57
PAL 2 (2035)	47,128	260,000	208,000	156,000	25	127	57
PAL 3 (2045)	50,031	260,000	208,000	156,000	27	127	57
Runways 14/32 and 9/27							
2024	42,476	230,000	184,000	138,000	23	135	57
PAL 1 (2030)	45,755	230,000	184,000	138,000	24	135	57
PAL 2 (2035)	47,128	230,000	184,000	138,000	25	135	57
PAL 3 (2045)	50,031	230,000	184,000	138,000	27	135	57

Sources:

MAC Noise and Operations Monitoring System (MACNOMS).
 FAA Advisory Circular 150/5060-5, Airport Capacity and Delay.
 Metropolitan Airports Commission (MAC) Annual Reports (2019-2024).
 Kimley-Horn, 2025.

Notes:

(a) Total forecast annual demand for the airfield.
 ASV = Annual Service Volume
 VFR = Visual Flight Rules
 IFR = Instrument Flight Rules
 PAL = Planning Activity Level

In addition to the AC methodology, ACRP Report 79 was also used to determine peak hourly capacity and ASV. The ACRP Report 79 approach requires a greater level of input data and allows for more detailed representation of actual operating conditions at an airport assuming those conditions are provided. The ACRP model provides hourly airfield capacity based on these detailed inputs, reflecting maximum sustainable throughput for various runway configurations and operating conditions. These hourly capacities are then converted to the ASV value by applying demand distribution factors that account for daily and seasonal peaking. Multiple runway configurations were used for this analysis to determine different levels of ASV and the results were aggregated. Each runway scenario was given a weight based on how often the configuration is used throughout the year to show a total average of the Airport's ASV. Weighted averages assigned to each runway configuration are shown below:

- Single-runway operation 95%
- Dual-runway operation 2.5%
- Intersecting-runway operation 2.5%

The weighted averages were then applied to the total calculated ASV for each corresponding scenario, and the resulting products were aggregated to derive the overall results.

Overall, the ACRP Report 79 methodology generally produces more conservative estimates of ASV than the AC method due to its explicit treatment of operational constraints and variability, while also requiring more comprehensive input data to accurately model airport-specific conditions.

The results of the ACRP method are summarized in **Table 3.29** and in **Figure 3.7**.

