APPENDIX F
NET BENEFITS ANALYSIS

F.1 INTRODUCTION

The Airport Sponsor's Proposed Project and the alternatives identified in the Draft EIS are proposed to improve the operational performance of Fort Lauderdale-Hollywood International Airport (FLL). The main operational benefits would result from the ability to land and depart air carrier aircraft from a new or reconfigured south runway, a new north runway, or a combination of improvements to the south and north airfields. The specific improvements included under each alternative are described in Chapter Four *Alternatives*.

Alternative A:	**No Action**
Alternative B1:	**Redevelop and extend existing Runway 9R/27L to an 8,600-foot by 150-foot elevated runway**
Alternative B1b:	**Redevelop and extend existing Runway 9R/27L to an 8,000-foot by 150-foot elevated runway with EMAS**
Alternative B1c	**(Airport Sponsor's Proposed Project): Redevelop existing Runway 9R/27L to an 8,000-foot by 150-foot elevated runway with EMAS; runway use determined by Broward County's Interlocal Agreements.**
Alternative B4:	**Build a new 6,001-foot at grade runway with EMAS located 340 feet north of existing south runway (to replace existing Runway 9R/27L)**
Alternative B5:	**Build a 7,800-foot elevated runway with EMAS located 320 feet south of existing south runway (to replace existing Runway 9R/27L)**
Alternative C1:	**Build a 7,721 foot at grade runway located 850 feet north of existing Runway 9L/27R (a dependent parallel runway to existing Runway 9L/27R)**
Alternative D1:	**Redevelop and extend existing Runway 9R/27L to 8,000 feet and build a new 7,721-foot runway north of existing Runway 9L/27R (combination of Alternatives B1b and C1)**
Alternative D2:	**Build a new 6,001-foot at grade runway with EMAS located 340 feet north of existing south runway and build a 7,721 foot at grade runway located 850 feet north of existing Runway 9L/27R (combination of Alternatives B4 and C1)**

In general, the benefits accrued from improving runway capacity at FLL can be measured in terms of reduced arrival and departure flight delays. Because the alternatives differ in terms of the number, location, and length of runway

improvements, the benefit of each alternative is not equal. This document presents the Draft EIS analysis conducted to calculate the operational benefit of each alternative. The following describes the steps used for this analysis:

1. **Determine the level and characteristics of future aviation demand.**
2. **Determine how the airfield runways will be operated to accommodate demand under each alternative.**
3. **Calculate the capacity of the various alternatives.**
4. **Conduct demand/capacity analysis and compute delay that would result from demand exceeding capacity for each alternative.**
5. **Calculate the delay benefit provided by each alternative in comparison to the baseline No Action Alternative.**

The assumptions used and the results of the operational benefit analysis are discussed in the following sections.

F.1. SUMMARY OF FORECAST AVIATION DEMAND

Each alternative was evaluated at future demand levels for 2012 and 2020 using a profile of 24-hour aircraft operations (i.e., flight schedule) that represents the Peak Month Average Day (PMAD) demand. The PMAD is a busy day at the airport, but not the busiest day, and is the industry standard for analyzing airfield capacity and delay. The flight schedules are based on the FAA Terminal Area Forecast (TAF) issued in January 2007, which is the annual forecast used in the Draft EIS analysis.[1] FLL annual and PMAD forecast operations are compared to the base year 2004 operations in Table F-1 *Forecast Annual and Peak Month Average Day Aircraft Operations*.

Table F-1
FORECAST ANNUAL AND PEAK MONTH AVERAGE DAY AIRCRAFT OPERATIONS
Fort Lauderdale-Hollywood International Airport

YEAR	ANNUAL OPERATIONS	PMAD OPERATIONS
2004	308,343	986
2012	341,877	1,072
2020	408,536	1,268

Source: FAA Terminal Area Forecast (TAF) issued in January 2007 and Landrum & Brown analysis, 2007.

[1] **The FAA Terminal Area Forecast (TAF) issued in January 2007 provides projections through Federal Fiscal Year 2025. The enplanement and operations data used in this Draft EIS analysis includes the actual enplanement and operations data from 2000 through 2006 and forecast data for 2012 and 2020. This data is provided in this Draft EIS in Appendix N.1 *Forecast Verification and Derivatives*, Table 1, FAA Terminal Area Forecast issued January 2007.**

The flight schedules for 2012 and 2020 are similar in content to any airline flight schedule. They contain information about the type of flight, the type of aircraft, the gate arrival and departure times, the origin and destination of the flight, and the airline operator. The principal differences between the PMAD flight schedules and a typical airline schedule are:

- **The PMAD flight schedule includes estimates of non-scheduled activity such as charter, air cargo, military, and general aviation.**
- **The PMAD flight schedule is a design day schedule and is considered an approximation of a typical busy day at FLL. Therefore, unlike a typical airline's schedule that is tied to a specific date and may exactly match the airlines actual activity for that date, the PMAD flight schedule parallels a number of days of activity, but does not attempt to exactly match a particular day's activity.**

The fleet mix and type of operation (i.e., arrival and departure) in the 2012 and 2020 PMAD schedules are summarized in Table F-2 *Operations by Aircraft Classification*. FLL's future fleet mix is a key factor in the analysis of capacity described in Section F.3, *Capacity Analysis*. The operations shown in Table F-2 are classified by aircraft group according to maximum certified take-off weight as follows:

- **"Heavy" aircraft are above 255,000 pounds and include aircraft such as the Boeing 767 and Airbus 300**
- **The Boeing 757 is a "Heavy" aircraft according to weight but is listed separately given its predominance**

Table F-2
OPERATIONS BY AIRCRAFT CLASSIFICATION
Fort Lauderdale-Hollywood International Airport

	2004				2012				2020			
	ARR	DEP	Total	Percent	ARR	DEP	Total	Percent	ARR	DEP	Total	Percent
Heavy	16	15	31	3.1%	16	16	32	3.0%	26	26	52	4.1%
B-757	59	61	120	12.2%	46	46	92	8.6%	53	53	106	8.4%
Large	324	318	642	65.1%	350	350	700	65.3%	415	415	830	65.5%
Small	94	99	193	19.6%	124	124	248	23.1%	140	140	280	22.1%
Total	493	493	986	100.0%	536	536	1072	100.0%	634	634	1268	100.0%

Source: Landrum & Brown analysis, 2007

- **"Large" aircraft are between 41,000 and 255,000 pounds and include the Boeing 737, Airbus 319/320, MD-80/90. Large aircraft are mostly jet aircraft, but they also include some propeller aircraft.**
- **"Small" aircraft are less than 41,000 pounds and include most small turboprops and small general aviation aircraft.**

The FAA uses these aircraft classifications to ensure that successive (in-trail)[2] aircraft of different classes maintain adequate separation. Generally, Air Traffic Control must maintain greater separation between a smaller aircraft following a larger or heavier aircraft than if following another aircraft of the same size or smaller.

As shown in Table F-2 *Operations by Aircraft Classification*, large aircraft are the predominant group in the fleet at FLL. By 2020, the percentage of B-757 aircraft is forecast to decrease by approximately four percent, small aircraft are forecast to increase by three percent, and heavy aircraft are projected to increase by one percent.

The increase in operations between 2004 and 2020 is mostly in the large and small aircraft categories. Most of these aircraft are not able to use the existing south Runway 9R/27L due to the runway's physical dimensions (i.e., length, width). As such, these additional air carrier operations will put increased pressure on the use of Runway 9L/27R. The delay that would result from such conditions is presented in Section F.4, *Demand/Capacity Analysis*.

F.2. RUNWAY OPERATING ASSUMPTIONS

FLL's current airfield consists of three runways: two widely spaced parallel runways oriented in an east/west direction (Runways 9R/27L and 9L/27R) and one crosswind runway oriented in a northwest/southeast direction (Runway 13/31). The airport cannot operate on all three runways simultaneously because of the intersecting nature of Runway 13/31. Thus, operations on Runway 13/31 must be coordinated with operations on the parallel runways 9R/27L and 9L/27R. Operations on the parallel runways can be conducted simultaneously under good weather conditions. As such, the airport has two predominant operating flows:

- **East flow – Arrivals and departures on Runways 9R and 9L; occasional arrivals and departures on Runway 13.**
- **West flow – Arrivals and departures on Runways 27R and 27L.**

East flow is the predominant operating direction at FLL based on wind and weather conditions. Air Traffic Control (ATC) conducts east flow operations at FLL approximately 81.2 percent of the year, while west flow operations are conducted 18.8 percent. Most of the time, the airport operates under good weather conditions. However, during approximately 6.9 percent of the year, low clouds, precipitation or poor visibility result in reduced operations on Runway 9R/27L. This is a result of more stringent air traffic control requirements in poor weather, as well as additional navigational aid/equipment requirements.

