APPENDIX C

SIMMOD Technical Report

San Diego International Airport

Master Plan and Environmental Analysis

Existing and Alternative Airfield Simulation Assumptions and Results

March 2006

Table of Contents

List of Figures

List of Tables

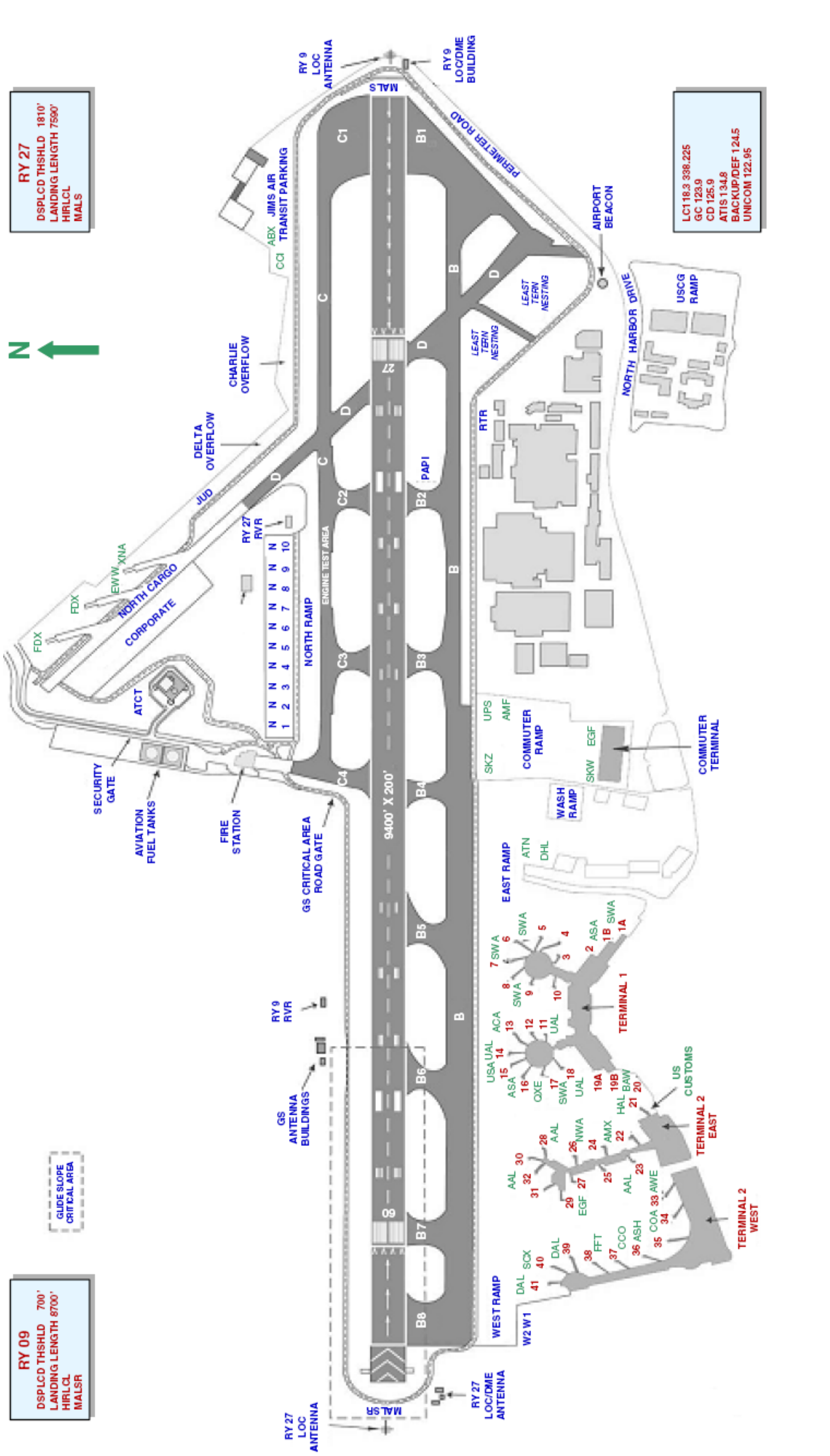
1 EXISTING AND ALTERNATIVE AIRFIELD SIMULATION ASSUMPTIONS AND RESULTS

The following report presents a summary of the simulation work that was performed in support of the San Diego International Airport (SDIA) Master Plan study consisting of an Environmental Analysis (EA) and Environmental Impact Report (EIR). Modeling assumptions and analysis results are presented for the current airfield configuration, or "No Action" case, as well as the proposed East and West Build options in which terminal additions provide for new airline gates. Each of these two terminal additions will allow the airport to accommodate a projected increase in passenger and cargo demand in the years 2010 and 2015. The impact of each of these alternatives was measured using Simmod *PRO!* simulation models for the East and West Build options in comparison to the No Action case at SDIA. The simulation output was used to analyze runway capacity and delay as well as assess the impact of specific constraints imposed by the airfield procedures. Simulation output specific for emission analyses, including delay, idle time, and runway queue time, were provided.

1.1 AIRFIELD OVERVIEW

As shown in **Figure 1**, the airfield at SDIA consists of a single runway, Runway 09/27, which extends 9,400 feet and is complemented by a full-length parallel taxiway to the south and a partial parallel taxiway to the northeast of the runway. Runway 09 has a displaced threshold of 700 feet and has precision approach capability while the displaced threshold of Runway 27 measures 1,810 feet and does feature precision approach capability. The airport is operated in two distinct modes: westbound with arrivals and departures on Runway 27 exclusively, and eastbound with arrivals on Runway 09 and departures on both Runways 09 and 27.

The mode of operation at SDIA is determined primarily by ceiling and visibility weather conditions. Runway 09 is equipped with an Instrument Landing System (ILS) with weather minima of 400 feet for ceilings and 1 mile for visibility. Runway 27 has a localizer with weather minima of 700 feet for ceilings and 2 miles for visibility. As a result, when the cloud ceiling drops below 700 feet or when visibility drops below 2 miles, Runway 27 is unavailable for arrivals. During those times that low ceilings/visibilities force the use of Runway 09 for arrivals, not all aircraft have sufficient climb performance to utilize Runway 09 for departure, and pilots often request Runway 27 for departure.



Source: SAN ATCT 7110.1A, San Diego Lindbergh Tower Standard Operating Procedures Handbook, April 29, 2003.

Figure 1: SDIA Airfield Layout

1.2 GENERAL MODELING ASSUMPTIONS

This section contains a summary of all general assumptions that were made in the development of the airfield and airspace computer simulation models for SDIA and presents analysis results from these models.

Weather data collected by the National Climatic Data Center between the years 1974 and 2004 was analyzed to determine the use of the runway system at SDIA. For the 2005 Master Plan study, three runway operating configurations were simulated to account for variations in capacity due to wind and weather conditions. **Table 1** presents the occurrence of these current operating conditions at SDIA on an annual basis and summarizes the runway operating configurations that were modeled.

Table 1: SDIA Annual Airport Operations

Operating Conditions	Percent Occurrence
West Flow VFR	73.4%
West Flow IFR	23.3%
East Flow IFR – Runway 09 or 09/27	3.3%

The predominant operating configuration at SDIA is the West flow under Visual Flight Rules (VFR) which uses visual arrival approaches and accounts for 73.4% of the total annual operations. In addition, a more restrictive West flow configuration using the Runway 27 localizer approach is utilized under Instrument Flight Rules (IFR) weather conditions and accounts for 23.3% of all operations. Finally, SDIA operates with the East flow under IFR conditions for approximately 3.3% of the annual airport operations.

Each of these three runway operating conditions was modeled for the No Action case and demand schedule in 2005 as well as for projected demand in the years 2010 and 2015. It should also be noted that SDIA has a noise curfew that prohibits departures between the hours of 11:30PM and 6:30AM. This prevents the operating day at SDIA from expanding into other hours and it was assumed that this curfew will remain in place under all future scenarios.

1.2.1 Airspace

To simulate the movements of aircraft in the model, Simmod *PRO!* utilizes node and link structures to create paths traversed by these aircraft. Ground links, which represent the ground tracks of the aircraft on the airfield, can be accurately modeled since the paths of these aircraft are constrained to existing taxiways and aprons at the airport. Thus duplicating these paths as links would result in a fairly accurate representation of the ground route structures. However, unlike the ground routes, air routes are more difficult to model since no two aircraft trajectories are identical. Consequently the simulation airspace is designed to capture an approximate air traffic flow of these aircraft.

The airspace and airfield analysis for SDIA considered the typical airspace routes used when operating on Runways 09 and 27. Flight tracks were generated from the FAA's Performance Data Analysis and Reporting System (PDARS) and this information was used to validate assumptions regarding flight paths, aircraft altitudes, aircraft approach speeds, and airspace route assignments. For example, based on an analysis of radar data performed by the FAA, aircraft approaching Runway 09 typically turn onto final approximately 12 nautical miles (NM) from the runway end, while aircraft approaching Runway 27 typically turn onto final approximately 9 NM from the runway end. **Figure 2** presents a graphical representation of the PDARS analysis of SDIA arrivals and departures using Runway 27.

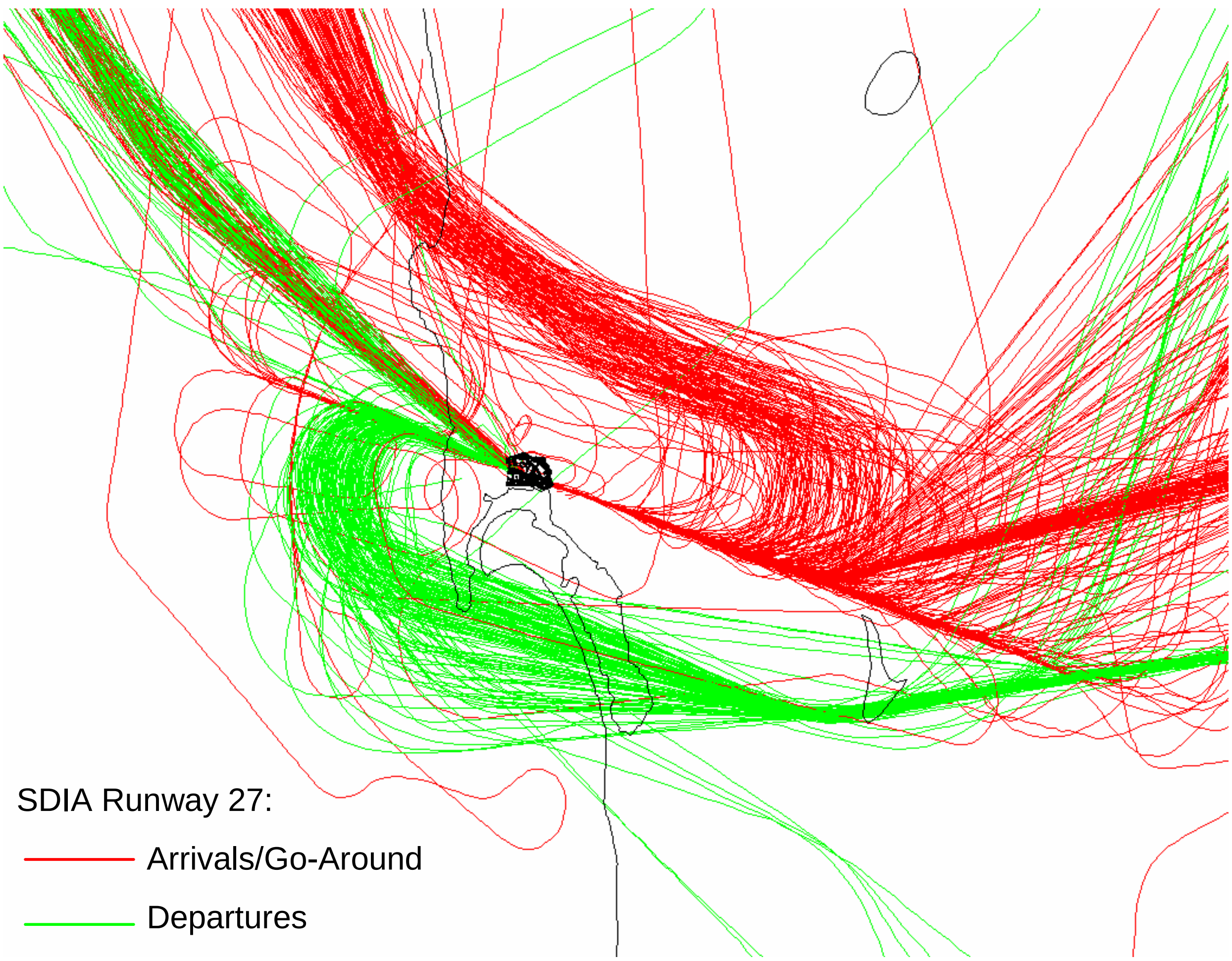


Figure 2: PDARS Radar Data at SDIA

As shown in **Figure 3**, several Standard Terminal Arrival Routes (STARs) and Standard Instrument Departures (SIDs) were used to represent the typical airspace routes followed when operating on Runway 27. A STAR is a pre-planned IFR ATC arrival procedure published for pilot use, while a SID is a similar procedure for departures. Approximately two-thirds of all Runway 27 arrivals use the BARET FOUR arrival procedure which accommodates most aircraft from the Midwest and the East Coast, while one-third use the HUBRD ONE procedure which receives most of the arrivals from California and other West Coast airports. The split is similar for Runway 27 departures, with West Coast departures utilizing the PEBLE THREE departure route and the remaining departures using the BORDER FIVE procedure.