Table 3.29 - Airfield Capacity Summary, ACRP Method

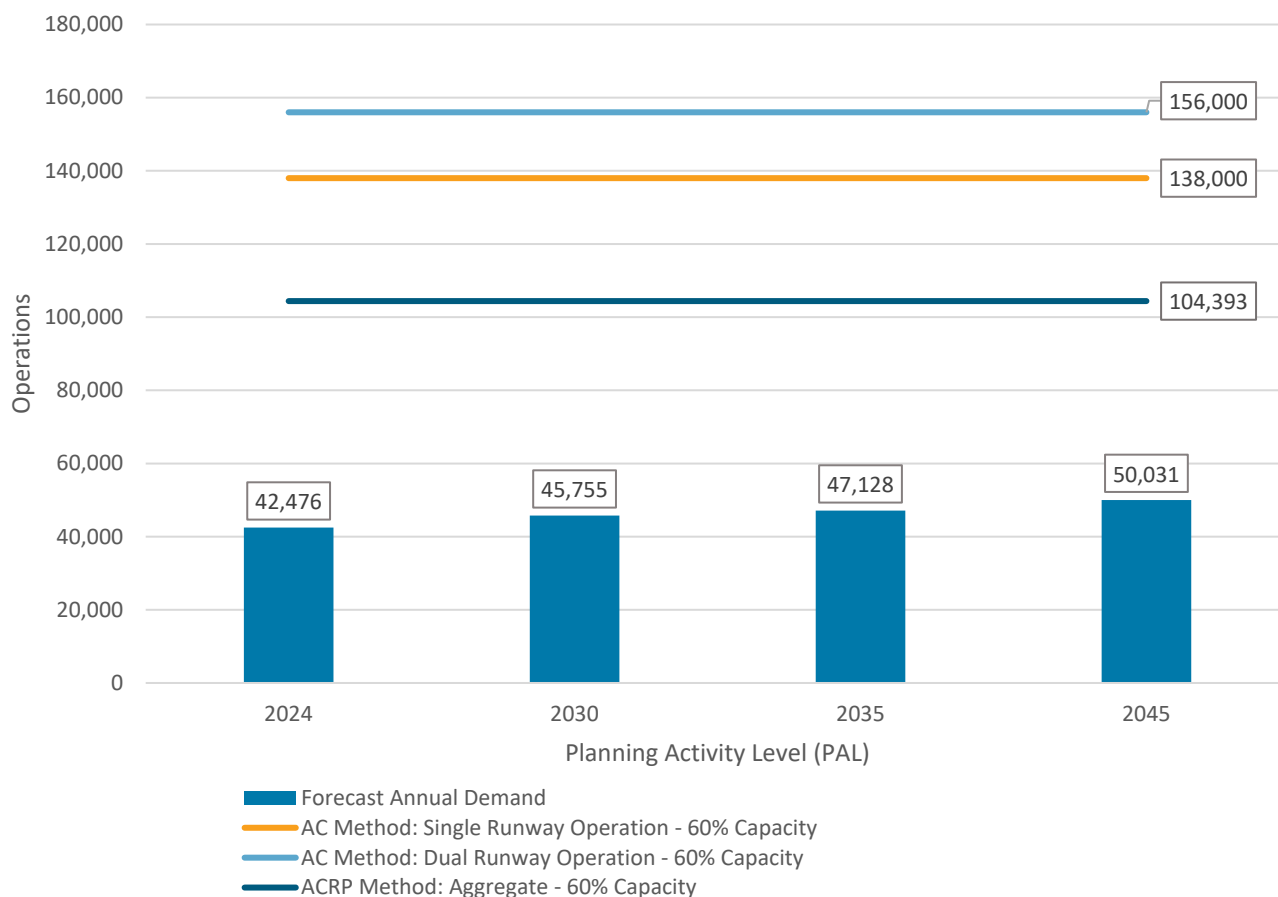
Year	Forecast Annual Demand ^(a)	Annual Service Volume	80% ASV	60% ASV	Peak Hour Operations	Hourly Runway Capacity	
						VFR	IFR
Runway 14/32							
2024	42,476	170,200	136,160	102,120	23	67	55
PAL 1 (2030)	45,755	170,200	136,160	102,120	24	67	55
PAL 2 (2035)	47,128	170,200	136,160	102,120	25	67	55
PAL 3 (2045)	50,031	170,200	136,160	102,120	27	67	55
Runways 14/32 and 13/31							
2024	42,476	306,000	244,800	183,600	23	118	113
PAL 1 (2030)	45,755	306,000	244,800	183,600	24	118	113
PAL 2 (2035)	47,128	306,000	244,800	183,600	25	118	113
PAL 3 (2045)	50,031	306,000	244,800	183,600	27	118	113
Runways 14/32 and 9/27							
2024	42,476	185,900	148,720	111,540	23	71	89
PAL 1 (2030)	45,755	185,900	148,720	111,540	24	71	89
PAL 2 (2035)	47,128	185,900	148,720	111,540	25	71	89
PAL 3 (2045)	50,031	185,900	148,720	111,540	27	71	89
Aggregate Results							
2024	42,476	173,988	139,190	104,393	23	68	57
PAL 1 (2030)	45,755	173,988	139,190	104,393	24	68	57
PAL 2 (2035)	47,128	173,988	139,190	104,393	25	68	57
PAL 3 (2045)	50,031	173,988	139,190	104,393	27	68	57

Sources:

Airport Cooperative Research Program (ACRP) Report 79, 2012.
MAC Noise and Operations Monitoring System (MACNOMS).
Metropolitan Airports Commission (MAC) Annual Reports (2019-2024).
Kimley-Horn, 2025.