[2] **In-trail is defined as the separation of aircraft to avoid aircraft wake turbulence. In-trail separation standards apply when one aircraft is behind another aircraft, and the trailing aircraft must maintain a safe separation from the hazardous wake vortices produced by the leading aircraft. Wake vortices are the result of the airflow around and about the aircraft wing during flight; and rotate rapidly and increase in intensity with heavier aircraft. The vortices from heavier aircraft can be hazardous to smaller aircraft.**

F.2.1 GENERAL OPERATING ASSUMPTIONS

According to the FLL ATC, air traffic controllers direct arrivals and departures to use the existing runways according to the following general guidelines:

Existing Airfield – Runway Operating Assumptions:

- **Air carrier arrivals and departures use the north Runway 9L/27R until the demand on this runway exceeds its capacity, at which time ATC will consider using Runway 13/31.**
- **Runway 13/31 is only used if the traffic volume on the south Runway 9R/27L is low. Since operations on the two runways need to be coordinated, using both runways simultaneously results in minimal or no added capacity.**
- **The type of aircraft that can use Runway 9R/27L is limited by current noise abatement procedures and by the runway's physical width, length, and navigational equipment.**
- **ATC maximizes the use of the south Runway 9R/27L by directing to it as many aircraft that are able to use that runway as possible, while maintaining the requirements stated above.**
- **Conversely, ATC minimizes the use of the north Runway 9L/27R for aircraft that are able to use the south runway, so as to leave the north runway open for large air carrier aircraft.**

The airfield alternatives that are being evaluated as part of the Draft EIS maintain a predominant east/west operation at FLL. However, the airport operation changes under the proposed alternatives as follows:

Airfield Alternatives – Runway Operating Assumptions:

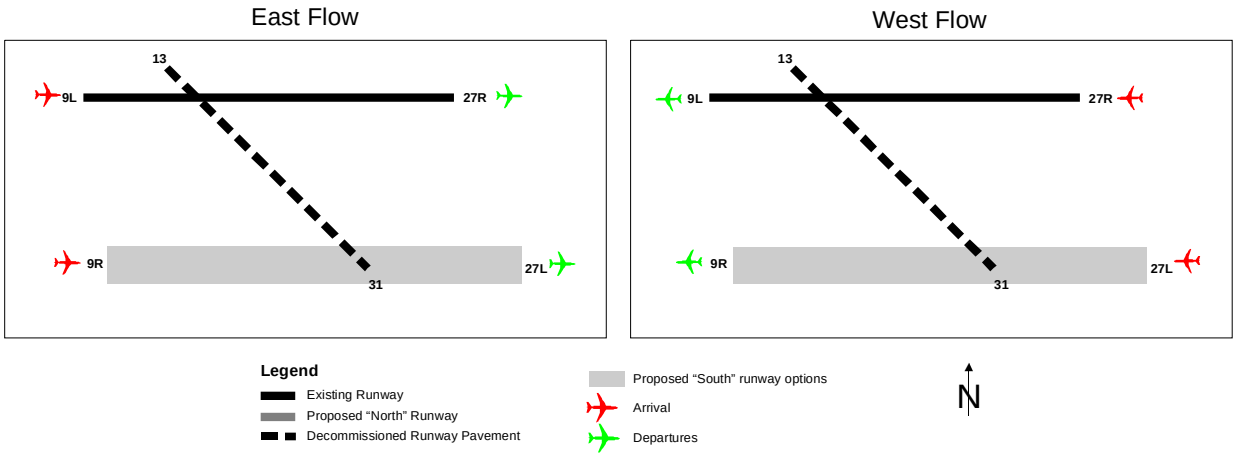
- **For all alternatives, except Alternative B1c in 2012[3] the use of all runways, including Runway 9R/27L, is not restricted by any voluntary or involuntary noise reduction/abatement measures; that is, runway use under all alternatives is "unabated."**
- **The use of the extended south Runway 9R/27L is limited to aircraft that can land/depart on the proposed length (which varies by alternative). Runway length requirements are presented in Section F.2.2, *Runway Length Requirements.***
- **An extended/improved south Runway 9R/27L that serves air carrier aircraft requires the establishment of a precision instrument approach to that runway. Presently, there is a single precision instrument approach to**

[3] **Memorandum from Leigh Fisher Associates to Virginia Lane (FAA Orlando District Office), dated August 24, 2006, describing the Airport Sponsor's Proposed Project runway use assumptions for 2012, which includes the proposed runway use per the County's Interlocal Agreements. The County's Interlocal Agreements are described in Chapter 5. The memorandum is located in Appendix H, Noise Analysis.**

Runway 9L/27R. In the future, all alternatives that assume an improved south Runway 9R/27L assume two parallel independent precision instrument approaches.

- **For Alternatives B1c (Airport Sponsor's Proposed Project) and B1b (Alternative B1 with EMAS), the approach to the north Runway 9L/27R is relocated 300 feet to the north until approximately 1.5 miles from the airport when the aircraft turn to line up with the runway for a straight-in approach. The 300-foot relocation is necessary to maintain a 4,300 foot lateral separation between Runways 9L/27R and 9R/27L to allow for independent instrument parallel approaches.**
- **All alternatives that include an extended/improved south Runway 9R/27L will conduct air carrier departures from two runways (north and south). Departure headings are assumed to include two diverging headings off each runway to provide the ability to conduct independent simultaneous departure operations on two runways.**
- **Alternatives that include one north runway and one south runway will be operated such that arrivals and departures (mixed operations) are conducted on both runways as indicated on Exhibit F-1.**

