SAN DIEGO
International Airport

AIRPORT MASTER PLAN
SAN DIEGO INTERNATIONAL AIRPORT

CHAPTER 5

Gate Requirements

HNTB

SAN DIEGO INTERNATIONAL AIRPORT

MAY 2008

5. GATE REQUIREMENTS

Requirements for additional aircraft gates were prepared based on a gated flight schedule determined through utilization of the aviation demand forecast data presented in Chapter Four. A description of the preparation of the gated flight schedule, including the assumptions and methodology is presented here in Chapter Five, Gate Requirements.

Preferential versus Common Use

There are two primary types of use agreements common at most US airports, preferential use and common use. Preferential use gate agreements are more widely used and have been in use for a longer period of time. However, common use gate agreements allow for airports to maintain more control over gate utilization and are often considered to be more efficient in terms of moving the greatest number of passengers through the fewest gates.

Preferential use gate agreements generally require that each gate at the airport can be operated such that each airline shall have preferential use and scheduling rights on its passenger holdrooms, associated passenger loading bridges, gates and passenger aircraft ramps and apron areas subject to the rules and regulations and the conditions of individual use and lease agreements. Airline holding preferential rights can generally utilize their gates as much or as little as they choose.

Airports typically offer gates under a common use method to airlines on a scheduled basis for per-use fee. Airport manage the gates day to day and have seasonal scheduling meetings with user airlines to set up the basic schedule, from which deviations may occur due to weather, mechanical delay, or other factors. In practice, the airport will schedule most of the flights for any one airline at gates close to one another. This permits rational allocation of airline personnel and equipment.

Common use implies an equivalent level of amenities for any airline that regularly uses a gate. In the terminal the airport may provide airline identification, passenger processing (particularly electronic "ticket lift" at the door of the boarding bridge), and communications systems that enable multiple airlines to use the facility and have access to their proprietary systems. On the apron, the airport may provide the passenger boarding bridges, aircraft ground power, preconditioned air, and hydrant fueling systems with self-service handling company operations. Parking guidance systems and other amenities become increasing complex with common use. The airport and airlines frequently negotiate the extent of common use amenities and the details of their operation and cost recovery as part of the project design.

Preferential use agreements offer airlines more control over their facilities and are in place currently at SDIA. Common use is an emerging trend at US airports and provides some increases in efficiency. There are challenges to the implementation of airport wide common use of gates at SDIA due to the fragmentation of the terminal facilities and the cost of redeveloping existing facilities to accommodate common use.

5.1 Approach to Preparation of Gated Flight Schedules

The purpose of the gated flight schedule is to provide the necessary details to prepare gate requirements and hourly activity forecasts. Two gated flight schedules have been prepared for the Master Plan, one for 2015 and one for 2030, utilizing the high-constrained forecast. Gated flight schedule forecasts are predicted on a flight-by-flight basis for an average weekday in the peak month (AWDPM). The following were also considered in the preparation of these gated flight schedules:

- With gate requirements and hourly activity forecasts, the shift from short-haul to long-haul flights can be reflected.

- The runway-constrained scenario is selected because it is most likely to reflect the future SDIA environment.
- The year 2015 is selected as an interim year because it represents the point at which the constrained and unconstrained forecasts begin to diverge in the high scenario.

Three major steps are involved in preparing the schedules. First, the annual aircraft operations projections from the forecasts (see **Table 5-1**) are converted into operations for the AWDPM. Second, the operations are then distributed among markets by airline and aircraft type. The final step is to assign arrival and departure times to each of the flights identified in the market analysis.