Notes:

(a) Total forecast annual demand for the airfield.
ASV = Annual Service Volume
VFR = Visual Flight Rules
IFR = Instrument Flight Rules
PAL = Planning Activity Level

Figure 3.7 - Annual Service Volume (ASV) Summary

Sources:

MAC Noise and Operations Monitoring System (MACNOMS).
 FAA Advisory Circular 150/5060-5, Airport Capacity and Delay.
 Metropolitan Airports Commission (MAC) Annual Reports (2019-2024).
 Kimley-Horn, 2025.

Between the two methodologies, the ACRP methodology differs from AC 150/5060-5 primarily in its level of detail, flexibility, and resulting capacity estimates. The AC method relies on generalized inputs and predefined lookup tables, whereas the ACRP method incorporates a wider range of operational variables such as fleet mix, runway occupancy times, separation standards, and runway dependencies, allowing for a more site-specific representation of airfield operations.

As a result, the ACRP approach typically produces more conservative estimates of airfield capacity and annual service volume, since it explicitly accounts for operational constraints and variability that are not fully captured in the AC methodology. However, the ACRP method is also more data-intensive. When detailed airport-specific inputs are unavailable, default values are often applied for key parameters such as separation buffers and runway occupancy times. While this maintains consistency in the analysis, reliance on default values can reduce the accuracy of the results and limit the benefit of the added model sophistication.



Despite this limitation, the ACRP methodology is recommended for use in planning analyses because it provides a more conservative estimate of annual service volume compared to the AC method.

As shown in **Figure 3.7**, even under the conservative ACRP methodology, all three runway configurations yield maximum annual service volumes that remain above 60% of capacity through the 2045 forecast horizon with only two runways in operation. Notably, the single-runway configuration alone is sufficient to accommodate the projected demand.

3.5. Pavement Condition Analysis

As discussed in **Chapter 1**, the last airfield pavement inspection at STP took place in 2024. During this inspection, Runway 14/32 was recorded as having a Pavement Condition Index (PCI) between 41 and 60, indicating a need for improvements, as depicted in **Figure 1.4 of Chapter 1**. To address this need, the MAC undertook a full reconstruction of Runway 14/32 at STP between June 2 and August 9 of 2025, replacing pavement originally installed in the 1980s. The project included the installation of bituminous pavement, aggregate base, and geotextile fabric, as well as lighting modifications, drain tile rehabilitation, pavement markings, and sawcut grooving.

The 2024 airfield pavement inspection also identified other portions of airfield pavement that will need rehabilitation or reconstruction over the planning horizon of this LTP Update. They are summarized in the following **Table 3.30**.

**Table 3.30 - Pavement Facilities with PCI 21 – 80 (2024)**

Pavement Condition Index (PCI)	Facility
21 – 40	Runway 13/31
	Portion of Runway 9/27 intersecting Runway 13/31
	Portion of Taxiway D intersecting Runway 13/31
	North military apron adjacent to Taxiway A1
41 – 60	Taxiway A2
	Taxiway A3
	Taxiway B
	Taxiway L
	VSR to ATCT
	Taxilanes to east and west of W20 box hangars
	Pavement surround S16 MAC maintenance building
	Southern portion of Eaton Street
61 – 80	Runway 9/27
	Taxiway E
	Taxiway P
	Southern portion of Taxiway W
	Eastern portion of Bayfield Street

Sources:Short Elliot Hendrickson Inc. (SEH) *Pavement Condition Index (PCI) Report, 2024***Notes:**

VSR = Vehicle Service Road

ATCT = Air Traffic Control Tower

It is recommended that pavement segments with PCIs including and below 60 be prioritized for rehabilitation, reconstruction, or removal within the Airport's Capital Improvement Program (CIP).