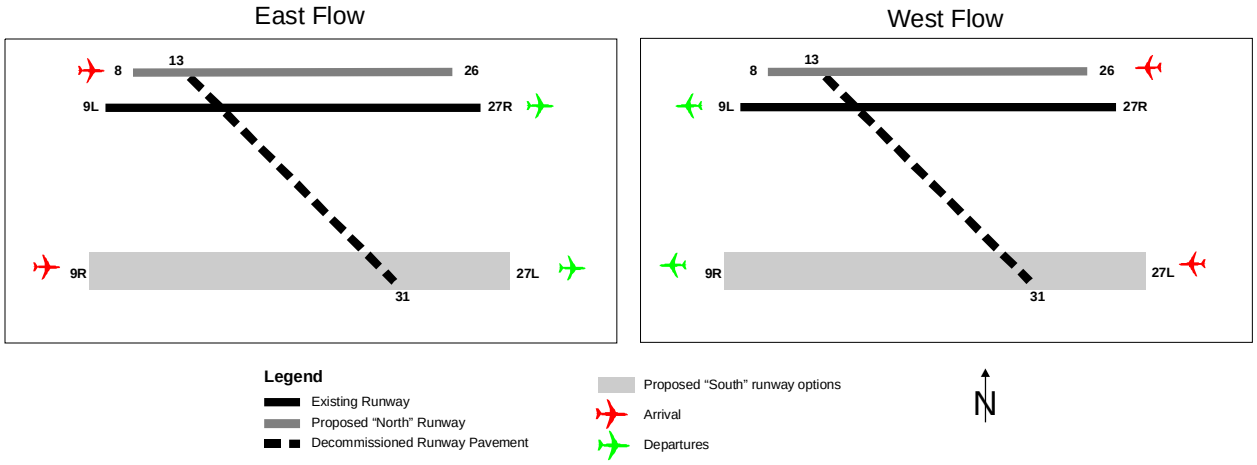
Exhibit F-1
TWO PARALLEL RUNWAY ALTERNATIVES – RUNWAY USE
Fort Lauderdale-Hollywood International Airport



Source: Landrum & Brown, 2006

- **Alternatives that include two runways on the north airfield will be operated such that the northern-most runway is predominantly used for arrivals, while the southern-most (i.e., existing) runway is used for departures as indicated on Exhibit F-2. The single south airfield runway will be used for both, arrivals and departures (i.e., mixed operations).**

Exhibit F-2
THREE PARALLEL RUNWAY ALTERNATIVES – RUNWAY USE
Fort Lauderdale-Hollywood International Airport



Source: Landrum & Brown, 2006

- **Air traffic controllers will assign arrivals and departures to the north or the south airfield depending on the flight geographic origin/destination, runway length required for the type of aircraft, and the terminal gate assigned to the flight. During periods of high demand, ATC will minimize delay by balancing the demand between the north and south airfields.**
- **To the extent practical, aircraft parked at Concourses A and B will be assigned to Runway 27R in west flow. Aircraft parked on Concourse H are assigned to depart Runway 27L in west flow.**
- **Air traffic controllers will sequence departures to minimize sequential take-offs to the same departure fix[4] to minimize time between departures.**
- **Alternatives that retain Runway 13/31 assume the same air traffic control procedures for its use as under the existing condition.**

F.2.2 RUNWAY LENGTH REQUIREMENTS

A detailed analysis of runway length requirements was performed to understand the potential use of the expanded and redeveloped south runway (9R/27L) as well as a proposed new north runway. The results of the runway length requirements analysis are presented in Appendix D.3 *Runway Length Analysis*. The runway length requirements were used to determine what flights in the PMAD flight schedule would be able to land and/or depart on the various runways based on runway length.

[4] **Departure fix is defined as the aircraft route coordinates followed immediately upon take-off to guide an aircraft to its enroute flight corridor. It also assists FAA Air Traffic Control in the flow management of aircraft departing an airport. There are also arrival fixes to an airport.**

The take off runway length requirements were calculated at an 80 percent, 90 percent, and 100 percent of maximum payload and the landing lengths were calculated for both dry and wet landing conditions. For the purposes of this analysis, dry landing conditions and the 90 percent payload conditions were used to determine runway suitability for all aircraft. These conditions hold true for all of the alternatives except Alternative B4, which assumes that in 2020, approximately 80 jet aircraft departures would take off at a reduced payload of 80 percent on the 6,001-foot runway.

To understand the delay impact of this assumption, a sensitivity analysis was performed for Alternative B4. In that analysis, it was assumed that approximately 80 jet aircraft departures would opt to use the longer existing north runway to avoid the payload penalty. This sensitivity analysis is presented in Section F.5.4, *Alternative B4 Sensitivity Analysis*.