Table 5-1

Annual Forecasts of Activity High Forecast

Activity Category	2002	2003[1]	2005	2010	2015	2020	2025	2030
Unconstrained								
Passenger Enplanements								
Domestic	7,321,641	7,506,858	8,060,303	9,417,820	10,846,004	12,295,248	13,750,391	15,382,283
International	150,003	130,335	160,000	342,000	557,000	670,000	800,000	954,000
Total	**7,471,644**	**7,637,193**	**8,220,303**	**9,759,820**	**11,403,004**	**12,965,248**	**14,550,391**	**16,336,283**
Operations								
Passenger	174,370	172,790	186,155	205,796	234,776	263,756	295,363	326,970
Cargo[2]	4,634	4,916	4,815	5,116	6,936	8,755	10,135	11,515
General Aviation[2]	15,044	14,535	15,601	16,530	18,439	20,348	22,699	25,049
Military	1,253	1,251	1,130	1,130	1,130	1,130	1,130	1,130
Total	**195,301**	**193,492**	**207,701**	**228,572**	**261,281**	**293,989**	**329,327**	**364,664**
Constrained								
Passenger Enplanements								
Domestic[3]	7,321,641	7,506,858	8,060,303	9,417,820	10,846,004	11,874,500	12,520,250	13,166,000
International[4]	150,003	130,335	160,000	342,000	557,000	670,000	800,000	954,000
Total[5]	**7,471,644**	**7,637,193**	**8,220,303**	**9,759,820**	**11,403,004**	**12,544,500**	**13,320,250**	**14,120,000**
Operations								
Passenger[5]	174,370	172,790	186,155	205,796	234,776	252,776	260,196	267,616
Cargo[4]	4,634	4,916	4,815	5,116	6,936	8,755	10,135	11,515
General Aviation[6]	15,044	14,535	15,601	16,530	18,439	18,439	18,439	18,439
Military[4]	1,253	1,251	1,130	1,130	1,130	1,130	1,130	1,130
Total	**195,301**	**193,492**	**207,701**	**228,572**	**261,281**	**281,100**	**289,900**	**298,700**

1 Actual from San Diego International Airport, Air Traffic Report, December 2003.
2 2005, 2015, and 2025 interpolated.
3 Total enplanements less international enplanements.
4 Assumed to be the same as in unconstrained case.
5 Activity through 2015 assumed to be the same as unconstrained case, 2020 and 2030 from SH&E Forecast, 2025 interpolated.
6 No growth after 2015, in accordance with SH&E forecast.

Sources: SH&E, San Diego International Airport Aviation Activity Forecasts, February 2004, and HNTB analysis.

5.2 Average Weekday Peak Month Aircraft Operation Forecasts

Table 5-2 presents the AWDPM forecasts for the high-constrained scenario in 2015 and 2030. The forecasts assume that 2003 seasonal and day-of-week distributions would continue into the future. July was the peak month in 2003 for total operations at SDIA. As shown in **Table 5-2**, 777 AWDPM operations are projected in 2015, and 891 AWDPM operations are projected in 2030.

Table 5-2

Estimated Average Week Day Peak Month Operations
High Constrained Aviation Activity Forecast

	2015		2030	
	Annual[1]	Average Week Day Peak Month	Annual[1]	Average Week Day Peak Month
Operations				
Domestic Passenger[2]	226,462	666	254,342	748
International Passenger[2]	8,314	24	13,274	39
Cargo[3]	6,936	25	11,515	41
General Aviation[4]	18,439	58	18,439	58
Military[5]	1,130	4	1,130	4
Total	**261,281**	**777**	**298,700**	**891**
Departures[6]				
Domestic Passenger	113,231	333	127,171	374
International Passenger	4,157	12	6,637	20
Cargo	3,468	12	5,758	21
General Aviation	9,220	29	9,220	29
Military	565	2	565	2
Total	**130,641**	**388**	**149,350**	**445**

1 Table 5-1.
2 In 2003, the average weekday in the peak month (July) accounted for 1 out of 342.6 annual air carrier operations. Annual operations were divided by 342.6 and increased by 1.00776 to account for difference between scheduled and actual operations
3 In 2003, the average weekday in the peak month (July) accounted for 1 out of 278.5 annual air cargo operations. Annual operations were divided by 278.5 to calculate AWDPM operations.
4 In 2003, the average weekday in the peak month (July) accounted for 1 out of 316.8 annual GA operations. Annual operations were divided by 316.8 to calculate AWDPM operations.
5 In 2003, the average weekday in the peak month (July) accounted for 1 out of 295.6 annual military operations. Annual operations were divided by 295.6 to calculate AWDPM operations.
6 Operations divided by 2.