The runways at STP provide sufficient weight-bearing capacity to accommodate all aircraft operating at the airport. Runway 14/32 supports up to 83,000 pounds for single-wheel gear, 111,000 pounds for dual-wheel gear, and 197,000 pounds for dual-wheel tandem gear. Runway 13/31 offers even greater strength, with capacities of 97,000 pounds (single-wheel), 135,000 pounds (double-wheel), and 228,000 pounds (double-wheel tandem). While Runway 9/27 is limited to a single-wheel capacity of 12,500 pounds, this is adequate for the A-I (Small) aircraft operations for which the runway is intended. The following **Table 3.31** demonstrates the Airport's weight-bearing capacity for each runway.



Table 3.31 - Runway Weight Bearing

Category	Runway 14/32	Runway 13/31	Runway 9/27
Single-Wheel	83,000 lbs.	97,000 lbs.	12,500 lbs.
Dual-Wheel	111,000 lbs.	135,000 lbs.	N/A
Dual-Wheel Tandem	197,000 lbs.	228,000 lbs.	N/A

Sources:

Airmav.com

Kimley-Horn, 2025.

3.6. Landside Facilities

This section evaluates the facility requirements for landside elements of the Airport. Landside facilities encompass all components that support passenger, crew, and visitor access to the airport from the ground transportation network. These include all amenities that facilitate the interface between air and ground transportation. As stated earlier, while aircraft aprons and storage hangars are physically located within the airfield boundary, they are evaluated as landside components because of their functional relationship with vehicular access, parking, and landside circulation.

3.6.1. Hangar Requirements

Aircraft hangars provide essential infrastructure for both aircraft storage and maintenance, offering protection from environmental elements. At STP, the existing hangar inventory includes primarily larger conventional box hangars capable of accommodating various aircraft types and sizes. Ownership of these hangars is comprised both of individual and corporate entities.

As detailed in **Chapter 1**, the Airport currently has 36 hangar buildings providing approximately 894,000 square feet of aircraft storage space. This includes:

- 822,000 square feet of conventional box hangar space,
- 72,000 square feet dedicated to military aircraft storage within the Saint Paul Army Aviation Facility.

The military facility and the hangars associated with the Saint Paul Flight Center fixed base operator (FBO) are located on the west side of the airfield, west of Taxiways A and W. Additional hangar space, including 274,000 square feet of box hangars, is situated northeast of the airfield along Taxiway E. However, most of the hangar capacity (386,000 square feet), is concentrated on the south end of the airport along Taxiways B and C, primarily consisting of large corporate and box hangars.

It is assumed that 100% of the based aircraft fleet at the airport are stored in hangars, reflecting the operational preference for indoor storage during winter months. While tiedown spaces are available on aprons adjacent to both FBOs, this space will continue to support transient aircraft needs.

The spatial requirements for aircraft storage hangars at the airport are determined by several factors, including aircraft type, the number of based and itinerant aircraft, and the operational needs of their users. These requirements were calculated using standardized dimensions for representative aircraft

in each category (single-engine piston, multi-engine piston, turboprop, jet, rotorcraft, and other types) along with allowances for general hangar functions.

All aircraft storage at STP is accommodated within conventional box hangars. These enclosed structures typically accommodate multiple aircraft and may include heating and other amenities. Space requirements were based on the average dimensions of common aircraft types, with additional area allocated for general use. It should be noted that no T-Hangars currently exist at the Airport and are typically owned/operated by the airport. As such, MAC does not have plans to construct, own, or operate T-hangars at STP.

Storage specifications were developed in alignment with the based aircraft forecasts presented in **Chapter 2** and are summarized in **Table 3.32**. While these specifications are representative and are used in projecting how much hangar space is needed to accommodate current and future demand, they reflect the airport's current fleet mix and aircraft counts. These representative specifications also account for a buffer for adequate clearance and operational flexibility.

Table 3.32 - Storage Space Requirements by Aircraft Type (Square Feet)

Aircraft Type	Box Hangar Space Needed to Accommodate Aircraft Type
Single-Engine Piston	1,574
Multi-Engine Piston	2,522
Turboprop	2,800
Jet	7,800

Sources:

FAA Aircraft Characteristics Database (accessed September 2025).
Kimley-Horn, 2025.