F.2.3 RUNWAY ASSIGNMENTS BASED ON FLIGHT ORIGIN/DESTINATION

En-route aircraft approach FLL from various directions depending on the flight's origin. For example, aircraft arriving from New York come in from the north/northeast, while arrivals from the west coast come in from the west. Departures are distributed into the airspace system in a similar fashion, according to their geographic destination.

Air traffic controllers manage the movement of aircraft in and out of major commercial airports such as FLL by designating specific airspace routes to come into FLL and to exit the FLL airspace. Aircraft transition in/out of the FLL airspace, which is within the jurisdiction of the Miami TRACON,[5] at one of several arrival/departure fixes. The airspace fixes are established at the location of a radio navigation aid (NAVAID), such as a VOR or VORTAC, or at the intersection of two or more NAVAID signals. The Miami TRACON controllers direct arriving aircraft from the arrival fix to the airport along established routes. Likewise, controllers direct departures from the airport to the fix along established routes.

At FLL, air traffic controllers further manage air traffic by segregating the traffic on the ground according to origin/destination. Using the example of an arriving flight from New York, the flight will approach FLL through a fix to the north and will most likely be directed to land on the north airfield. If the flight is coming in from the south, and the south runway is able to accommodate that aircraft, the flight will land on the south runway. The same principle is used to segregate departure traffic. The segregation of air traffic by origin and destination allows for the orderly and efficient movement of aircraft through the National Airspace System.

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[5] **TRACON is the acronym for Terminal Radar Approach Control. This FAA facility is usually located within the vicinity of an airport. Typically, the TRACON controls aircraft approaching and departing between 5 and 50 miles of the airport. Radar equipment allows an air traffic controller to "see" the aircraft even at that distance.**

Using the origin and destination assumptions in the PMAD flight schedules for FLL, each flight was assigned to a fix and to a runway according to the assumptions described in the following paragraphs. Runway length restrictions and other assumptions described earlier were also taken into consideration. This analysis yielded a profile of demand by runway for each of the Draft EIS alternatives.

The origin/destination to fix assignments assumed for this analysis is presented in Table F-3 *Origin/Destination to Fix Assignments*. These assumptions are based on input from the Miami TRACON and the FLL Air Traffic Control Tower (ATCT) and are generally consistent with the fix assignments used in the simulation analysis performed for the *Assessment of Airfield Development Alternatives*,[6] in 2003. Recent airspace modifications made as a result of the Florida Airspace Optimization Project are reflected in the analysis contained herein. Markets (i.e., cities) that had previously been assigned to the MRLIN arrival fix are now assigned to BLUFI or GISSH fix. Assigning the fixes defined in Table T-3 *Origin/Destination to Fix Assignments*, to the PMAD demand schedule results in the distribution of operations by fix presented in Table F-4 *PMAD Distribution of Operations by Fix*.

[6] **Leigh Fisher Associates. *Assessment of Airfield Development Alternatives Fort Lauderdale-Hollywood International Airport*. Final Report. November 2003.**

Table F-3
ORIGIN/DESTINATION TO FIX ASSIGNMENTS
Fort Lauderdale-Hollywood International Airport