Sources: FAA ATADS system, San Diego International Airport, Air Traffic Report, and HNTB analysis.

5.3 Air Service Assumptions

The AWDPM operation estimates are allocated by market, airline, and aircraft type before they are converted to gated flight schedules. The following information was collected to prepare this analysis:

- existing flights by market obtained from an electronic version of the Official Airline Guide (OAG) schedules;

- the flight-time distributions for non-scheduled operations obtained from Airport radar data; and
- Estimated origins and destinations for non-scheduled markets based on available information on carrier markets and aircraft ranges.

Appendix D presents the 2015 and 2030 estimates of scheduled domestic departures by market, airline, and aircraft type. There are several steps involved, and these steps are described below:

1. *Establish overall control totals for aircraft departures and seat departures.* The control total (refer to **Table 5-2**) for scheduled seat departures was calculated by dividing the aviation activity forecast passenger projections by the SH&E load factor projections.
2. *Apportion seat departures by market.* Scheduled seat departures in each market are projected to grow per the forecasted passenger growth rate for that market segment (less than 500 miles, 500 to 2,000 miles, over 2,000 miles). The scheduled seat departures are then adjusted with the forecast load factor and the ratio of constrained to unconstrained passengers.
3. *Identify new domestic non-stop markets.* New non-stop markets are estimated based on current origin and destination (O&D) thresholds for non-stop service at SDIA. Candidate markets for non-stop service are determined by identifying the current thresholds of O&D traffic justified by non-stop service to SDIA markets. These thresholds vary depending on the type of market. For example, nearby markets tend to have lower O&D thresholds than more distant markets because service can be offered with smaller aircraft and because there is less competition from connecting hubs between the two markets. The O&D threshold for non-stop service is assumed to be the average of the largest O&D market without non-stop service and the smallest O&D market with non-stop service in each market segment. O&D traffic in each market is assumed to grow by the same percentage as the passenger forecast for the market segment in which the market belongs. If future year originations in a market exceed the O&D threshold for that market's segment, it is assumed the market would obtain non-stop service.
4. *Adjust seat departures in existing non-stop markets*. Seat departures to new non-stop markets were balanced by a corresponding reduction in seat departures to existing airline hubs in the same market segment. Based on this assumption, new non-stop passengers would be drawn from ranks of existing connecting passengers.
5. *Identify international markets.* International markets are obtained from the forecast.
6. *Allocate individual market seat departures to airlines.* Airlines were assumed to serve each market based on existing service trends, existing airline service strategies, and the assumptions contained in the forecast report. Critical assumptions are:

- Increased market share by low-fare carriers such as Southwest and JetBlue.
- No major changes in hubbing strategy among legacy carriers.

7. *Allocate individual airline seat departures by market to aircraft*. This step was combined with Step 6. Aircraft were assumed to serve each market based on the fleet and fleet acquisition plans for each airline and the unconstrained forecast fleet mix (the constrained fleet mix was not available), and these figures were adjusted to match average aircraft size in high-constrained 2030 forecast.

AWDPM air cargo, GA, and military operations are presented in **Table 5-2**. The future fleet mix for these categories is based on the forecast. The current distribution of cargo routes is assumed to continue into the future.