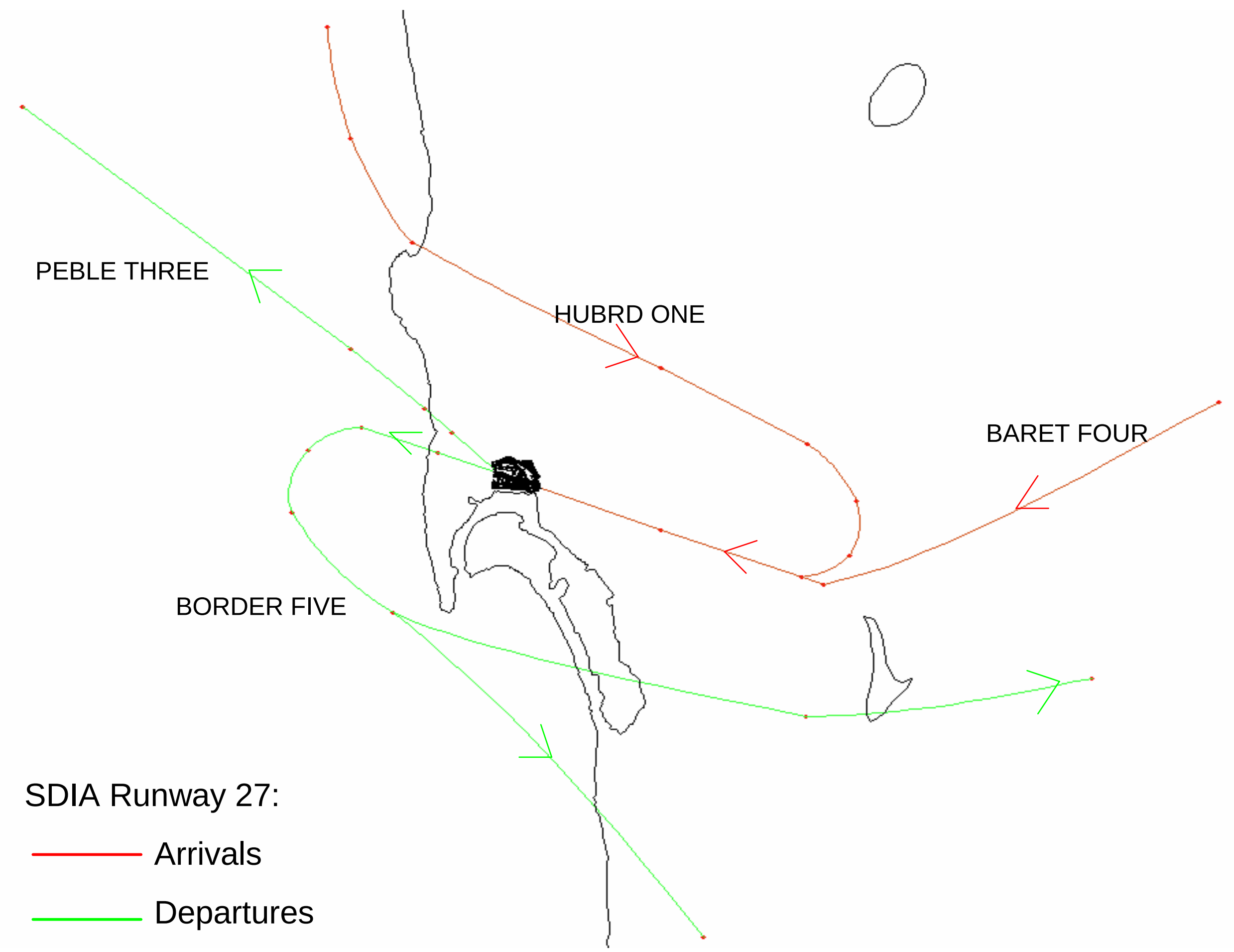


Figure 3: Modeled Flight Tracks at SDIA Runway 27

The modeled STARs and SIDs for Runway 09 are shown in **Figure 4.** Similarly to the West flow, roughly two-thirds of all arrivals use the BARET FOUR procedure which accommodates most aircraft from the Midwest and the East Coast, while one-third approach from the Northwest. Both of these arrival routes intercept a common Initial Approach Fix (IAF) and follow the ILS RWY 09 approach. The arrival route split is similar for Runway 09 departures, with West Coast departures utilizing the LNSAY TWO departure route and the remaining departures using the BORDER FIVE procedure for Midwest and East Coast destinations.

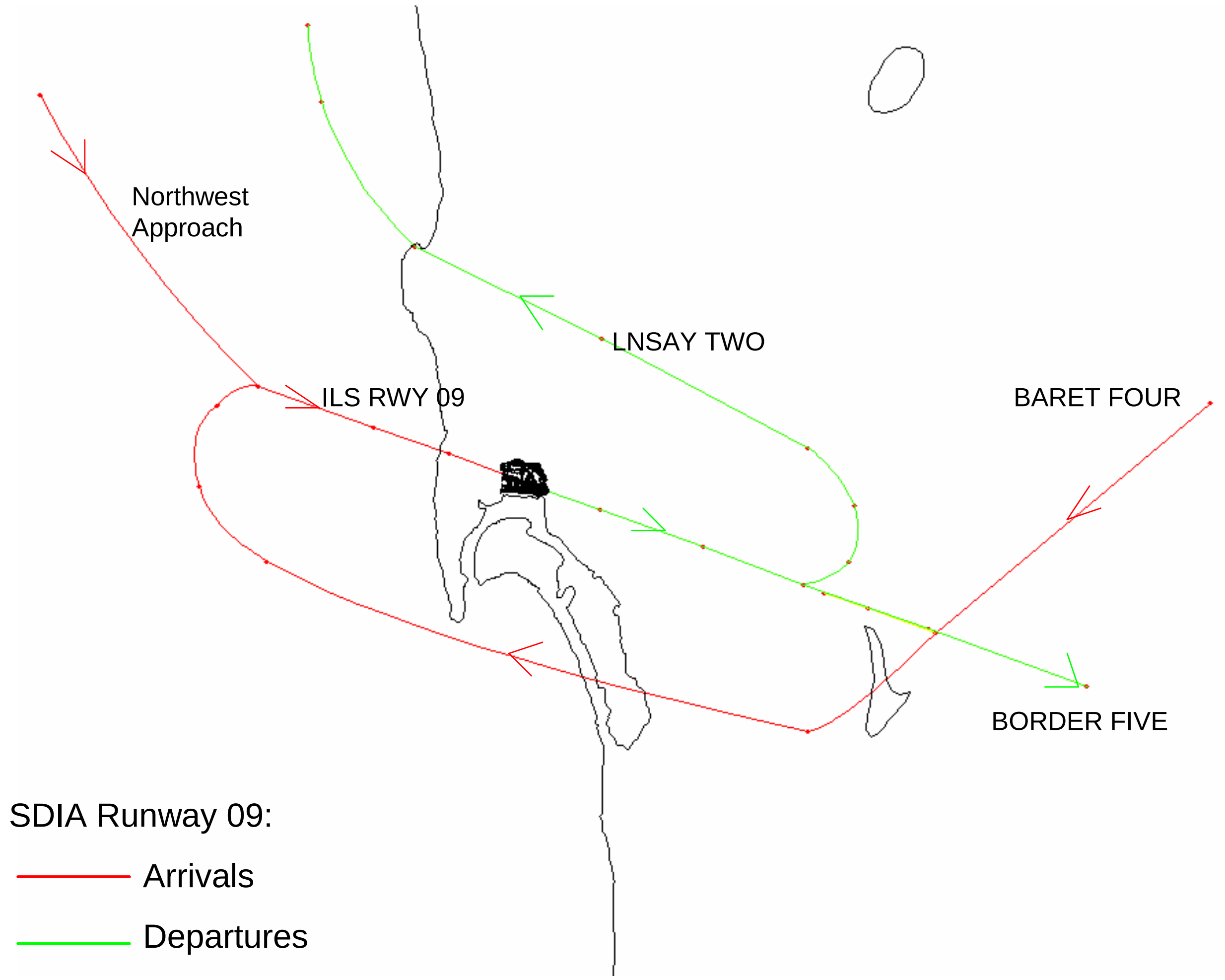


Figure 4: Modeled Flight Tracks at SDIA Runway 09

1.2.2 Aircraft Separations

Standard radar separations applied in this modeling effort conform to the criteria contained in the FAA Order 7110.65P, Air Traffic Control. This document defines the minimum separation requirements between aircraft of different weight classes operating in different sequences: an arrival followed by another arrival, an arrival followed by a departure, and a departure followed by another departure. In addition, buffers were added to the separation requirements to represent the fact that controllers rarely maintain the absolute minimum separation distance, and typically allow additional spacing.

FAA Air Traffic Control (ATC) place aircraft into one of four possible categories as defined below:

- Heavy: Gross weight greater than 255,000 lbs
- B757: Boeing 757 series aircraft
- Large: Gross weight greater than 41,000 lbs but less than 255,000 lbs
- Small: Gross weight less than 41,000 lbs

Based on the aircraft's category, general airspace wake turbulence separations in nautical miles would apply as presented below:

- Heavy behind heavy – 4 miles
- Large/heavy behind B757 – 4 miles
- Small behind B757 – 5 miles
- Small/large behind heavy – 5 miles

Based on the aircraft's category, final approach wake turbulence separations in nautical miles that exist when the lead aircraft is over the landing threshold are shown below:

- Heavy behind heavy – 4 miles
- Large/heavy behind B757 – 4 miles
- Large behind heavy – 5 miles
- Small behind large – 4 miles
- Small behind B757 – 5 miles
- Small behind heavy – 6 miles

During periods when visual separations are allowed at SDIA, ATC uses as little as 2.5 NM separation between aircraft established on the final approach within 10 NM of the landing runway. **Table 2** presents the minimum final approach visual separation values allowed by aircraft category as used in the model. These separation values are derived from the collected radar data encountered during visual weather conditions (VFR).

Table 2: Minimum Final Approach Visual Separation (NM) at SDIA

	Trailing Aircraft			
Lead Aircraft	**B757**	**Heavy**	**Large**	**Small**
B757	2.9	2.9	2.9	3.7
Heavy	3.6	2.9	3.6	4.5
Large	2.5	2.5	2.5	2.7
Small	2.5	2.5	2.5	2.5

1.2.3 Airfield

Figure 5 shows the layout of the SDIA airfield and airline terminals. The Commuter Terminal features four gates that provide access to the ramp and ten aircraft parking positions. Terminal 1 features twenty gates spread over two rotunda while Terminal 2 features twenty-two gates, thirteen of which are located in the original Terminal 2 East building and nine in the more recent Terminal 2 West addition. For the future 2010 and 2015 scenarios, gate assignments were forecasted and provided by HNTB Corporation. Airlines were assumed to operate from the same terminals as in 2005 but gate assignments were selected to ensure a balanced use of all gates.

The taxiway system at SDIA links the runway to the gate and apron areas. The airport features a single, full-length parallel taxiway, Taxiway B, on the south side of the runway. Due to its proximity to both the runway and the terminals, there is insufficient room for dual taxi lanes.

The runway exits at SDIA and their utilization can impact runway occupancy times and airport capacity significantly. The runway has seven exits on the South side and four exits on the North side, as show in **Figure 5**. Two of these − Exits B5 and B6 − are angled taxiways that serve Runway 27 arrivals and reduce runway occupancy times when operating to the west. They are located approximately 4,500 feet and 5,600 feet from the Runway 27 threshold, respectively.