Notes:

Measurements include indoor aircraft storage space only—apron sizes are not included.

At STP, there are 97 total based aircraft. This includes 45 validated, per **Chapter 2** results, and 11 military aircraft housed at the Saint Paul Army Aviation Facility. Although the physical square footage of existing hangars could theoretically accommodate additional aircraft, all hangars are currently leased and considered fully occupied. Transient hangar space is available through both FBOs but remains limited, totaling approximately 40,000 square feet.

As detailed in **Chapter 2**, the number of based aircraft at the Airport is projected to increase from 97 to 110 (13 additional aircraft) over the forecast period. This assumes growth from 45 validated based aircraft to 52, and no growth in military aircraft. To assess future aircraft hangar storage needs, the following additional assumptions were incorporated into the analysis to reflect current airport conditions, anticipated demand, and broader industry trends:

- Existing tenants are fully utilizing their leased hangar space or subletting any surplus as needed. Therefore, all future demand will require additional aircraft storage capacity.
- The current trend of 100% of based aircraft being stored indoors is expected to continue.
- Future demand will be exclusively for box hangars, rather than T-Hangars, due to the projected growth in jet aircraft within the based fleet.
- Transient hangar demand is anticipated to increase by 25% over the planning horizon.

- The space requirements per aircraft type are expected to remain consistent with those of the current fleet.
- Aircraft storage trends are assumed to remain consistent throughout the forecast period.

Table 3.33 provides a summary of projected increases in storage demand by aircraft type and the hangar development square footage necessary to meet future demand. Potential locations for new hangars are discussed in **Chapter 4**.

Table 3.33 - Forecasted Aircraft Storage Space Requirements

Additional Aircraft	PAL 1 (2030)	PAL 2 (2035)	2040	PAL 3 (2045)	Total Square Footage
Single-Engine Piston	0	1	1	1	4,722
Multi-Engine Piston	0	0	0	0	0
Turboprop	0	0	1	0	2,800
Jet	3	2	2	2	70,200
Helicopter	0	0	0	0	0
Additional Square Footage Needed	23,400	17,174	19,974	17,174	77,722

Sources:

FAA Aircraft Characteristics Database (accessed September 2025).
Kimley-Horn, 2025.

Notes:

PAL = Planning Activity Level

Transient aircraft storage demand is projected to increase by 25% over the planning period. With current transient hangar space limited to approximately 40,000 square feet between the two FBOs onsite, a total of 50,000 square feet will be needed by 2045, representing an increase of 10,000 square feet.

Therefore, based on existing facilities and forecasted storage requirements, it is recommended that the Airport plan for:

- 77,722 square feet of additional box hangar space for based aircraft, and
- 10,000 square feet of additional box hangar space for transient aircraft.

In total, a minimum of 87,722 square feet of new box hangar space will be required over the planning horizon.

While these recommendations are based on forecasted needs, it is important to recognize that true demand for hangar space can fluctuate and long hangar waitlists are often a continual concern for GA airports in Minnesota. The minimum requirement identified here reflects projected growth, but actual demand may exceed, or not exceed, these estimates due to market dynamics, changes in aircraft ownership, or shifts in aviation activity. However, it is reasonable for this LTP Update to consider airfield buildout scenarios that go beyond the minimum requirement, ensuring the Airport remains well-positioned to accommodate potential future demand and support continued operational flexibility.



3.6.2. Apron Requirements

The airfield currently provides approximately 196,350 square yards of apron space, as documented in **Chapter 1**. Portions of this apron area designated for transient aircraft are divided between three primary locations: adjacent to the Holman Field Administration and Terminal Building on the north side of the airfield, and at the two FBOs located on the west side.