Gated Flight Schedules

Gated flight schedules were developed for 2015 and 2030 using the July 2004 schedule and the AWDPM service projections (refer to **Appendix D**) as controls. These schedules include operations performed by

all segments of aviation – passenger, cargo, GA, and military flights. The schedules provide the following details for each flight:

1. Type of Operation (Arrival or Departure)
2. Time of Operation
3. Airline (except GA flights)
4. Equipment
5. Origin of Arrivals / Destination of Departures
6. Gate
7. Passenger Deplanements and Terminations for Arrivals
8. Passenger Enplanements and Originations for Departures

The gated flight schedules are prepared using the following steps:

1. *Identify arrival and departure times for existing flights.* The July 21, 2004 OAG schedule was used to identify these times. Where necessary, the equipment for existing flights was changed to reflect the fleet mix projection as presented in **Appendix D**.
2. *Identify arrival and departure times for new flights.* Times for new flights are based on the flight times for the same market to LAX where available. Otherwise, flight times for new flights are assumed based on industry knowledge incorporating the following three factors:

- When scheduling multiple frequencies with the same city pair market for any individual airline, an attempt is made to distribute the flights in a balanced manner over the course of the day.
- Flights were scheduled to avoid take-offs and landings during nighttime (11:00 PM to 6:00 AM) at destination markets (i.e., no arrivals from the East Coast before 9:00 AM to 10:00 AM and no departures for the East Coast after 3:00 PM to 4:00 PM, unless a "red-eye" flight).
- When scheduling flights in a new market, departures and arrivals were timed similarly as those found in comparable markets (i.e., a new transcontinental market had flights timed similarly to an existing transcontinental market).

3. *Determine Aircraft Turnarounds*. Determining aircraft turnarounds (or which arriving flight becomes, or is paired with, a departing flight) is based on current practice and the four factors listed below:

- Regional aircraft turnarounds are scheduled for no less than 25 minutes.
- Wide-body aircraft turnarounds are scheduled for no less than one hour.
- Narrow-body turnarounds for most airlines are scheduled for no less than 45 minutes.
- Turnarounds for Southwest Airlines are scheduled for no less than 20 minutes.

4. *Determine load factors by market.* Average load factors for the AWDPM are assumed to be 87 percent. This is based on the annual forecast of 77 percent adjusted to reflect higher load factors during the peak month. Average load factors are assumed to be the same for all markets.
5. *Determine load factors by flight*. The distribution of load factors by time of day is based on professional judgment with an effort made to increase load factors during the morning and afternoon peaks at the place of origin.
6. *Determine* passenger *originations and terminations by flight*. The ratio of originations to enplanements by carrier is based on existing airline origination to enplanement ratios at SDIA and adjusted to match the projection, contained in the forecast, of 96 percent.

7. *Assign Gates***.** A common use and a preferential use gate scenario were prepared for each of the gated flight schedules. However, common use is not currently in place at SDIA and would be difficult to implement on an airport-wide basis given the existing preferential use agreements with airlines and the physical infrastructure available at SDIA. Five gate categories are identified: 1) international, 2) domestic wide-body, 3) domestic large narrow-body (757), 4) other domestic narrowbody, and 5) regional aircraft. It is assumed each gate could accommodate smaller aircraft when not required to accommodate the aircraft type for which it was designed. A minimum 15-minute buffer is assumed between departures and the next arrival for domestic flights, and a 30-minute minimum buffer is assumed for international flights. Aircraft flights are assigned gates in order to minimize the number of gates required. No spare gates are included in this analysis. The 2015 exclusive use gate scenario is prepared at a higher level of detail than the other scenarios to better identify initial gate requirements. Flights are assigned to existing gates with consideration of gauge limitations, restrictions imposed by adjacent gate use, and the availability of Federal Inspection Services (FIS) facilities. As demand required, additional gates were assumed to be available either east of Terminal 1, or west of Terminal 2 West so that all aircraft were able to be gated.

The gated flight schedules are presented in **Appendix D**.

Results

The flight-by-flight AWDPM forecasts in the gated flight schedules are aggregated to generate forecasts of gate requirements, hourly aircraft operations, and hourly passenger and O&D flows.

Table 5-3 presents the contact gate requirements for 2015 and 2030 for common use and preferential use cases. As shown in the table, based on projected schedules, 2015 contact gate and commuter position requirements range from 45 to 54 units, and the 2030 gate and position requirements range from 53 to 60 units. Typically, airlines with larger operations levels at an airport prefer one or more spare gates for dealing with schedule disruptions. No allowances were made for spare gates in this analysis; hence, if spare gates are needed, the gate requirements will increase accordingly.