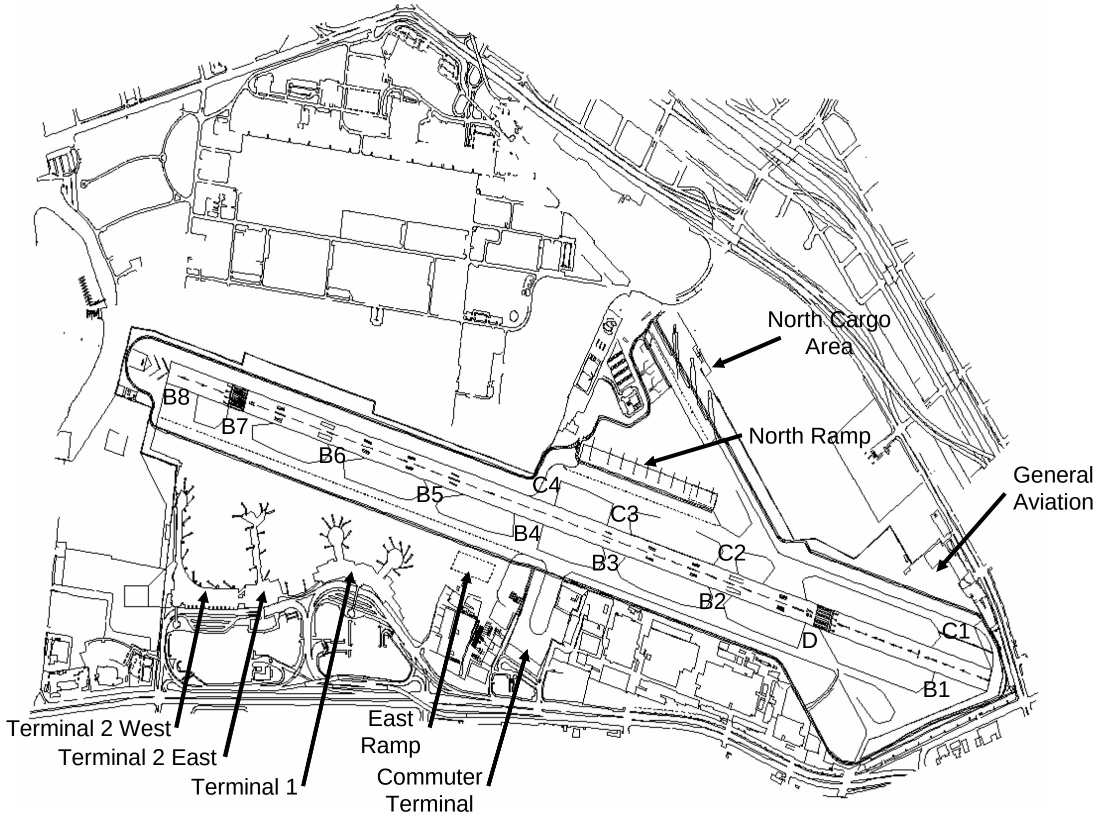


Figure 5: SDIA Airfield Terminals

1.2.3.1 West Flow

The SDIA airfield is typically operated in a westbound mode, with arrivals to and departures from Runway 27. This configuration is the most efficient mode of operation and offers the highest hourly capacity for two primary reasons. First, in terms of arrival capacity, runway exits are more efficient in the westerly direction. Exits B5 and B6 as shown in **Figure 5**, for example, are angled exits that reduce runway occupancy times for arrivals. Second, in terms of departure capacity, the westerly operation provides diverging departure routes immediately after the runway end. While aircraft following one another on a single route must maintain in-trail separations of three to five miles, an aircraft using a diverging route of 15 degrees or greater requires only one mile of separation from the previous departure (*FAA Order 7110.65P, 5-8-3, 3a*).

Certain flights require an aircraft to tug from a Remain Over Night (RON) parking location such as a departure to an open gate. For departure tug operations from the North Ramp area to Terminals 1 and 2, aircraft are first towed across Taxiway C4, into and out of the East Ramp apron area to allow the passing of aircraft moving in the East direction towards the Commuter Terminal or the departure queue, and then along Taxiway B against regular taxi flow.

Due to obstruction clearance, Group 5 and 6 aircraft are prohibited from operating on Taxiway B between the B4 and D crossings, and on Taxiway C between D and C1. The net result of these restrictions is that Group 5 and 6 aircraft departing Terminals 1 and 2 must taxi to the departure queue using the following procedure: taxi East via Taxiway B; cross Runway 27 at B4; taxi East via Taxiway C to Taxiway D; cross Runway 27 via Taxiway D; taxi via Taxiway B1 to the Runway 27 departure queue. Departure taxi flow procedures are illustrated in **Figure 6**.

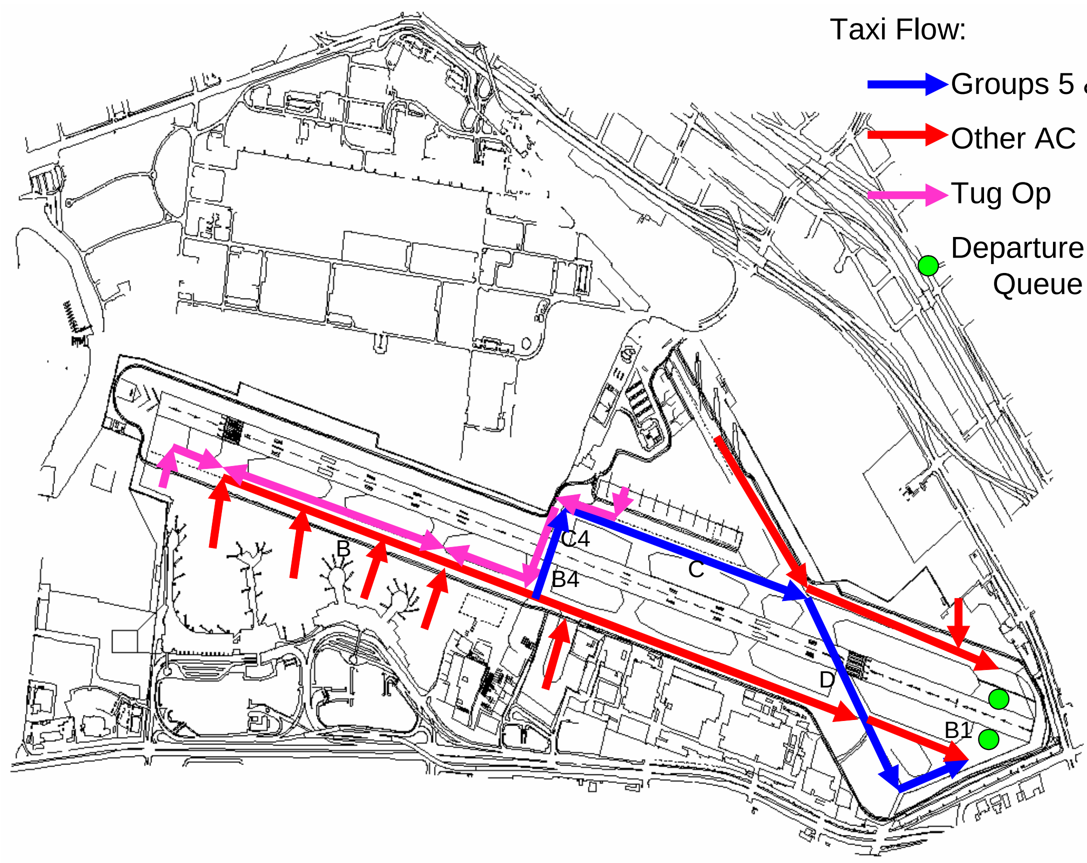


Figure 6: SDIA West Flow Departure Taxi Flow

When operating to the west, the majority of runway arrivals use Exits B4 through B7 with exit utilization dependent upon both aircraft performance and destination terminal. While heavier aircraft generally require greater landing distances and use exits further down the runway, airline terminal locations also have an impact on runway exit choice. In order to reduce taxi conflict, the West flow model was designed such that arriving aircraft exit the runway from a taxi path located to the West of their destination terminal. For example, Southwest Airlines operates from the east rotunda of Terminal One, and therefore frequently uses Exit B5, which is adjacent to their gates. On the other hand, American Airlines operates from Terminal Two and its flights frequently roll further down the runway to Exits B6 and B7, which are closer to its gates. Arrival taxi flow procedures are illustrated in **Figure 7**.

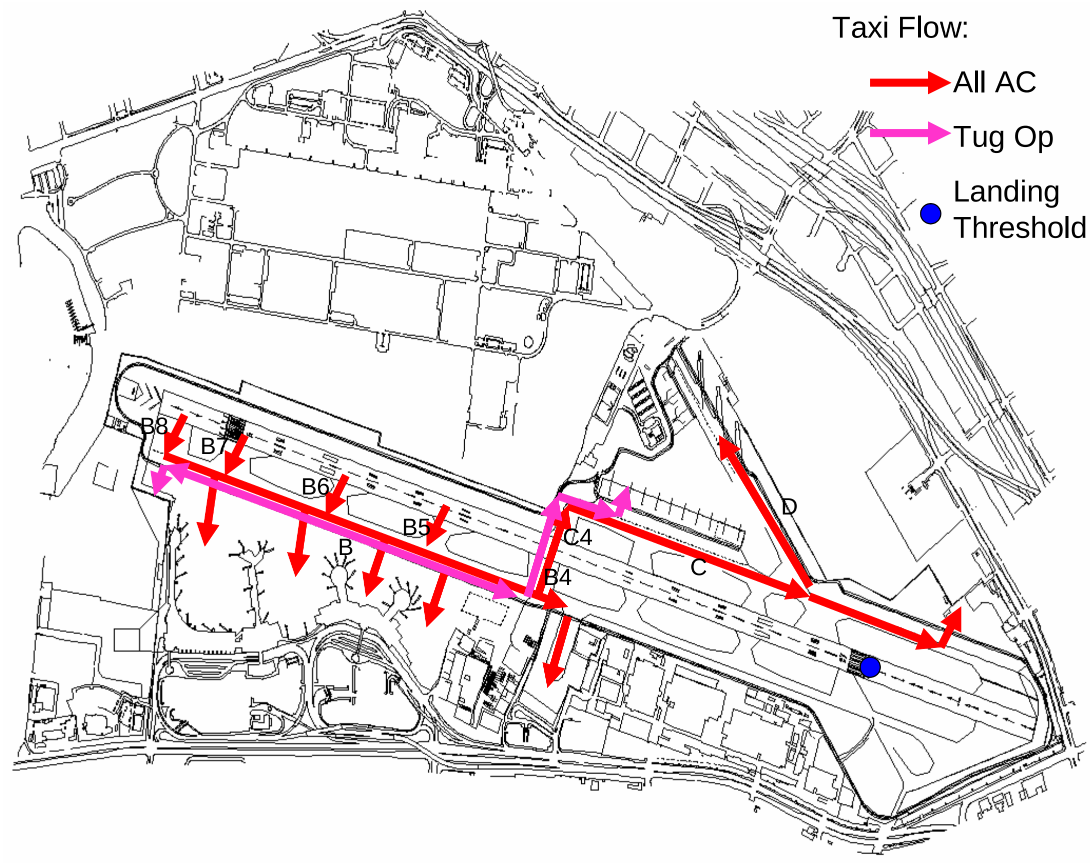


Figure 7: SDIA West Flow Arrival Taxi Flow

1.2.3.2 East Flow

Under the East flow, aircraft taxi westbound along Taxiway B to the departure queue. Aircraft departing from the North airfield areas taxi along Taxiway C, as well as Taxiway D for cargo aircraft, and then cross Runway 09 at C4 to join the aircraft taxi flow along Taxiway B.

Departure taxi flow procedures are illustrated in **Figure 8**.

