MEMO

TO: Susan St. Cyr, P.E., San Antonio Airport System

FROM: John van Woensel, Brittany Hause

SUBJECT: San Antonio International Airport Strategic Development Plan
Crosswind Runway 4-22 Future Eligibility - Wind and Operational Analysis

DATE: October 22, 2019 (Revised February 20, 2020)

The **purpose of this memo** is to report the findings of additional seasonal wind analysis and the implications on the future Federal Aviation Administration (FAA) funding eligibility of Runway 4-22, as a crosswind runway at San Antonio International Airport (SAT). A crosswind runway is typically needed when wind conditions do not allow for arrivals or departures on a primary runway.

The October 2, 2019 discussion with the FAA Airports District Office program manager led to the additional seasonal analysis, to establish whether Runway 4-22 might be eligible for future FAA participation at a reduced runway design code (RDC) for smaller aircraft. It was established and reported in Phase 1 of the SAT Strategic Development Plan (SDP), that due to the very high wind coverage of Runway 13R-31L (the primary runway at SAT), crosswind Runway 4-22 is not required, per FAA airport planning and design standards. Therefore, it is ineligible for FAA funding participation as a full commercial service runway with an RDC of D-IV. Once Runway 4-22 exceeds its useful life, it will require replacement, decommissioning, or shortening/downgrading. Because of the runway's current good pavement condition, this is not estimated to occur until the end of the SDP's 2038 planning horizon or later.

Based on the information presented below and discussions with San Antonio Airport System (SAAS) staff and the FAA, the SDP is considering reduced RDC options for a shortened Runway 4-22 in the 20-year alternatives evaluation, rather than completely eliminating the runway. An RDC B-I runway would be narrower and shorter than an RDC D-IV runway.

Wind Analysis:

The **applicable FAA guidance** in Order 5100.38D, *Airport Improvement Program (AIP) Handbook,* states that for a crosswind runway (Runway 4-22) to be eligible for FAA funding participation, the wind coverage on the primary runway (Runway 13R-31L) must be 95% or less for the future RDC D-VI (documented in the forecast approved by the FAA in October 2018). In other words, the need for a crosswind runway (due to excessive crosswinds) would need to occur more than 5% of the time for a crosswind runway to be required and eligible for FAA funding participation. This criterion is also contained in FAA Advisory Circular 150/5300-13A, *Airport Design*.

Overall SAT wind conditions: The wind coverage analysis for the recent 10-year period (2008-2017) for All-Weather, Instrument Flight Rules (IFR), and Visual Flight Rules (VFR) conditions is shown in **Table 1**.

The analysis shows that the wind coverage of Runway 13R-31L was a very high 99.94% for All Weather conditions and that therefore, no crosswind runway is required for the current design aircraft (RDC D-IV, e.g. Boeing 767-300). This means that when the runway comes due for reconstruction, it will not be eligible for FAA funding participation as a D-IV runway. We first reported this finding during the SDP's Phase 1, in 2018 presentations to the SDP advisory groups, the community, and City Council and its Transportation and Mobility Committee. SAAS could theoretically fund the entire cost of an air carrier runway reconstruction project without FAA funding participation, but given the high cost of major airfield projects, this is unlikely (also, a long-term elimination of the Runways 13R-31L and 4-22 intersection is required by the FAA, to improve airfield safety).

Because SAT accommodates significant non-commercial service aircraft activity, both by propeller and jet aircraft, the impact of high crosswinds on smaller aircraft was considered. The analysis shows that the primary runway (Runway 13R-31L) also exceeds the 95% wind coverage requirement for the 13- and 16-knot crosswind components for smaller aircraft (the crosswind component is the highest value of a direct crosswind in which a pilot can land the aircraft safely), which correspond to aircraft such as the King Air 200 (13 knots) or Boeing 737 (16 knots). The only aircraft categories for which the primary runway does not meet the FAA 95% wind coverage requirement are those of the smallest users, A-I and B-I aircraft (e.g., Cirrus SR22, King Air 90). These aircraft can only operate with a crosswind component up to 10.5 knots.

Table 1: Wind Coverage for SAT's Runways 13-31

Crosswind (knots)	Wind Coverage (%)		
	All Weather	Instrument Flight Rules (IFR)	Visual Flight Rules (VFR)
10.5	**94.19**	96.87	93.87
13	97.47	98.53	97.35
16	99.53	99.65	99.51
20	**99.94**	**99.89**	**99.94**

Sources: National Oceanic and Atmospheric Administration, San Antonio International Airport Weather Observations, 2008-2017; WSP USA, 2019.