Origin	ICAO	Description	Arrival Fix	Departure Fix
ACY	KACY	Atlantic City	GISSH	ZAPPA / ARKES
ATL	KATL	Atlanta	FORTL	ARKES
BDL	KBDL	Hartford	GISSH	ZAPPA / ARKES
BIM	MYBO	Bimini, Bahamas	DEKAL	BEECH
BNA	KBNA	Nashville	FORTL	ARKES
BOG	SKBO	Bogota, Columbia	DEKAL	MNATE
BOS	KBOS	Boston	GISSH	ZAPPA / ARKES
BUF	KBUF	Buffalo	GISSH	ZAPPA / ARKES
BWI	KBWI	Baltimore	FORTL	ZAPPA / ARKES
CAP	MTCH	Cap Haitian, Haiti	DEKAL	BEECH
CAT	MYCA	Cat Island, Bahamas	DEKAL	BEECH
CCS	SVMI	Caracas, Venezuala	DEKAL	MNATE
CLE	KCLE	Cleveland	FORTL	ARKES
CLT	KCLT	Charlotte	FORTL	ZAPPA / ARKES
CMH	KCMH	Columbus	FORTL	ARKES
CVG	KCVG	Cincinnati	FORTL	ARKES
DCA	KDCA	Washington (National)	GISSH	ZAPPA / ARKES
DEN	KDEN	Denver	FORTL	THNDR
DFW	KDFW	Dallas Ft-Worth	FORTL	THNDR
DTW	KDTW	Detroit	FORTL	ARKES
ELH	MYEH	North Eluethera, Bahamas	DEKAL	PREDA
EWR	KEWR	New York	GISSH	ZAPPA / ARKES
EYW	KEYW	Key West	DVALL	MNATE
FPO	MYGF	Freeport, Bahamas	GISSH	PREDA
FPR	KFPR	Fort Pierce - Port St Lucie	BLUFI	ARKES
GCM	MWGC	Grand Cayman, Cayman Islands	DEKAL	MNATE
GGT	MYEG	Georgetown Bahamas	DEKAL	BEECH
GHB	MYEM	Governors Harbour, Bahamas	DEKAL	BEECH
GPT	KGPT	Gulfport	FORTL	THNDR
IAD	KIAD	Washington (Dulles)	GISSH	ZAPPA / ARKES
IAH	KIAH	Houston (Intercontinental)	FORTL	THNDR
ILN	KILN	Wilmington, Ohio	FORTL	ARKES
IND	KIND	Indianapolis	FORTL	ARKES
ISP	KISP	Islip	GISSH	ZAPPA / ARKES
JAX	KJAX	Jacksonville	BLUFI	ARKES
JFK	KJFK	New York	GISSH	ZAPPA / ARKES
KIN	MKJP	Kingston, Jamaica	DEKAL	BEECH
LAS	KLAS	Las Vegas	FORTL	THNDR
LAX	KLAX	Los Angeles	FORTL	THNDR
LGA	KLGA	New York	GISSH	ZAPPA / ARKES
LGB	KLGB	Long Beach	FORTL	THNDR
MBJ	MKJS	Montego Bay	DEKAL	BEECH
MCI	KMCI	Kansas City	FORTL	THNDR
MCO	KMCO	Orlando	FORTL	ARKES
MDW	KMDW	Chicago (Midway)	FORTL	ARKES
MEM	KMEM	Memphis	FORTL	THNDR
MHH	MYAM	Marsh Harbor, Bahamas	DEKAL	PREDA
MKE	KMKE	Millwaukee	FORTL	ARKES
MSP	KMSP	Minneapolis-St. Paul	FORTL	ARKES
MSY	KMSY	New Orleans	FORTL	ARKES
MTH	KMTH	Marathon, Florida	DEKAL	MNATE
MYR	KMYR	Myrtle Beach	GISSH	ARKES
NAS	MYNN	Nassau, Bahamas	DEKAL	BEECH
ORD	KORD	Chicago	FORTL	THNDR
PHL	KPHL	Philadelphia	GISSH	ZAPPA / ARKES
PHX	KPHX	Phoenix	FORTL	THNDR
PID	MYPI	Nassau, Paradise Island, Bahamas	DEKAL	BEECH
PIT	KPIT	Pittsburgh	GISSH	ARKES
PVD	KPVD	Providence	GISSH	ZAPPA / ARKES
RDU	KRDU	Raleigh-Durham	GISSH	ARKES
RSD	MYER	Rock Sound, Bahamas	DEKAL	BEECH
SDF	KSDF	Louisville	FORTL	ARKES
SDQ	MDSD	Santo Domingo, PR	DEKAL	BEECH
SJU	TJSJ	San Yuan, PR	DEKAL	BEECH
SLC	KSLC	Salt Lake City	FORTL	THNDR
SRQ	KSRQ	Sarasota	FORTL	THNDR
STL	KSTL	St.Louis	FORTL	THNDR
TCB	MYAT	Treasure Cay, Bahamas	GISSH	PREDA
TLH	KTLH	Tallahassee	FORTL	THNDR
TPA	KTPA	Tampa	FORTL	THNDR
YUL	CYUL	Montreal	GISSH	ZAPPA / ARKES
YYZ	CYYZ	Toronto	FORTL	ZAPPA / ARKES

Source: Landrum & Brown, 2006

Table F-4
PMAD DISTRIBUTION OF OPERATIONS BY FIX
Fort Lauderdale-Hollywood International Airport

FIX	Geographic Direction	2004		2012		2020	
		Ops	Percent	Ops	Percent	Ops	Percent
Arrival							
BLUFI	N/NE	10	2.0%	6	1.1%	8	1.3%
DEKAL	S/SE	124	25.2%	128	23.9%	149	23.5%
DVALL	S/SW	11	2.2%	12	2.2%	12	1.9%
FORTL	W	198	40.2%	221	41.2%	277	43.7%
GISSH	N/NE	150	30.4%	169	31.5%	188	29.7%
Arrival Total		493	100.0%	536	100.0%	634	100.0%
Departure							
ARKES	NW	165	33.5%	159	29.7%	186	29.3%
BEECH	S/SE	48	9.7%	59	11.0%	71	11.2%
MNATE	S/SW	58	11.8%	57	10.6%	65	10.3%
PREDA	S/SE	26	5.3%	21	3.9%	22	3.5%
THNDR	W	92	18.7%	99	18.5%	135	21.3%
ZAPPA	NE	104	21.1%	141	26.3%	155	24.4%
Departure Total		493	100.0%	536	100.0%	634	100.0%

Source: Miami TRACON, FLL Air traffic Control Tower, and Landrum & Brown analysis, 2007.