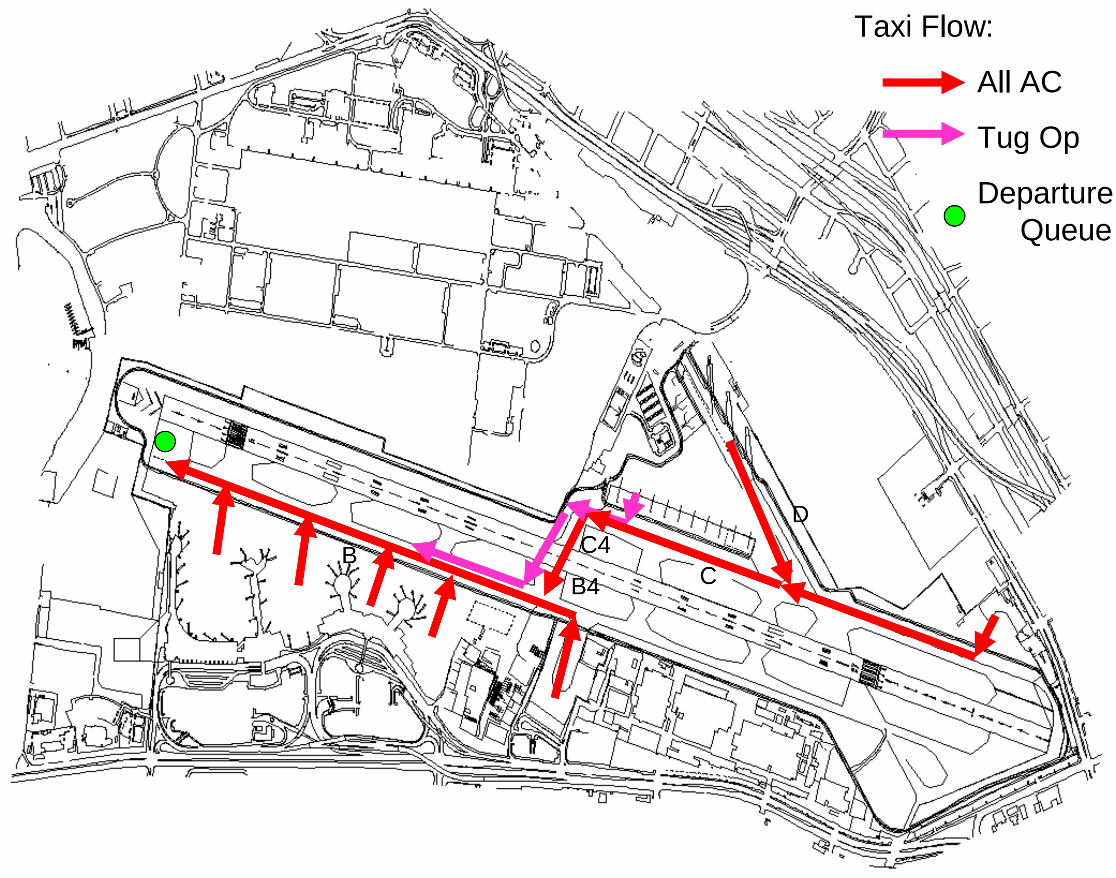


Figure 8: SDIA East Flow Departure Taxi Flow

Arriving aircraft may exit the runway on either side along Taxiway B or Taxiway C.

Arrival taxi flow procedures are illustrated in **Figure 9**.

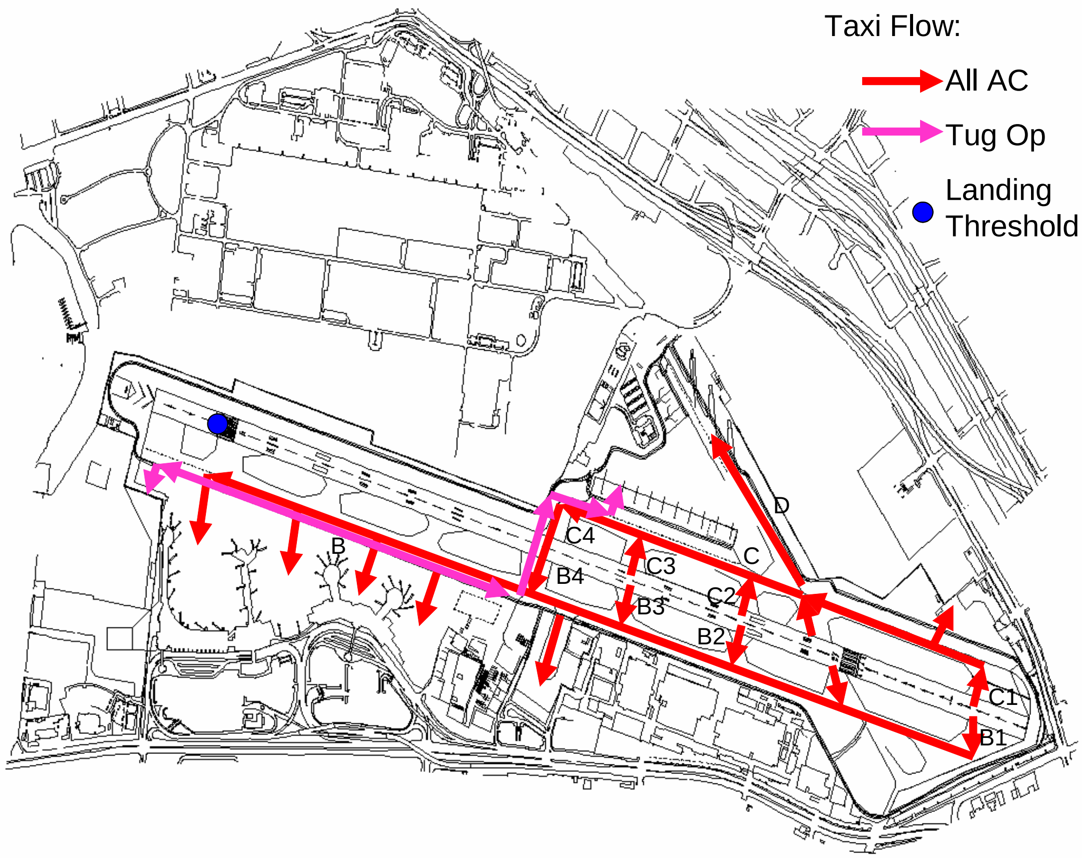


Figure 9: SDIA East Flow Arrival Taxi Flow

1.3 SIMULATION EVENT FILES

The simulation event files are representative of a typical day at SDIA. Aircraft in this demand schedule are grouped into one of eight groups. They are defined as:

- B757 – Boeing 757, all models
- Heavy Jet – Jet aircraft with a maximum gross takeoff weight limit greater than 255,000 pounds (e.g., 777, 747)
- Large Jet – Jet aircraft with a maximum gross takeoff weight limit greater than 41,000 pounds and less than 255,000 pounds (e.g., 727, 737, A320)
- Large Turboprop – Large turbine-propeller and piston-propeller powered aircraft with a maximum gross takeoff weight limit greater than 41,000 pounds (e.g., C130)
- Small Jet – Jet aircraft with a maximum gross takeoff weight limit less than 41,000 pounds (e.g., Learjet 60)

- Small Turboprop – Small turbine-propeller and piston-propeller driven aircraft with a maximum gross takeoff weight limit between 12,000 and 41,000 pounds (e.g., E120)

- Small Twin Piston – Small twin piston-propeller powered aircraft with a maximum gross takeoff weight limit less than 12,000 pounds (e.g., C414)

- Small Single Piston – Small single piston-propeller powered aircraft with a maximum gross takeoff weight limit less than 12,000 pounds (e.g., BE36)

1.3.1 Air Operations

Table 3 illustrates operational counts for a typical day at SDIA by the above defined aircraft groups in the demand schedule year of 2005.

Table 3: Daily Operation Totals by Aircraft Type at SDIA in 2005

	2005 Event File	
Aircraft Type	**Arrivals**	**Departures**
Boeing 757's	21	21
Heavy Jet	11	11
Large Jet	206	206
Large Turboprop	19	19
Small Jet	7	7
Small Single-Engine	1	1
Small Turboprop	20	20
Small Twin-Engine	2	2
Total	287	287

Figure 10 presents hourly airport runway demands for all aircraft in the 2005 demand schedule year.

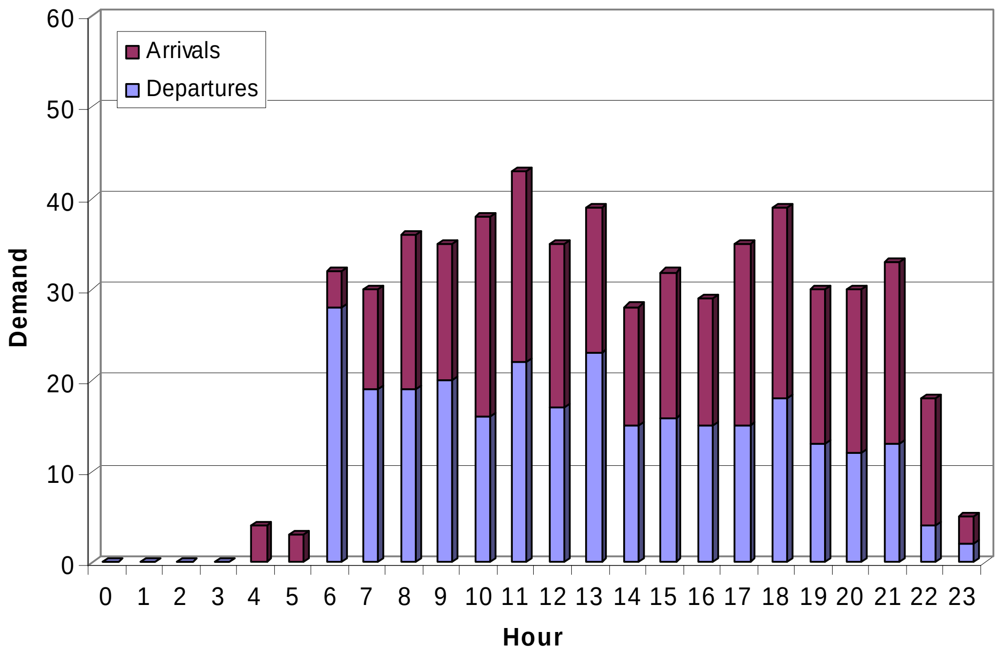


Figure 10: Hourly Demand at SDIA in 2005

Table 4 illustrates operational counts for a typical day at SDIA in the demand schedule year of 2010.

Table 4: Daily Operation Totals by Aircraft Type at SDIA in 2010

	2010 Event File	
Aircraft Type	**Arrivals**	**Departures**
Boeing 757's	12	12
Heavy Jet	13	13
Large Jet	275	275
Large Turboprop	0	0
Small Jet	6	6
Small Single-Engine	0	0
Small Turboprop	6	6
Small Twin-Engine	0	0
Total	312	312

Figure 11 presents hourly airport runway demands for all aircraft in the 2010 demand schedule year.

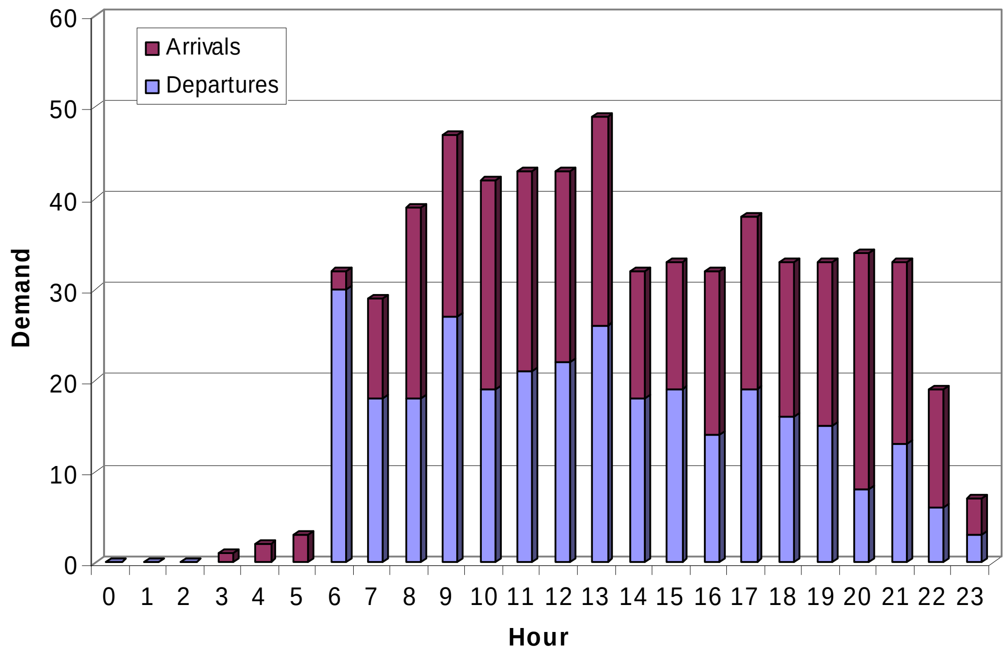


Figure 11: Hourly Demand at SDIA in 2010

Table 5 illustrates operational counts for a typical day at SDIA in the demand schedule year of 2015.

Table 5: Daily Operation Totals by Aircraft Type at SDIA in 2015

	2015 Event File	
Aircraft Type	**Arrivals**	**Departures**
Boeing 757's	15	15
Heavy Jet	18	18
Large Jet	312	312
Large Turboprop	0	0
Small Jet	7	7
Small Single-Engine	0	0
Small Turboprop	6	6
Small Twin-Engine	0	0
Total	358	358

Figure 12 presents hourly airport runway demands for all aircraft in the 2015 demand schedule year.