Table 2 summarizes **seasonal wind coverage** for Runway 13R-31L. The months of November through January were identified for the seasonal wind analysis, as they bring occasional strong northerly winds that result in excessive crosswind components on the primary runway, Runway 13R-31L, requiring the use of the crosswind runway, Runway 4-22. Seasonally, the primary runway still exceeds the FAA wind coverage requirement for the design aircraft (20-knot crosswind component), as well as for smaller or slower aircraft capable of a 16-knot crosswind component. However, the seasonal analysis found that the primary runway does not provide seasonal 95% wind coverage for aircraft with a 13-knot or 10.5-knot crosswind component, which includes A-II, B-II and smaller or slower aircraft.

Table 2: Seasonal Wind Coverage for Runways 13-31 for All Weather Conditions

Year	Month	Crosswind Component (knots)			
		10.5	13	16	20
2017	January	88.69	94.07	98.54	99.92
2017	November	89.41	94.79	98.86	99.67
2017	December	89.53	94.06	98.17	99.66
2017	Nov, Dec, Jan	89.44	94.42	98.54	99.75
2014	Nov, Dec, Jan	85.52	92.28	97.96	99.65
2011	Nov, Dec, Jan	90.47	95.53	99.2	99.85
2008	Nov, Dec, Jan	87.31	92.53	97.28	99.37
2008-2017	Nov, Dec, Jan	**89.90**	**94.75**	98.56	99.73
2008-2017	12 months	**94.19**	97.47	99.53	99.94

Sources: National Oceanic and Atmospheric Administration, San Antonio International Airport Weather Observations, 2008-2017; WSP USA, 2019.

Operational Analysis:

SAT is an air carrier airport with an Airport Reference Code (ARC) of D-IV (existing) and D-VI (future) (the ARC is the highest RDC of all runways at the airport). However, SAT also serves a significant share of non-commercial operations. To help quantify the number of aircraft that could be affected (either inconvenienced or unable to operate due to crosswind runway unavailability during high crosswind conditions) if Runway 4-22 were to be eliminated, aircraft operations recorded by the SAT Airport Noise and Operations Monitoring System (ANOMS) between September 2018 and August 2019 were analyzed. **Appendix A** summarizes the most common aircraft types and operations recorded by the SAT ANOMS during this time period.

Table 3 shows total aircraft operations at SAT from September 2018 to August 2019, by runway. Approximately 36% of SAT's aircraft operations occurred on Runway 4-22 during the sample period.

Table 3: Total Operations by Runway

Runway	Operations	Percent of Operations
13R-31L	87,151	59%
13L-31R	7,078	5%
4-22	54,310	36%
Total*	**148,539**	100%

Sources: San Antonio International Airport, *Airport Noise and Operations Monitoring Systems*, September 2018-August 2019; WSP USA, 2019.
*ANOMS captures most aircraft operations, but actual total airport operations were slightly higher

Table 4 summarizes Runway 4-22 aircraft operations by RDC, for small aircraft. During the analysis timeframe, 54,310 operations occurred on Runway 4-22. Of those operations, over 6,600 operations were conducted by A-I and B-I aircraft. Based on the wind data, only an estimated 462 aircraft operations (0.3% of all SAT aircraft operations) were required to take place on Runway 4-22 because the crosswind component exceeded 10.5 knots on the primary runway. Additionally, there were over 8,000 aircraft operations by A-II and B-II aircraft (e.g., Cessna Caravan, Beechcraft 1900), with only an estimated 164 (0.1% of total SAT aircraft operations) required to operate on Runway 4-22 because the crosswind component exceeded 13 knots on the primary runway. Of the 54,310 aircraft operations on Runway 4-22 during the analysis

timeframe, only 626 (1.2%) A-I through B-II aircraft were required to operate on Runway 4-22 due to the crosswinds being beyond aircraft limits. The remaining 98.8% of the aircraft that operated on Runway 4-22 did so out of convenience (proximity to apron, takeoff aligned with route of flight, etc.).

Table 4: Runway 4-22 Small Aircraft Operations

Aircraft	FAA Crosswind Component Limit (knots)	Runway 4-22 Aircraft Operations	
		Total Aircraft Operations	Wind-Dictated Operations
A-I	10.5	2,582	194
B-I	10.5	4,033	268
A-II	13	1,564	17
B-II	13	6,513	147

Sources: San Antonio International Airport, *Airport Noise and Operations Monitoring Systems*, September 2018-August 2019; WSP USA, 2019.