The assignment of operations to runways based on fix varied for each alternative. However, there were general assumptions that were consistent for each group of alternatives:

- **No Action Alternative – The limited length of existing Runway 9R/27L limits controller's ability to effectively balance operations on the two existing parallel runways. Aircraft size is the primary consideration during the runway assignment process for the No Action Alternative.**
- **The runway assignments for the B Alternatives (i.e., south airfield development), which have extended or new 9R/27L runways, were balanced between the north and south runways to the extent possible. While runway length requirements and terminal gate position impacted the runway assignments, the fixes were predominately assigned to the runways as indicated in Table F-5 *Allocation of Fix Demand to FLL Runways*.**
- **The runway assignments for the C1 alternative (i.e., north airfield development) are similar to the No Action Alternative with respect to the south airfield but differ for the north airfield. New Runway 8/26 would be predominantly an arrival runway while existing Runway 9L/27R would be predominantly a departure runway. Physical limitations on Runway 9R/27L restrict controller's ability to balance demand between the north and south airfields.**

- **The D alternatives (i.e., south and north airfield development) runway assignments are similar to the B alternatives as shown in Table T-5 *Allocation of Fix Demand to FLL Runways*. The ability of the two closely spaced parallel runways on the north airfield to handle more traffic per hour resulted in additional operations being assigned to those runways.**

Table F-5
ALLOCATION OF FIX DEMAND TO FLL RUNWAYS
Fort Lauderdale-Hollywood International Airport

Arrival Fix	Geographic Direction	B ALTERNATIVES		D ALTERNATIVES	
		East Flow Runway(s)	West Flow Runway(s)	East Flow Runway(s)	West Flow Runway(s)
BLUFI	N/NE	9L	27L	8	27L & 26
GISSH	N/NE	9L	27L & 27R	8	27L & 26
DEKAL-jet	S/SE	9L	27L	8	27L
DEKAL-prop	S/SE	9R	27L	9R	27L
DVALL-jet	S/SW	9R	27R	9R	26
DVALL-prop	S/SW	9R	27L	9R	27L
FORTL	W	9L & 9R	27R	8 & 9R	26
Departure Fix					
THNDR	W	9L	27L & 27R	9L	27L & 27R
ARKES	N/NW	9L	27R	9L	27R
ZAPPA	N/NE	9R & 9L	27R	9R & 9L	27R
PREDA	E/SE	9R & 9L	27R	9R & 9L	27R
BEECH	S/SE	9R	27L	9R	27L
MNATE	S/SW	9R	27L	9R	27L

Source: Miami TRACON, FLL Air traffic Control Tower, and Landrum & Brown analysis, 2006.

As shown in Table F-5 *Allocation of Fix Demand to FLL Runways*, demand from select fixes can be directed to the north and/or south runways under the B and D Alternatives to balance demand and minimize delay. For example:

- **During east flow, when Runway 9L is busy with traffic from the north, air traffic controllers have the flexibility to direct west arrivals coming in over FORTL to the south Runway 9R.**
- **Conversely, if Runway 9R is busy, arrivals from the west over FORTL can be directed to Runway 9L.**
- **In west flow, north arrivals over BLUFI and GISSH are used to balance traffic.**
- **ZAPPA to the north, and PREDA to the south, are the two departure fixes that are used to balance departure demand between the north and south runways.**

F.3. CAPACITY ANALYSIS

The FAA Advisory Circular 150/5060, *"Airport Capacity and Delay"* was used as the basis for determining the capacity for each airfield alternative. Due to the operating characteristics of various types of aircraft, runway capacity can vary depending on the aircraft fleet mix. The capacity of a runway that serves a homogeneous fleet of large aircraft is different than that of a runway that serves a diversely-sized fleet of large, heavy, and small aircraft. The FAA Advisory circular uses the classifications in Table F-6 *Aircraft Classifications,* to calculate a Fleet Mix Index, which is then used to determine capacity. The Fleet Mix Index calculation used in AC 150/5060 is: % (C+3D) = Fleet Mix Index; where 'C' is the percent of the aircraft in the fleet mix from Class C and 'D' is the percent of the aircraft in the fleet mix from Class D. For example, if the mix of aircraft demand for a runway is 10 percent class A, 25 percent class B, 40 percent class C, and 25 percent class D, the Fleet Mix Index would be 40+(3*25)=115.