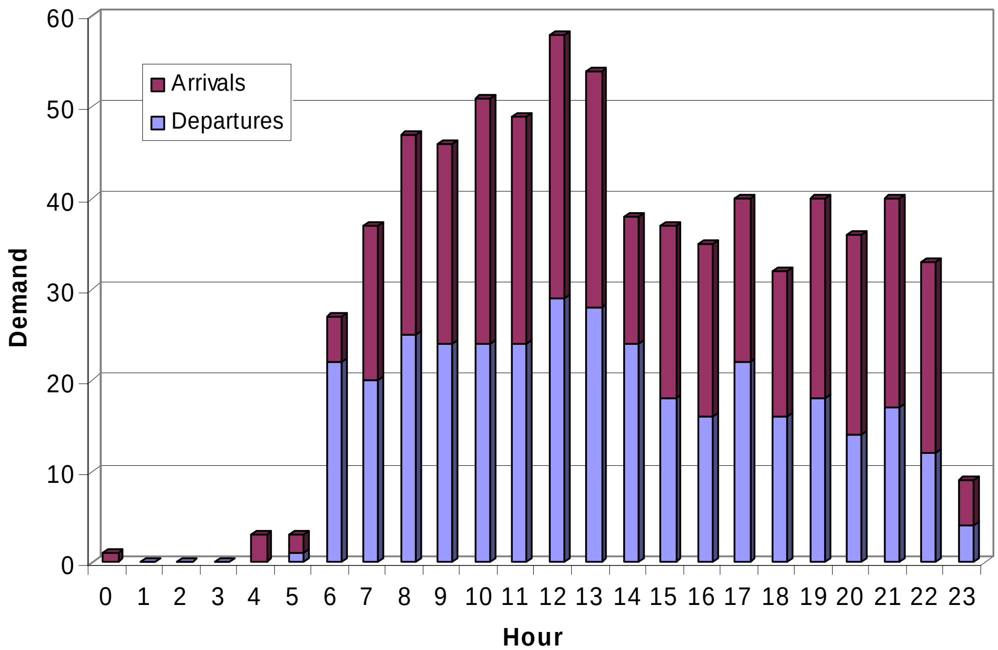


Figure 12: Hourly Demand at SDIA in 2015

1.3.2 Tug Operations

Tug operations were determined from the SDIA demand schedules and gate assignments; they are summarized in **Table 6**. Tug "Out of Gate" operations refer to arrival flights that are towed from their final destination gate to a RON location while tug "Into Gate" operations refer to departure flights that are towed to the departure gate for boarding.

Table 6: Tug Operations at SDIA

	2005		2010		2015	
Airport Layout	**Out of Gate**	**Into Gate**	**Out of Gate**	**Into Gate**	**Out of Gate**	**Into Gate**
No Action	17	14	16	15	19	22
T1 East Build			15	13	18	11
T2 West Build			15	14	20	22

1.4 AIRFIELD CONFIGURATIONS

1.4.1 No Action Case

The SDIA airfield layout and ground procedures were presented in **Section 1.2.3**. The Simmod *PRO!* ground network for the No Action airfield configuration is presented in **Figure 13**. Included in the figure are the ground links and nodes as well as airline gates.

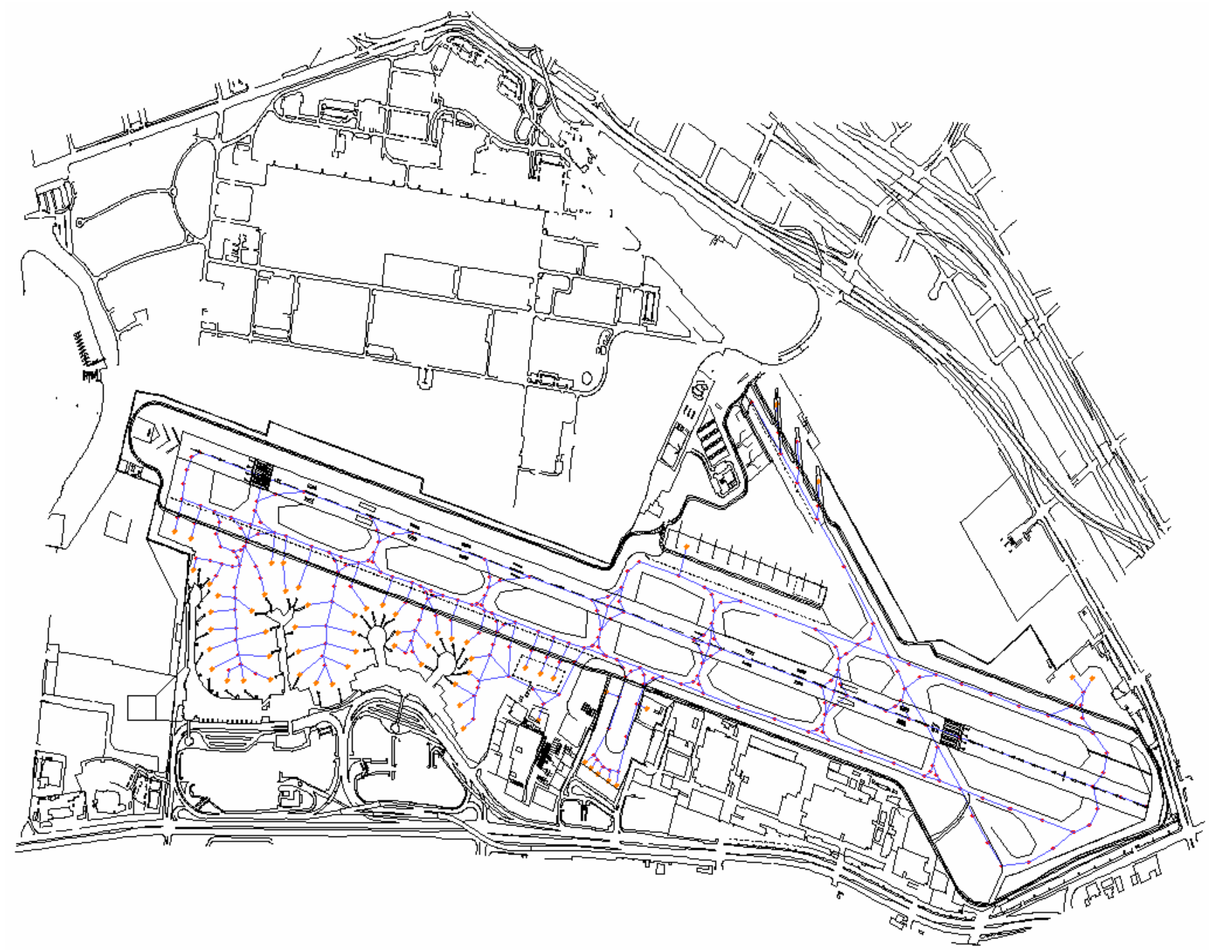


Figure 13: SDIA No Action Case

1.4.2 North Cargo Area

Under the proposed T1 East and T2 West Build options, all cargo aircraft operations at SDIA would take place in the North Cargo area, as shown in **Figure 14**. In addition, General Aviation aircraft are moved further north along the proposed Group V Taxiway.

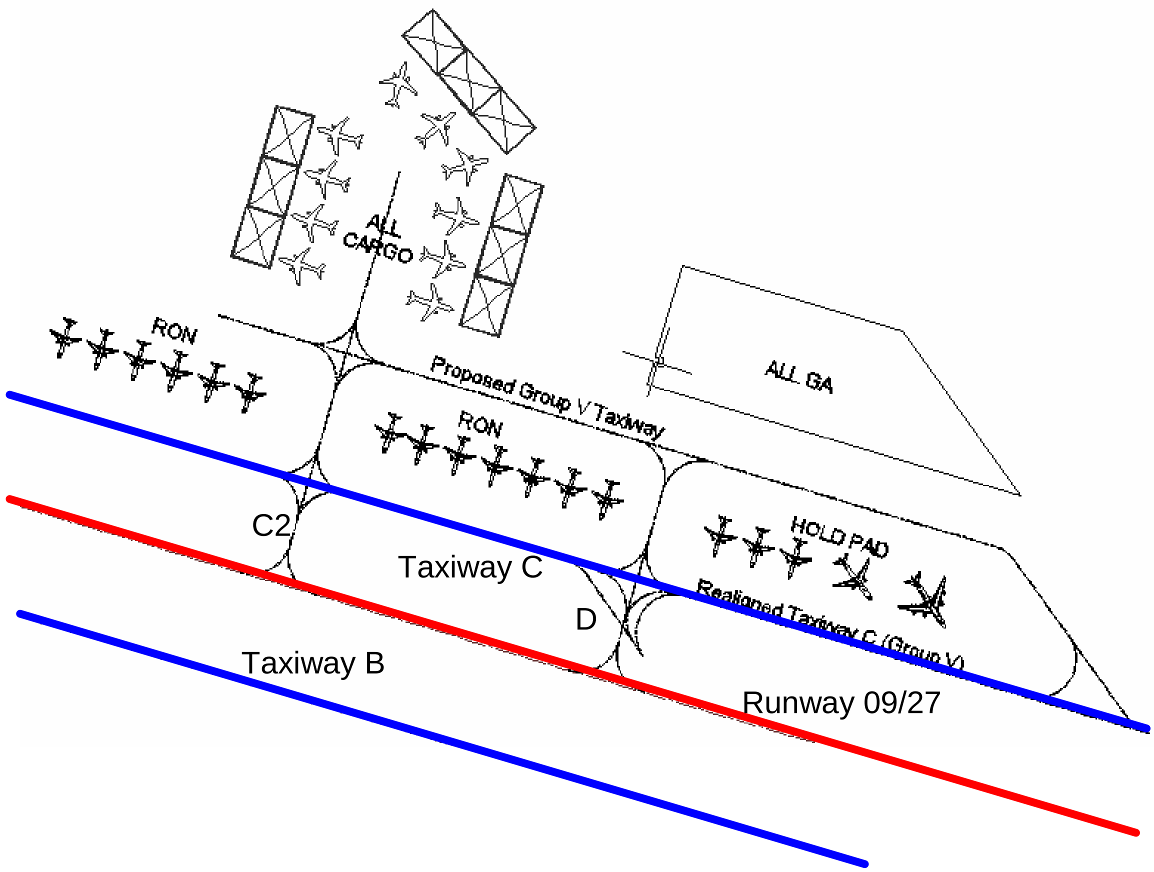


Figure 14: SDIA Future North Cargo Area

1.4.3 T1 East Build

Under the T1 East Build option, a new terminal building is constructed at the current East Ramp area between the East rotunda of Terminal 1 and the Commuter Terminal, as shown in **Figure 15**. Twelve gates are added to the new terminal building and existing Gates 1, 2, and 3 are removed from Terminal 1. In addition, three new gates are added to the West side of Terminal 2 West and another apron area is created to accommodate eight RON aircraft, as shown in **Figure 16.**