By 2015 eight additional contact gates will be needed with the addition of two recommended spare gates for a total of 10 new contact gates. By 2030 10 to 11 additional contact gates will be needed. The loss or down-gauge of an existing gate may result from airfield modifications to implement a dual parallel south taxiway north of Terminal Two West. Additionally, the prepared schedule requires two Group V aircraft to be parked at Gates 19 and 21 simultaneously, which will result in the need for an additional replacement gate as parking a Group V aircraft at Gate 21 restricts Gate 24.

Table 5-3

Summary of Gate and Commuter Position Requirements
Based on Gated Flight Schedules

	2015		2030	
	Common Use[1]	Preferential Use[2]	Common Use[1]	Preferential Use[2]
Gate Requirements[3]				
Widebody	4	5	3	4
Large Narrowbody (757)	5	5	6	5
Other Narrowbody	28	34	38	39
Regional	4	7[3]	1	3
International	4	3	5	9
Total	**45**	**54**	**53**	**60**

1 Appendix D.
2 Two regional contact gates and five commuter positions.
3 Does not include spare gates. Assumes each gate type can also accommodate smaller aircraft. For example, a narrowbody gate is assumed to be able to accommodate a regional jet when not required by a narrowbody aircraft.

Sources: Appendix D and HNTB analysis.

Table 5-4 and **Table 5-5** present the projected hourly distributions of operations and passengers for the 2015 and 2030 high-constrained forecasts, respectively. As shown in the tables, the percentage of peak hour operations is projected to decline slightly from 2015 to 2030. The tendency for airlines to spread operations to off-peak periods as delays increase is offset by the increase in the percentage of long-haul flights. This occurs because of time zone differences, which limit an airline's hours of operation. The peak hour percentage for passengers is projected to increase slightly between 2015 and 2030 as a result of overseas flight increases per the forecasts. Overseas flights tend to peak in the late morning and early afternoon.

Table 5-4

Forecast Hourly Distribution of Passengers and Operations
2015 High Constrained Forecast

Hour	Originations	Terminations	Total O&D	Enplanements	Deplanements	Total Passengers	Aircraft Departures	Aircraft Arrivals	Aircraft Operations
0000-0059	-	115	115	-	115	115	-	1	1
0100-0159	-	118	118	-	118	118	-	1	1
0200-0259	-	-	-	-	-	-	-	-	-
0300-0359	-	-	-	-	-	-	-	-	-
0400-0459	-	-	-	-	-	-	-	3	3
0500-0559	-	-	-	-	-	-	-	3	3
0600-0659	2,814	164	2,978	2,814	177	2,990	28	3	31
0700-0759	2,026	836	2,862	2,026	894	2,920	20	12	32
0800-0859	2,455	2,153	4,608	2,571	2,287	4,858	24	24	48
0900-0959	2,931	1,809	4,740	3,090	1,918	5,008	30	21	51
1000-1059	2,111	3,140	5,252	2,244	3,318	5,562	24	31	55
1100-1159	2,270	3,158	5,428	2,386	3,304	5,690	25	31	56
1200-1259	2,676	2,686	5,361	2,819	2,855	5,674	29	27	56
1300-1359	2,755	2,498	5,252	2,907	2,595	5,502	28	28	56
1400-1459	2,489	1,812	4,301	2,610	1,914	4,525	26	21	47
1500-1559	1,942	1,794	3,737	2,035	1,875	3,910	22	19	41
1600-1659	2,056	1,410	3,465	2,155	1,502	3,657	20	19	39
1700-1759	2,012	2,031	4,043	2,117	2,192	4,309	22	24	46
1800-1859	1,742	1,195	2,937	1,884	1,240	3,124	21	14	35
1900-1959	1,549	2,464	4,012	1,624	2,605	4,229	22	25	47
2000-2059	1,512	2,960	4,472	1,591	3,113	4,704	17	26	43