The Airport indicated that the existing transient apron space generally meets operational needs. However, there are periods when this space becomes congested, particularly during peak activity or special events. To maintain operational flexibility and accommodate future demand, it is prudent to incorporate additional transient apron space into long-term planning efforts. Potential apron expansion concepts will be addressed in greater detail in **Chapter 4** as part of the airfield buildout alternatives.

3.6.3. Fuel Facilities

STP is served by two fueling areas, providing operations on both the east and west sides of the airfield. In total, FBOs Signature Aviation and St. Paul Flight Center provide 24,000 gallons of AvGas tank storage and 62,000 gallons for jet fuel, not including mobile refueling trucks.

Examining historical fuel flowage and aircraft operations data, the average volume of fuel pumped per jet/turboprop operation between 2019 and 2023 at STP was approximately 250 gallons. For piston aircraft operations, approximately 7.5 gallons of fuel per operation was pumped. Application of these estimates to aircraft operations forecasts described in the previous chapter results in approximately 110 annual (or twice weekly) fuel tank refueling operations by PAL 4 (2045). For AvGas, approximately 5 annual tank refuels (roughly every other month) would be required by PAL 4.

Airport fuel facilities have not been identified as deficient by MAC or Airport users; however, it is recommended that Airport management continue to monitor fuel flowage and frequency of tank refuels, primarily for jet fuel to determine if expansion of the fuel farm or additional tank capacity is needed.

3.6.4. Access and Parking

Vehicle access to and around the Airport is generally adequate though the unique configuration of the Airport's property due to development on the west and curvature of the Mississippi River as it bypasses STP presents some constraints.

As noted, portions of Airport Road and Bayfield Street are situated within various FAA-designated protection areas, although complete relocation of either roadway alignment is not reasonable due to the limited space available. As such, no significant improvements to the Airport's roadway system are recommended in this LTP. However, as development occurs over time, particularly as it pertains to the Airport's east side, landside/hangar development alternatives presented in the following chapter pay specific attention to ensuring that sufficient vehicle and aircraft access is provided. Due to some of the non-standard geometries of Taxiways E and P, and existing development generally following the alignment of the adjacent River, focus on avoiding any roadway/taxilane crossings or unnecessary aircraft movements will be imperative.

Vehicle parking for public users and tenants is adequate, except for the Minnesota Army National Guard, which is detailed in the next section. Future hangar development areas or tenant expansion



areas should consider inclusion of vehicle parking that meets City code requirements and eliminates any need for Airport users to park vehicles inside of aircraft storage hangars or require long walking distances.

3.6.5. Minnesota Army National Guard Facility

The Minnesota Army National Guard (Guard), located on the Airport's east side, is one of the cornerstone tenants at STP, and the facility generates substantial aircraft and vehicle traffic. The facility presently includes office, training, maintenance, and storage areas, along with approximately 72,000 square feet of hangar space and 18,000 square yards of apron space.

There are some small secure areas north and south of the building, though they are typically used for equipment storage and some limited space for vehicles. Vehicle parking is generally provided in an unsecured landside parking area of approximately 37,000 square feet across Airport Road to the west.

In discussions with the Guard, it was identified that vehicle parking can be challenging during peak periods of activity, and a desire for additional secure parking was expressed. It is recommended that the Airport continue to work with tenants, including the Guard, to understand development needs and how to accommodate potential expansion needs.

3.6.6. Support Facilities

3.6.6.1. Fencing and Security

Airport fencing and security is sufficient at STP, except where noted. As outlined in **Chapter 1**, a secure airfield perimeter fence is present on all portions of the Airport except for portions to the south where the Mississippi River negates vehicle or pedestrian access. Currently, a segment of the Airport fence encroaches upon the Runway 14 RSA and ROFA at the northern corners.

The fence runs along Airport Road and Bayfield Street, where available space for relocation is limited, though it should be noted that the fence is not considered to be an impediment to airspace.

From a safety standpoint, the most significant threat comes from wildlife present on the airfield. Deer, birds, and other wildlife are often present because of the proximity to the Mississippi River. The Airport monitors and reports strikes and practices active control of wildlife as needed.