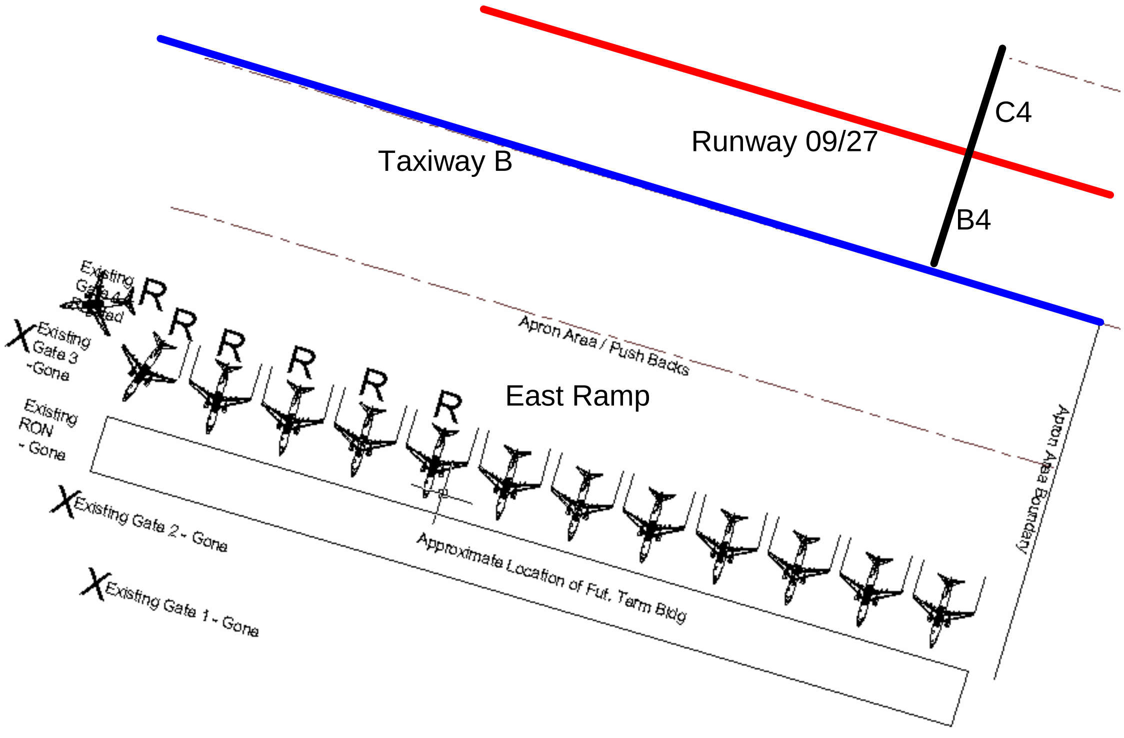


Figure 15: SDIA T1 East Build New Terminal

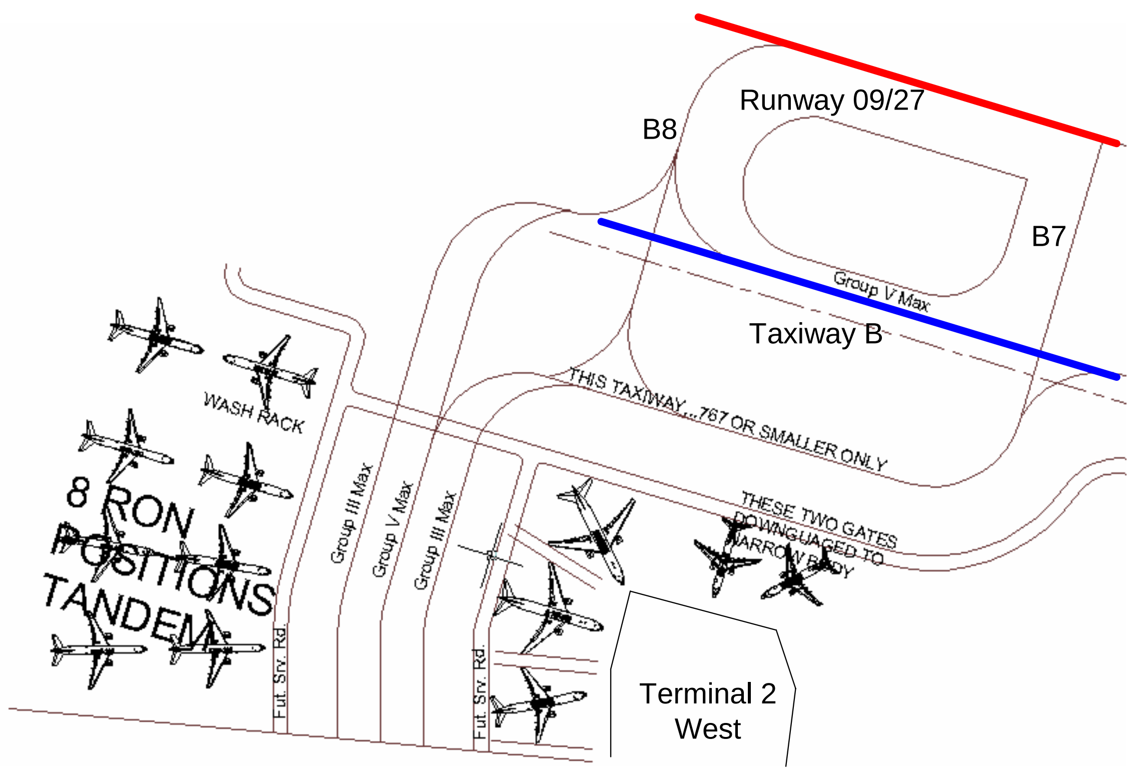


Figure 16: SDIA T1 East Build Terminal 2 West Addition

1.4.4 T2 West Build

Under the T2 West Build option, ten gates are added to the West side of Terminal 2 West and another apron area is created to accommodate twelve RON aircraft, as shown in **Figure 17**.

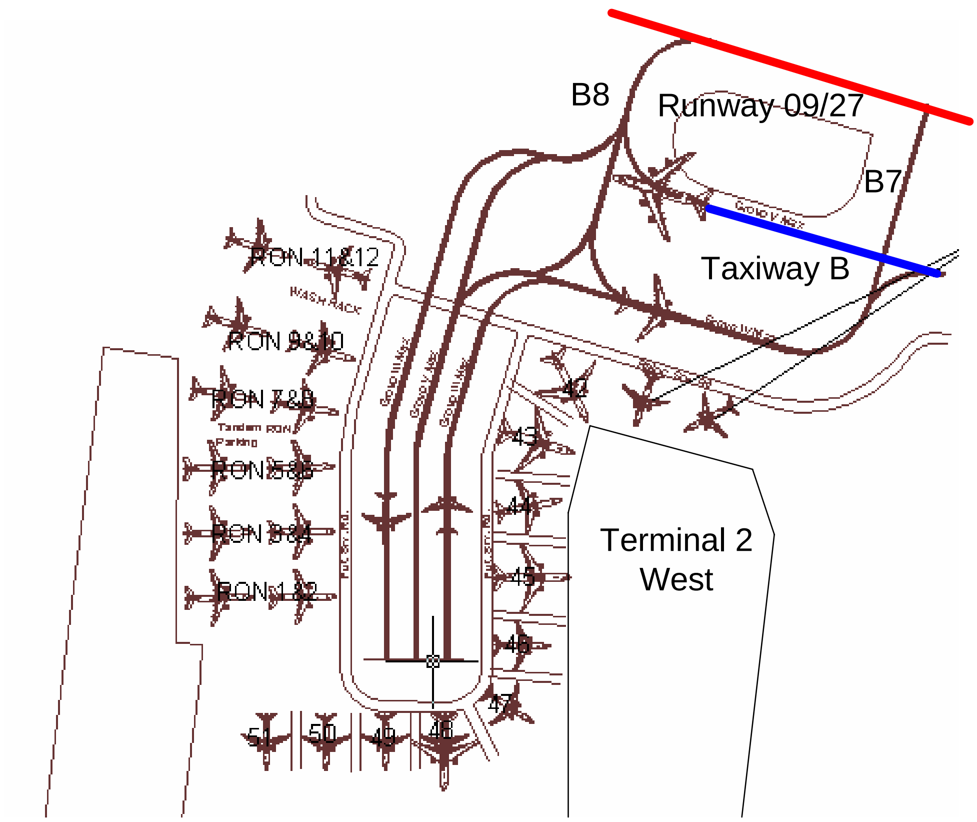


Figure 17: SDIA T2 West Build

1.5 SIMULATION RESULTS

The simulation models for SDIA were developed using the demand forecasts provided by HNTB Corporation. The models represent gated constrained forecasts for SDIA in the years 2005, 2010 and 2015. In each of the three years, the three different airport operational configurations of SDIA were modeled to better reflect the fluid nature of the weather systems and their impact on the airport operations. This section describes various output statistics of the Simmod *PRO!* models under the three different weather conditions, using the three airfield alternatives in the 2010 and 2015 demand years. The No Action alternative was modeled for the 2005 demand year in addition to the 2010 and 2015 demand years.

1.5.1 Arrival Operations

Table 7 presents average arrival times in the simulation under the three operating configurations.

The airspace travel times include time spent on the airspace routes from the injection into the simulation to the runway touchdown point. The times include any airspace delays that occur due to aircraft sequencing. In east flow, arrivals are held outside of the airspace during times that there are departures from Runway 27 resulting in a large amount of average delay and travel time.

For arriving aircraft, the travel taxi times represent ground travel times between runway exit points and the gates. The average delay taxi times include any delays incurred by the aircraft while traveling on the ground routes. Refer to Section 1.2, for the taxi patterns utilized by the aircraft under the various modeling configurations.

Total ground movement time is the average duration that an arrival operation is moving on the ground at SDIA with engines running; it includes travel-taxi and delay-taxi times.

1.5.2 Departure Operations

Table 8 presents average departure times in the simulation under the three operating conditions.

The airspace travel times include time spent on the airspace routes from takeoff to ejection from the simulation airspace structure. Airspace delays are incurred due to aircraft sequencing.

The taxi times for departing aircraft consist of ground travel times between the gates and the departure queues. Delays are incurred by the aircraft while traveling on the ground routes, while waiting at the departure queues, or while waiting for gate pushback. Refer to Section 1.2 for the taxi patterns utilized by the aircraft under the various modeling configurations.

Gate delays occur most often in the East Flow configuration due to departures that request Runway 27. In such cases, Runway 27 departures that need to travel eastbound on Taxiway B must wait until the taxiway is clear of departures and arrivals that are traveling in the normal westbound direction along Taxiway B.

Total ground movement time is the average duration that a departure operation is moving on the ground at SDIA with engines running; it includes travel-taxi, delay-taxi, and delay-queue times.

Table 7: Average Times per Arrival Operation

Year/Alternative	Flow	Weather Condition	Average Time per Arrival Operation (Minutes)							
			Travel			Delay			Gate Time	Total Ground Movement Time
			Air	Taxi	Total	Air	Taxi	Total		
2005										
No Action	West	VFR	10.5	3.6	14.1	0.4	0.6	0.9	43.1	4.1
	West	IFR	10.5	3.6	14.1	0.5	0.6	1.1	43.4	4.2
	East	IFR	15.0	5.2	20.2	16.0	1.0	17.0	29.9	6.2
2010										
No Action	West	VFR	10.3	3.6	13.9	0.5	0.6	1.0	37.3	4.1
	West	IFR	10.3	3.6	13.9	0.6	0.6	1.2	37.1	4.2
	East	IFR	16.5	5.3	21.8	20.6	1.1	21.7	20.0	6.4
T1 East Build	West	VFR	10.3	3.6	13.9	0.4	0.7	1.1	38.4	4.3
	West	IFR	10.3	3.6	13.9	0.7	0.7	1.4	38.6	4.3
	East	IFR	21.0	5.6	26.6	36.6	1.4	38.0	17.9	7.0
T2 West Build	West	VFR	10.3	3.7	14.0	0.4	0.4	0.8	18.0	4.1
	West	IFR	10.3	3.7	14.0	0.7	0.4	1.0	18.0	4.1
	East	IFR	19.5	5.6	25.1	26.8	1.5	28.2	9.4	7.1
2015										
No Action	West	VFR	10.4	3.5	13.9	0.6	0.8	1.4	47.9	4.3
	West	IFR	10.4	3.5	13.9	0.8	0.7	1.5	47.6	4.3
	East	IFR	17.7	5.2	22.9	27.5	1.2	28.7	27.2	6.4
T1 East Build	West	VFR	10.4	3.6	14.0	0.6	0.7	1.3	50.2	4.3
	West	IFR	10.4	3.6	14.0	0.9	0.7	1.6	50.1	4.3
	East	IFR	23.9	5.7	29.6	45.9	2.3	48.2	23.7	8.0
T2 West Build	West	VFR	10.5	3.6	14.1	0.6	0.4	1.0	50.0	4.0
	West	IFR	10.5	3.6	14.1	0.9	0.3	1.2	50.1	4.0
	East	IFR	19.8	5.6	25.5	30.9	2.4	33.3	26.0	8.0

Note: differences may occur due to rounding.

Table 8: Average Times per Departure Operation

Year/ Alternative	Flow	Weather Condition	Average Time per Operation (Minutes)								
			Travel			Delay					Total Ground Movement Time
			Air	Taxi	Total	Air	Taxi	Gate	Queue	Total	
2005											
No Action	West	VFR	7.5	10.6	18.1	0.1	0.3	0.2	1.8	2.4	13.0
	West	IFR	7.5	10.6	18.1	0.1	0.4	0.2	1.9	2.5	13.0
	East	IFR	7.7	10.2	17.9	0.1	5.4	20.6	10.5	36.6	46.7
2010											
No Action	West	VFR	7.9	10.7	18.7	-	0.5	0.3	1.9	2.7	13.4
	West	IFR	7.9	10.7	18.7	-	0.6	0.3	2.0	2.9	13.6
	East	IFR	7.5	10.3	17.8	0.0	8.3	22.2	12.0	42.4	52.7
T1 East Build	West	VFR	7.7	11.5	19.2	-	0.5	0.2	2.0	2.6	14.1
	West	IFR	7.7	11.5	19.2	0.0	0.4	0.2	2.1	2.7	14.2
	East	IFR	7.5	10.5	18.0	0.0	12.9	40.8	12.7	66.4	76.9
T2 West Build	West	VFR	7.7	12.3	20.0	-	0.3	0.3	1.9	2.6	14.9
	West	IFR	7.7	12.3	20.0	-	0.3	0.3	2.2	2.8	15.1
	East	IFR	7.6	10.0	17.5	0.0	9.8	27.7	12.4	49.9	59.9
2015											
No Action	West	VFR	7.9	10.6	18.6	-	0.7	0.9	2.7	4.3	14.9
	West	IFR	7.9	10.6	18.6	-	0.7	0.8	3.0	4.5	15.1
	East	IFR	7.5	10.3	17.8	0.0	1.5	37.2	46.4	85.1	95.4
T1 East Build	West	VFR	7.7	11.5	19.3	-	0.6	0.1	2.8	3.5	15.0
	West	IFR	7.7	11.5	19.3	-	0.6	0.1	3.2	3.8	15.3
	East	IFR	7.6	10.5	18.0	0.0	20.0	45.5	15.4	80.9	91.3
T2 West Build	West	VFR	7.7	12.0	19.7	-	0.5	0.0	2.7	3.2	15.2
	West	IFR	7.7	12.0	19.7	-	0.5	0.0	3.1	3.6	15.6
	East	IFR	7.6	10.0	17.6	0.0	21.7	39.5	15.1	76.3	86.2

Note: differences may occur due to rounding.