APPENDIX A

Table A-1: San Antonio International Airport - Top 40 Aircraft by Operations (Sep 2018-Aug 2019)

Aircraft			Runway						Total
			13R	31L	4	22	13L	31R	
Boeing 737	B737	C-III	12,690	2,626	11,219	392	3	4	26,934
Boeing 737-800	B738	D-III	8,175	1,700	4,954	204	4	5	15,042
Airbus A319	A319	C-III	5,134	982	2,655	123	3	1	8,898
Airbus A320	A320	C-III	4,164	778	3,525	140	3	0	8,610
Embraer 175	E75L	C-III	3,840	776	1,953	90	2	0	6,661
Airbus A321	A321	C-III	2,619	562	1,510	74	1	3	4,769
Bombardier CRJ-900	CRJ9	C-III	1,883	328	1,483	51	1	0	3,746
Boeing 737-900	B739	D-III	1,727	313	889	25	1	0	2,955
McDonnell Douglas MD-83	MD83	D-III	1,560	298	760	135	0	0	2,753
McDonnell Douglas MD-90	MD90	C-III	1,223	248	1,111	53	1	0	2,636
Boeing 757-200	B752	C-IV	963	202	793	433	1	1	2,393
Cessna 208 Caravan	C208	A-II	111	42	477	495	682	288	2,095
Embraer 170	E170	C-III	1,102	309	557	54	0	1	2,023
Beechcraft King Air 90	BE9L	B-II	885	212	725	50	43	24	1,939
Cessna Citation CJ1	C525	B-I	887	192	539	47	171	29	1,865
Beechcraft King Air 200	BE20	B-II	901	189	567	41	89	41	1,828
Pilatus PC-12	PC12	A-II	596	108	565	24	308	81	1,682
Cessna Citation Excel	C56X	B-II	873	183	463	17	76	16	1,628
Bombardier CRJ-700	CRJ7	C-II	875	190	438	27	0	0	1,530
Cessna Citation Sovereign	C680	B-II	697	143	360	15	170	56	1,441
Beechcraft 1900	B190	B-II	66	18	397	406	335	210	1,432
Beechcraft Hawker 800	H25B	C-II	742	157	404	19	59	11	1,392
McDonnell Douglas MD-11	MD11	D-IV	600	103	473	199	2	0	1,377
Bombardier Challenger 300	CL30	C-II	822	153	250	17	27	17	1,286
Embraer Phenom 300	E55P	B-II	685	134	350	39	26	8	1,242
Embraer Phenom 100	E50P	B-I	573	83	500	29	31	8	1,224
Cirrus SR22	SR22	A-I	450	89	347	21	203	65	1,175
Cessna Citation Encore	C560	B-II	580	111	358	23	50	24	1,146
Cessna Citation CJ4	C25C	B-II	378	87	409	24	165	29	1,092
Cessna Citation II	C550	B-II	455	84	396	27	69	18	1,049

Aircraft			Runway						Total
			13R	31L	4	22	13L	31R	
Cessna Citation X	C750	B-II	580	106	258	26	19	3	992
Gulfstream V	GLF5	D-III	513	114	236	17	23	14	917
Beechcraft Beechjet 400	BE40	B-I	477	103	301	23	8	4	916
Raytheon/Beech Beechjet 400/T-1	BE40	B-I	477	103	301	23	8	4	916
Beechcraft King Air 350	B350	B-II	394	93	312	21	68	22	910
Fairchild Merlin 3	SW3	B-I	322	74	417	13	23	13	862
Gulfstream IV	GLF4	D-II	512	95	197	17	4	1	826
Bombardier Learjet 45	LJ45	C-I	415	76	303	12	13	3	822
Embraer 190	E190	C-III	389	85	297	15	1	0	787
Boeing 727-200	B712	C-III	350	64	346	4	0	0	764
Other			11693	2460	7410	1040	2575	806	25,984
Total Aircraft Operations*			**72,378**	**14,773**	**49,805**	**4,505**	**5,268**	**1,810**	**148,539**

Sources: San Antonio International Airport, *Airport Noise and Operations Monitoring Systems*, September 2018-August 2019; WSP USA, 2019.

*ANOMS captures the majority of aircraft operations, but actual total airport operations are slightly higher