3.6.6.2. Maintenance Facilities

The Airport currently maintains a diverse fleet of maintenance and snow removal equipment (SRE) that is housed across three separate facilities. One building is positioned at the north end of the main terminal parking lot, while three additional function-specific buildings are situated near the south hangar area adjacent to the airfield beacon. This fleet supports both winter operations and general airfield maintenance and includes snow removal vehicles such as brooms, blowers, plows, and a deicing truck; hauling and maintenance vehicles including pickup trucks, an SUV, and a maintenance truck; airfield maintenance equipment such as tractors with mower attachments, Toro units, and a skid steer with multiple attachments; and heavy equipment including loaders and a multi-functional equipment unit. In addition, the Airport operates with a staff of approximately eight personnel responsible for maintaining and deploying this equipment.

The existing distributed arrangement of facilities results in operational inefficiencies, including increased response times, redundant storage conditions, and cumbersome airfield access as all maintenance equipment must use or cross a public road to access the airfield. As a result, the Facility Requirements analysis evaluated the feasibility of consolidating these functions into a single, purpose-built maintenance and SRE facility.

A planning-level assessment was conducted to estimate the space required to accommodate the Airport's existing equipment fleet within a consolidated building. This analysis followed a defensible, FAA-informed methodology that first estimates the footprint of each piece of equipment, then applies allowances for maneuvering space and safety clearances, and finally incorporates space for maintenance, storage, and personnel functions.

Based on representative equipment bay sizes, the total equipment storage footprint was estimated at approximately 16,500 square feet. To account for operational circulation and safety clearances within the building, a planning factor of approximately 1.5 times the equipment footprint was applied, consistent with the concept of providing adequate maneuvering space around equipment. This results in an estimated equipment and circulation area of approximately 24,750 square feet.

Additional space was then allocated for support functions, including maintenance bays, parts and attachment storage, and staff support areas such as offices, locker rooms, and break space. These areas are necessary to support day-to-day operations and are consistent with FAA guidance for maintenance and SRE facilities. The inclusion of these functions results in a total estimated building size in the range of approximately 30,000 to 35,000 square feet.

This planning-level estimate is consistent with guidance provided in AC 150 5220-18A - Maintenance Facility, which recommends that facility sizing be based on the total space required for three primary components: storage areas for equipment and materials, support areas for personnel and maintenance functions, and special equipment areas to support building systems. The AC also emphasizes the need to provide adequate equipment clearance and maneuvering space through the use of an Equipment Safety Zone surrounding each piece of equipment.

Consistent with this guidance and the results of the planning analysis, the Airport should plan for the development of a consolidated maintenance and SRE facility of approximately 32,000 square feet, with flexibility to expand in the future as equipment needs evolve. This facility should be designed to accommodate the full equipment fleet, provide efficient circulation and maintenance access, and incorporate appropriate storage for materials and attachments. In addition, the facility should include a dedicated fueling area to support maintenance operations and improve operational efficiency, consistent with FAA guidance recommending that SRE facilities provide convenient access for servicing and fueling equipment.

Consolidation of maintenance functions into a single facility located on the airfield is expected to improve operational efficiency, enhance equipment longevity through proper storage and maintenance conditions, and support more effective deployment of resources during both winter operations and routine airfield maintenance activities.

3.6.6.3. Terminal/Administration Building

The Airport's Holman Field Administration Building offers approximately 19,500 square feet of space and currently accommodates offices, public meeting areas, restrooms, and a full-service restaurant. As



the facility no longer functions as an FBO or passenger terminal, its size and location are expected to meet operational needs throughout the 20-year planning horizon. However, ongoing maintenance and periodic improvements should be undertaken to preserve functionality and appearance.

Given that the building is listed on the National Register of Historic Places, it is recommended that the airport maintain the facility's historical character and footprint, while allowing for modifications or renovations as necessary to support its current uses.