1.5.3 Average Times per Landing-Takeoff Cycle Operation

Table 9 presents average annual average times for all aircraft in the simulation based on the three airport operational configurations and at each modeled demand level. The percent occurrence of the each configuration is listed in **Table 1**. The Average Annual Landing-Takeoff Cycle Ground Movement Time represents the weighted average of all arrival and departure operations.

Table 9: Average Times per Landing-Takeoff Cycle

Year/ Alternative	Flow	Weather Condition	Average Time per Operation (Minutes)						
			Arrivals		Departures		Total	Annual Flow Use	Average Annual Landing-Takeoff Cycle Ground Movement Time
			Travel	Delay	Travel	Delay			
2005									
No Action	West	VFR	3.6	0.6	10.6	2.2	17.0	73.4%	17.5
	West	IFR	3.6	0.6	10.6	2.3	17.1	23.3%	
	East	IFR	5.2	1.0	10.2	16.0	32.4	3.3%	
2010									
No Action	West	VFR	3.6	0.6	10.7	2.4	17.2	73.4%	17.9
	West	IFR	3.6	0.6	10.7	2.6	17.5	23.3%	
	East	IFR	5.3	1.1	10.3	20.2	36.9	3.3%	
T1 East Build	West	VFR	3.6	0.7	11.5	2.4	18.2	73.4%	19.1
	West	IFR	3.6	0.7	11.5	2.6	18.3	23.3%	
	East	IFR	5.6	1.4	10.5	25.6	43.1	3.3%	
T2 West Build	West	VFR	3.7	0.4	12.3	2.3	18.6	73.4%	19.4
	West	IFR	3.7	0.4	12.3	2.5	18.9	23.3%	
	East	IFR	5.6	1.5	10.0	22.2	39.2	3.3%	
2015									
No Action	West	VFR	3.5	0.8	10.6	3.4	18.3	73.4%	19.9
	West	IFR	3.5	0.7	10.6	3.7	18.6	23.3%	
	East	IFR	5.2	1.2	10.3	47.9	64.6	3.3%	
T1 East Build	West	VFR	3.6	0.7	11.5	3.4	19.2	73.4%	20.4
	West	IFR	3.6	0.7	11.5	3.7	19.5	23.3%	
	East	IFR	5.7	2.3	10.5	35.4	53.8	3.3%	
T2 West Build	West	VFR	3.6	0.4	12.0	3.2	19.2	73.4%	20.4
	West	IFR	3.6	0.3	12.0	3.6	19.5	23.3%	
	East	IFR	5.6	2.4	10.0	36.8	54.7	3.3%	

Note: differences may occur due to rounding.

San Diego International Airport

Master Plan and Environmental Analysis

Appendix A

Additional Simulation Modeling for Demand Years 2020, 2025, and 2030

Existing and Alternative Airfield Simulation Results

DRAFT

July 2007

ATAC

Table of Contents

Appendix A

Supplemental Existing and Alternative Airfield Simulation Assumptions and Results

List of Tables

A. SIMULATION RESULTS

The simulation models for SDIA were developed using demand forecasts provided by HNTB Corporation. The models represent gated constrained forecasts for SDIA in the years 2005, 2010 2015, 2020, 2025, and 2030. In each of the six years, the three different airport operational configurations of SDIA were modeled to better reflect the fluid nature of the weather systems and their impact on the airport operations. This section describes various output statistics of the Simmod *PRO!* models under the three different weather conditions, using the three airfield alternatives in the 2010, 2015, 2020, 2025, and 2030 demand years. The No Action case was modeled for the 2005 demand year in addition to the 2010, 2015, 2020, 2025, and 2030 demand years. **Table 0.1** presents the daily demand level for the gated and constrained demand forecast prepared by HNTB.

Table 0.1: SDIA Gated and Constrained Demand Forecast

	Demand					
	2005	2010	2015	2020	2025	2030
No Action	574	624	716	768	774	768
T1 East		624	716	768	794	818
T2 West		624	716	768	794	818

It is important to note that these schedules were not intended to derive statistics for overall airport capacity. Simulation output produced from this study is being used as input to an emissions model as part of the environmental analysis. A typical capacity and delay analysis would have used demand files that tested the capacity constraints of the airfield; this type of study would usually use demand schedules produced by forecasting the average day from the peak month of the year. For this study however, the demand schedules represent an average annual day. Because the demand from an average annual delay is lower than the demand from the average day of the peak month of the year, it can therefore be expected that airfield delay would be lower as well.

1.A.1 Arrival Aircraft – Ground Travel and Delay Times

Table 0.2 presents average taxi times in the simulation under the three operating configurations at SDIA for arrivals. For arriving aircraft, the taxi times represent ground travel times between runway exit points and the gates. The average taxi times also include any delays incurred by the aircraft while traveling on the ground routes. Refer to section 1.2, for the taxi patterns utilized by the aircraft under the various modeling configurations.

Table 0.2: Average Taxi Time in Minutes for Arriving Aircraft (Delay Included)

Average Taxi Time in Minutes for Arriving Aircraft (Delay Included)

	2005	2010	2015	2020	2025	2030
			West Plan VFR – Visual Approach			
No Action	4.1	4.1	4.3	5.2	4.6	4.2
T1 East		4.3	4.3	4.0	3.9	3.9
T2 West		4.1	4.0	3.7	3.8	3.8
			West Plan IFR			
No Action	4.2	4.2	4.3	5.2	4.7	4.3
T1 East		4.3	4.3	4.0	3.9	3.9
T2 West		4.1	4.0	3.7	3.8	3.8
			East Plan IFR – ILS Approach, 09/27 Departures			
No Action	6.2	6.4	6.4	5.8	6.1	5.9
T1 East		7.0	8.0	6.6	6.1	6.2
T2 West		7.1	8.0	6.0	6.1	6.3

Table 0.3 and **Table 0.4** present the two components that make up the average arrival taxi times shown in **Table 0.2**. **Table 0.3** presents the undelayed average taxi times in the simulation under the three operating configurations at SDIA for arrivals. For arriving aircraft, the undelayed taxi times represent ground travel times between runway exit points and the gates without delay caused by aircraft interactions.

Table 0.3: Undelayed Average Taxi Time in Minutes for Arriving Aircraft

Undelayed Average Taxi Time in Minutes for Arriving Aircraft

	2005	2010	2015	2020	2025	2030
			West Plan VFR – Visual Approach			
No Action	3.6	3.6	3.5	3.6	3.5	3.6
T1 East		3.6	3.6	3.6	3.6	3.6
T2 West		3.7	3.6	3.6	3.6	3.6
			West Plan IFR			
No Action	3.6	3.6	3.5	3.6	3.5	3.6
T1 East		3.6	3.6	3.6	3.6	3.6
T2 West		3.7	3.6	3.6	3.6	3.6
			East Plan IFR – ILS Approach, 09/27 Departures			
No Action	5.2	5.3	5.2	5.2	5.3	5.2
T1 East		5.6	5.7	5.5	5.5	5.5
T2 West		5.6	5.6	5.5	5.6	5.6

Table 0.4 presents average taxi delays incurred in the simulation under the three West Plan operating conditions for arrivals. The taxi delays represent any delays incurred by the aircraft while traveling on the ground routes.

Table 0.4: Average Taxi Delay Incurred in Minutes for Arriving Aircraft

Average Taxi Delay Incurred in Minutes for Arriving Aircraft

	2005	2010	2015	2020	2025	2030
			West Plan VFR – Visual Approach			
No Action	0.6	0.6	0.8	1.6	1.1	0.6
T1 East		0.7	0.7	0.4	0.3	0.3
T2 West		0.4	0.4	0.2	0.2	0.2
			West Plan IFR			
No Action	0.6	0.6	0.7	1.6	1.2	0.7
T1 East		0.7	0.7	0.4	0.3	0.3
T2 West		0.4	0.3	0.2	0.2	0.2
			East Plan IFR – ILS Approach, 09/27 Departures			
No Action	1.0	1.1	1.2	0.6	0.9	0.6
T1 East		1.4	2.3	1.0	0.7	0.7
T2 West		1.5	2.4	0.4	0.5	0.7

1.A.2 Arrival Aircraft – Airspace Travel and Delay Times

Table 0.5 presents the average airspace travel times incurred in the simulation under the three West Plan operating conditions for arrivals. The airspace travel times include time spent on the airspace routes from the injection into the simulation to the runway touchdown point. The times include any airspace delays that incur due to aircraft sequencing. In the East Plan configurations, arrivals are held outside of the airspace during times that there are departures from Runway 27 resulting in a large amount of average delay and travel time.

Table 0.5: Average Airspace Travel Time in Minutes for Arriving Aircraft (Delay Included)

Average Airspace Travel Time in Minutes for Arriving Aircraft (Delay Included)

	2005	2010	2015	2020	2025	2030
West Plan VFR – Visual Approach						
No Action	10.9	10.8	11.0	13.4	13.4	13.1
T1 East		10.7	11.0	13.2	13.7	14.0
T2 West		10.8	11.1	13.3	13.9	14.4
West Plan IFR						
No Action	11.1	11.0	11.2	13.6	13.6	13.4
T1 East		11.0	11.3	13.3	13.9	14.0
T2 West		11.0	11.4	13.6	14.3	14.6
East Plan IFR – ILS Approach, 09/27 Departures						
No Action	31.0	37.1	45.2	123.9	144.8	131.8
T1 East		57.6	69.8	141.3	133.4	155.9
T2 West		46.3	50.7	112.6	138.5	161.3

Table 0.6 and **Table 0.7** present the two components that make up the average arrival airspace travel times shown in **Table 0.5**. **Table 0.6** presents the average airspace travel times incurred in the simulation under the three West Plan operating conditions for arrivals without delay sequencing needed for aircraft interactions. The airspace travel times include time spent on the airspace routes from the injection into the simulation to the runway touchdown point.

Table 0.6: Undelayed Average Airspace Travel Time in Minutes for Arriving Aircraft

Undelayed Average Airspace Travel Time in Minutes for Arriving Aircraft

	2005	2010	2015	2020	2025	2030
West Plan VFR – Visual Approach						
No Action	10.5	10.3	10.4	10.3	10.3	10.3
T1 East		10.3	10.4	10.3	10.3	10.2
T2 West		10.3	10.5	10.3	10.3	10.2
West Plan IFR						
No Action	10.5	10.3	10.4	10.3	10.3	10.3
T1 East		10.3	10.4	10.3	10.3	10.2
T2 West		10.3	10.5	10.3	10.3	10.2
East Plan IFR – ILS Approach, 09/27 Departures						
No Action	15.0	16.5	17.7	38.1	43.2	39.6
T1 East		21.0	23.9	39.9	38.7	47.7
T2 West		19.5	19.8	35.4	43.6	49.4

Table 0.7 presents the average airspace delay times incurred in the simulation under the three West Plan operating conditions for arrivals. The airspace delay times include any delay needed to sequence aircraft from their injection into the simulation to the runway touchdown point.