Table 5-4

Forecast Hourly Distribution of Passengers and Operations
2015 High Constrained Forecast

Hour	Originations	Terminations	Total O&D	Enplanements	Deplanements	Total Passengers	Aircraft Departures	Aircraft Arrivals	Aircraft Operations
2100-2159	1,471	2,681	4,151	1,538	2,684	4,222	17	24	41
2200-2259	1,126	2,533	3,659	1,165	2,533	3,698	10	23	33
2300-2359	356	748	1,103	396	748	1,144	3	8	11
Total	**36,292**	**36,303**	**72,595**	**37,972**	**37,985**	**75,957**	**388**	**388**	**776**
Peak Hour	**2,931**	**3,158**	**5,428**	**3,090**	**3,318**	**5,690**	**30**	**31**	**56**
Peak Hour Percent	8.1%	8.7%	7.5%	8.1%	8.7%	7.5%	7.7%	8.0%	7.2%

Source: Appendix C and HNTB analysis.

Table 5-5

Forecast Hourly Distribution of Passengers and Operations
2030 High Constrained Forecast

Hour	Originations	Terminations	Total O&D	Enplanements	Deplanements	Total Passengers	Aircraft Departures	Aircraft Arrivals	Aircraft Operations
0000-0059	-	96	96	-	96	96	-	1	1
0100-0159	-	143	143	-	143	143	-	2	2
0200-0259	-	-	-	-	-	-	-	1	1
0300-0359	-	-	-	-	-	-	-	-	-
0400-0459	-	-	-	-	-	-	-	4	4
0500-0559	-	-	-	-	-	-	1	1	2
0600-0659	3,461	130	3,591	3,461	136	3,597	34	3	37
0700-0759	2,769	798	3,566	2,769	855	3,623	27	12	39
0800-0859	2,879	2,701	5,580	3,042	2,855	5,897	26	29	55
0900-0959	3,368	2,242	5,610	3,532	2,369	5,901	31	21	52
1000-1059	2,819	4,007	6,826	2,988	4,229	7,216	28	35	63
1100-1159	2,675	3,536	6,211	2,807	3,683	6,490	28	32	60
1200-1259	3,444	3,052	6,496	3,598	3,221	6,819	34	29	63
1300-1359	3,075	2,983	6,058	3,230	3,092	6,322	31	29	60
1400-1459	3,042	2,957	5,999	3,178	3,122	6,300	29	31	60
1500-1559	3,194	2,400	5,594	3,364	2,513	5,877	30	25	55
1600-1659	2,981	2,157	5,138	3,143	2,255	5,398	30	26	56
1700-1759	2,359	1,985	4,344	2,456	2,138	4,594	23	24	47
1800-1859	1,582	1,662	3,245	1,711	1,722	3,433	18	19	37
1900-1959	1,574	3,840	5,413	1,651	4,017	5,669	18	33	51

Table 5-5

Forecast Hourly Distribution of Passengers and Operations
2030 High Constrained Forecast

Hour	Originations	Terminations	Total O&D	Enplanements	Deplanements	Total Passengers	Aircraft Departures	Aircraft Arrivals	Aircraft Operations
2000-2059	1,616	3,782	5,399	1,696	4,001	5,697	19	31	50
2100-2159	2,061	2,795	4,856	2,156	2,798	4,954	20	23	43
2200-2259	1,661	2,894	4,555	1,749	2,894	4,643	14	25	39
2300-2359	318	721	1,039	351	721	1,072	4	9	13
Total	**44,877**	**44,881**	**89,758**	**46,882**	**46,857**	**93,739**	**445**	**445**	**890**
Peak Hour	**3,461**	**4,007**	**6,826**	**3,598**	**4,229**	**7,216**	**34**	**35**	**63**
Peak Hour Percent	7.7%	8.9%	7.6%	7.7%	9.0%	7.7%	7.6%	7.9%	7.1%

Source: Appendix C and HNTB analysis.

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