Table 0.7: **Average Airspace Delay Incurred in Minutes for Arriving Aircraft**

Average Airspace Delay Incurred in Minutes for Arriving Aircraft

	2005	2010	2015	2020	2025	2030
West Plan VFR – Visual Approach						
No Action	0.4	0.5	0.6	3.0	3.1	2.9
T1 East		0.4	0.6	2.9	3.4	3.7
T2 West		0.4	0.6	3.0	3.6	4.2
West Plan IFR						
No Action	0.5	0.6	0.8	3.2	3.3	3.1
T1 East		0.7	0.9	3.0	3.7	3.8
T2 West		0.7	0.9	3.3	4.0	4.3
East Plan IFR – ILS Approach, 09/27 Departures						
No Action	16.0	20.6	27.5	85.9	101.6	92.2
T1 East		36.6	45.9	101.4	94.7	108.2
T2 West		26.8	30.9	77.2	94.8	111.9

1.A.3 Departure Aircraft – Ground Travel and Delay Times

Table 0.8 presents average taxi times in the simulation under the three operating conditions for departures. The tax times for departing aircraft consist of ground travel times between the gates and the departure queues. The average taxi times also include any delays incurred by the aircraft while traveling on the ground routes, while waiting at the departure queues, or while waiting for gate pushback. Gate delays occur most often in the East Plan configuration due to departures that request Runway 27. In such cases, Runway 27 departures that need to travel eastbound on Taxiway B must wait until the taxiway is clear of departures and arrivals that are traveling in the normal westbound direction along Taxiway B. Refer to section 1.2 for the taxi patterns utilized by the aircraft under the various modeling configurations.

Table 0.8: Average Taxi Time in Minutes for Departing Aircraft (Delay Included)

Average Taxi Time in Minutes for Departing Aircraft (Delay Included)

	2005	2010	2015	2020	2025	2030
			West Plan VFR – Visual Approach			
No Action	13.0	13.4	14.9	16.1	16.6	16.4
T1 East		14.1	15.0	17.2	18.0	20.4
T2 West		14.9	15.2	16.0	16.5	17.2
			West Plan IFR			
No Action	13.0	13.6	15.1	16.1	16.5	16.4
T1 East		14.2	15.3	17.3	18.1	20.3
T2 West		15.1	15.6	15.9	16.5	17.2
			East Plan IFR – ILS Approach, 09/27 Departures			
No Action	46.7	52.7	95.4	64.0	71.9	68.5
T1 East		76.9	91.3	57.7	55.6	59.6
T2 West		59.9	86.2	64.1	68.3	78.9

Table 0.9 presents undelayed average taxi times in the simulation under the three operating conditions for departures. The tax times for departing aircraft consist of ground travel times between the gates and the departure queues without aircraft interactions.

Table 0.9: Undelayed Average Taxi Time in Minutes for Departing Aircraft

Undelayed Average Taxi Time in Minutes for Departing Aircraft

	2005	2010	2015	2020	2025	2030
			West Plan VFR – Visual Approach			
No Action	10.6	10.7	10.6	10.8	10.8	10.8
T1 East		11.5	11.5	11.4	11.5	11.5
T2 West		12.3	12.0	12.0	12.0	12.1
			West Plan IFR			
No Action	10.6	10.7	10.6	10.8	10.8	10.8
T1 East		11.5	11.5	11.4	11.5	11.5
T2 West		12.3	12.0	12.0	12.0	12.1
			East Plan IFR – ILS Approach, 09/27 Departures			
No Action	10.2	10.3	10.3	10.4	10.5	10.5
T1 East		10.5	10.5	10.4	10.3	10.3
T2 West		10.0	10.0	9.9	10.0	10.0

Table 0.10 presents average taxi delays incurred in the simulation under the three operating conditions for departures. **Table 0.10** includes any delays incurred by departing aircraft while

traveling on the ground routes, while waiting to depart in the departure queue areas, or delay associated with waiting at a gate for clearance to pushback.

Table 0.10: Average Taxi Delay Incurred in Minutes for Departing Aircraft

Average Taxi Delay Incurred in Minutes for Departing Aircraft

	2005	2010	2015	2020	2025	2030
			West Plan VFR – Visual Approach			
No Action	2.4	2.7	4.3	5.3	5.7	5.6
T1 East		2.6	3.5	5.8	6.6	8.9
T2 West		2.6	3.2	4.1	4.5	5.1
			West Plan IFR			
No Action	2.4	2.9	4.5	5.3	5.7	5.6
T1 East		2.7	3.8	5.9	6.7	8.8
T2 West		2.8	3.6	4.0	4.5	5.1
			East Plan IFR – ILS Approach, 09/27 Departures			
No Action	36.5	42.4	85.1	53.6	61.3	58.0
T1 East		66.4	80.9	47.3	45.3	49.3
T2 West		49.9	76.3	54.1	58.3	68.9

Table 0.11 shows the average ground and departure queue congestion delays incurred by the departing aircraft in the simulation under the three operating conditions. The average ground delay, combined with the departure queue delay, represent all of the delay associated with the aircraft once it has left the gate until liftoff.

Table 0.11: Average Taxi and Queue Delay in Minutes for Departing Aircraft

Average Taxi and Queue Delay in Minutes for Departing Aircraft

	2005	2010	2015	2020	2025	2030
			West Plan VFR – Visual Approach			
No Action	2.2	2.4	3.4	4.7	5.4	5.1
T1 East		2.4	3.4	5.7	6.3	8.4
T2 West		2.3	3.2	4.0	4.4	5.0
			West Plan IFR			
No Action	2.2	2.6	3.7	4.7	5.3	5.1
T1 East		2.5	3.7	5.9	6.4	8.4
T2 West		2.5	3.6	3.9	4.4	5.0
			East Plan IFR – ILS Approach, 09/27 Departures			
No Action	15.9	20.2	47.9	17.7	21.2	19.3
T1 East		25.6	35.4	19.4	18.2	18.4
T2 West		22.2	36.7	17.2	19.1	23.3

Table 0.12 shows the average gate delays incurred by the departing aircraft in the simulation under the three operating conditions. The average gate delays for departures are low for the two West Plan configurations and are high in the East Plan configuration due directly to departures that request Runway 27 which is the opposite departure direction during East Plan.

Table 0.12: Average Gate Delay in Minutes for Departing Aircraft

Average Gate Delay in Minutes for Departing Aircraft

	2005	2010	2015	2020	2025	2030
			West Plan VFR – Visual Approach			
No Action	0.2	0.3	0.9	0.6	0.3	0.4
T1 East		0.2	0.1	0.0	0.3	0.5
T2 West		0.3	0.0	0.1	0.1	0.1
			West Plan IFR			
No Action	0.2	0.3	0.8	0.6	0.4	0.5
T1 East		0.2	0.1	0.0	0.3	0.5
T2 West		0.3	0.0	0.1	0.1	0.1
			East Plan IFR – ILS Approach, 09/27 Departures			
No Action	20.6	22.2	37.2	35.9	40.1	38.7
T1 East		40.8	45.5	27.9	27.0	31.0
T2 West		27.7	39.5	36.9	39.3	45.6

1.A.4 Departure Aircraft – Airspace Travel and Delay Times

Table 0.13 presents the average airspace travel times incurred in the simulation under the three West Plan operating conditions for departures. The airspace travel times include time spent on the airspace routes from liftoff to ejection from the simulation airspace structure. The times include any airspace delays incurred due to aircraft sequencing.

Table 0.13: **Average Airspace Travel Time in Minutes for Departing Aircraft (Delay Included)**

Average Airspace Travel Time in Minutes for Departing Aircraft (Delay Included)

	2005	2010	2015	2020	2025	2030
			West Plan VFR – Visual Approach			
No Action	7.6	7.9	7.9	7.8	7.9	7.9
T1 East		7.7	7.7	7.8	7.9	8.0
T2 West		7.7	7.7	7.8	7.9	8.0
			West Plan IFR			
No Action	7.6	7.9	7.9	7.8	7.9	7.9
T1 East		7.7	7.7	7.8	7.9	8.0
T2 West		7.7	7.7	7.8	7.9	8.0
			East Plan IFR – ILS Approach, 09/27 Departures			
No Action	7.8	7.5	7.5	7.7	7.8	7.7
T1 East		7.5	7.6	7.7	7.7	7.8
T2 West		7.6	7.6	7.7	7.8	7.7

Table 0.14 and **Table 0.15** and present the two components that make up the average arrival airspace travel times shown in **Table 0.13**. **Table 0.14** presents the average airspace travel times incurred in the simulation under the three West Plan operating conditions for departures without delay sequencing needed for aircraft interactions. The airspace travel times include time spent on the airspace routes from liftoff to ejection from the simulation airspace structure.

Table 0.14: Undelayed Average Airspace Travel Time in Minutes for Departing Aircraft

Undelayed Average Airspace Travel Time in Minutes for Departing Aircraft

	2005	2010	2015	2020	2025	2030
West Plan VFR – Visual Approach						
No Action	7.5	7.9	7.9	7.8	7.9	7.9
T1 East		7.7	7.7	7.8	7.9	8.0
T2 West		7.7	7.7	7.8	7.9	8.0
West Plan IFR						
No Action	7.5	7.9	7.9	7.8	7.9	7.9
T1 East		7.7	7.7	7.8	7.9	8.0
T2 West		7.7	7.7	7.8	7.9	8.0
East Plan IFR – ILS Approach, 09/27 Departures						
No Action	7.7	7.5	7.5	7.7	7.8	7.7
T1 East		7.5	7.6	7.7	7.7	7.8
T2 West		7.6	7.6	7.7	7.8	7.7

Table 0.15 presents the average airspace delay times incurred in the simulation under the three West Plan operating conditions for departures. The airspace delay times include any delay needed to sequence aircraft from liftoff to ejection from the simulation airspace structure. Because of the limited airspace structure for these simulation models the vast majority of the delay experienced by departures occurs while the aircraft are on the ground waiting to depart.

Table 0.15: Average Airspace Delay Incurred in Minutes for Departing Aircraft

Average Airspace Delay Incurred in Minutes for Departing Aircraft

	2005	2010	2015	2020	2025	2030
West Plan VFR – Visual Approach						
No Action	0.1	0.0	0.0	0.0	0.0	0.0
T1 East		0.0	0.0	0.0	0.0	0.0
T2 West		0.0	0.0	0.0	0.0	0.0
West Plan IFR						
No Action	0.1	0.0	0.0	0.0	0.0	0.0
T1 East		0.0	0.0	0.0	0.0	0.0
T2 West		0.0	0.0	0.0	0.0	0.0
East Plan IFR – ILS Approach, 09/27 Departures						
No Action	0.1	0.0	0.0	0.0	0.0	0.0
T1 East		0.0	0.0	0.0	0.0	0.0
T2 West		0.0	0.0	0.0	0.0	0.0

1.A.5 Average Annual Ground Travel and Delay Time

Table 0.16 presents average annual taxi times for all aircraft in the simulation based on the three airport operational configurations and at each modeled demand level. The percent occurrence of the each configuration is listed in Error! Reference source not found.. The total taxi times reflect the weighted average of all arrival and departure operations.

Table 0.16: **Annual Average Taxi Time in Minutes for All Aircraft**

Annual Average Taxi Time in Minutes for All Aircraft

	2005	2010	2015	2020	2025	2030
No Action	9.2	9.5	11.1	11.5	11.6	11.2
T1 East		10.4	11.1	11.4	11.7	12.9
T2 West		10.3	11.0	10.7	11.1	11.6

Table 0.17 presents average annual taxi delay times for all aircraft in the simulation based on the three airport operational configurations and at each modeled demand level. The total taxi times reflect the weighted average of the all arrival and departure operations including departure queue delay. Airspace delay is not included in **Table 0.17**.

Table 0.17: **Annual Average Taxi Delay in Minutes for All Aircraft**

Annual Average Taxi Delay in Minutes for All Aircraft

	2005	2010	2015	2020	2025	2030
No Action	2.1	2.4	4.0	4.3	4.4	4.0
T1 East		2.8	3.5	3.8	4.1	5.3
T2 West		2.3	3.1	3.0	3.3	3.8

1.A.6 Average Annual Delay – Ground and Airspace

Table 0.18 presents average annual delay times for all aircraft in the simulation based on the three airport operational configurations and at each modeled demand level. The total delay times include delay incurred in the airspace as well as on the ground. The times reflect the weighted average for all arrivals and departures.

Table 0.18: Annual Average Delay (Minutes Per Aircraft)

Annual Average Delay in Minutes for All Aircraft

	2005	2010	2015	2020	2025	2030
No Action	2.6	3.0	4.8	7.3	7.7	7.1
T1 East		3.7	4.6	7.0	7.5	9.0
T2 West		3.0	4.0	5.8	6.7	7.8

Table 0.19 presents average annual delay times for all aircraft in the simulation based on the three airport operational configurations and at each modeled demand level for the two West Plan configurations. The total delay times include delay incurred in the airspace as well as on the ground. The times reflect the weighted average for all arrivals and departures.

Table 0.19: Annual Average Delay (Minutes Per Aircraft) - West Plan Components Only

Annual Average Delay in Minutes for All Aircraft - West Plan Components Only

	2005	2010	2015	2020	2025	2030
No Action	1.6	1.8	2.8	4.8	4.8	4.4
T1 East		1.9	2.4	4.4	5.0	6.2
T2 West		1.7	2.1	3.5	4.0	4.6