Table F-6
AIRCRAFT CLASSIFICATIONS
Fort Lauderdale-Hollywood International Airport

Aircraft Class	Maximum Certified Take off Weight (lbs)	Number of Engines	Wake Turbulence Classification
A	12,500 or less	Single	Small (S)
B		Multi	
C	12,500 – 300,000	Multi	Large (L)
D	over 300,000	Multi	Heavy (H)

Source: US Department of Transportation, FAA Order 7110.65P "Air Traffic Control, 2004.

The following steps were conducted to calculate the airfield capacity for each alternative:

- **First, the PMAD flight schedule demand was assigned to specific runways based upon the equipment type and corresponding runway length requirements, origin/arrival fix, destination/departure fix, and the general aircraft parking location in the terminal area. Assumptions for performing these assignments were described in Section F.2, *Runway Operating Assumptions*.**
- **The resulting fleet mix for each runway was then used to calculate the Fleet Mix Index according to the FAA AC 150/5060 guidelines. The Fleet Mix Index and capacity of the north runway(s) and south runway was computed separately to provide a more accurate analysis based on fleet mix differences.**
- **Existing hourly capacity was calculated using the *"Hourly Capacity of Runway-Use Diagrams"* contained in FAA AC 150/5060. The existing capacity was calibrated against actual operations provided by the TRACON and the FLL ATCT. The calibration was accomplished by adjusting the Fleet Mix Index to reflect FLL's unique operating environment.**

- **The hourly capacity of all potential alternatives was then calculated using the corresponding calibrated Fleet Mix Index and corresponding *"Hourly Capacity of Runway-Use Diagrams"* contained in FAA AC 150/5060.**

Table F-7 *Calibrated Fleet Mix Index,* indicates the calibrated mix index used in the capacity calculations for each alternative, and Table F-8 *Maximum Hourly Capacity Estimates – By Runway,* presents the resulting hourly capacities for each alternative, by runway, under balanced arrival and departure demand, arrival peak, and departure peak. Table F-9 *Hourly Capacity Estimates – Total Airfield*, summarizes the hourly capacity of the airport under each alternative. Maximum capacity shown in these tables refers to the capacity estimated from the FAA AC 150/5060. By comparison, the practical capacity listed on Table F-9 takes into consideration actual demand able to use available runways according to the aircraft types and runway length characteristics of each alternative. The practical capacity is lower than the maximum capacity for those alternatives that have shorter runways.

Table F-7
CALIBRATED FLEET MIX INDEX
Fort Lauderdale-Hollywood International Airport

	RUNWAY(S)					
	9L	9R	9L/8	27L	27R	27R/26
No Action	138	54		58	136	
Alternatives B1/B1b/B1c/B5	125	102		92	135	
Alternative B4	126	100		100	128	
Alternative C1		54	138	69		133
Alternative D1		114	115	103		126
Alternative D2		90	131	93		133

Source: FAA Advisory Circular 150/5600 and Landrum & Brown analysis, 2006.

Table F-8
MAXIMUM HOURLY CAPACITY ESTIMATES – BY RUNWAY
Fort Lauderdale-Hollywood International Airport

		VFR						IFR					
		Mixed Ops		Arrival Push		Departure Push		Mixed Ops		Arrival Push		Departure Push	
Alternative	Runway(s)	ARR	DEP	ARR	DEP	ARR	DEP	ARR	DEP	ARR	DEP	ARR	DEP
East Flow													
No Action	9L	26	29	31	21	21	32	25	25	29	20	20	30
B1/B1b/B1c/B5	9L	26	26	31	21	22	32	26	26	29	20	20	31
B4	9L	26	26	31	21	22	32	26	26	29	20	20	31
C1	8/9L	36	38	37	25	34	40	30	30	30	20	30	30
D1	8/9L	37	39	38	26	36	40	30	30	29	20	30	30
D2	8/9L	37	38	38	25	35	40	30	30	30	20	30	30
No Action	9R	30	30	35	23	25	37	28	28	34	22	22	34
B1/B1b/B1c/B5	9R	28	28	32	22	23	35	27	27	29	20	21	32
B4	9R	28	28	32	22	23	35	27	27	29	20	21	32
C1	9R	30	30	35	23	25	37	28	28	34	22	22	34
D1	9R	27	27	32	21	22	34	26	26	29	20	21	31
D2	9R	28	28	34	22	24	35	27	27	29	19	22	32
West Flow													
No Action	27R	24	24	29	19	20	30	24	24	28	19	19	28
B1/B1b/B1c/B5	27R	24	24	31	21	20	30	24	24	28	19	19	28
B4	27R	24	24	31	21	20	30	24	24	29	19	19	29
C1	26/27R	35	35	38	25	33	50	24	24	29	19	28	42
D1	26/27R	35	35	38	25	33	50	24	24	29	19	28	42
D2	26/27R	35	35	38	25	33	50	24	24	29	19	28	42
No Action	27L	28	28	33	22	23	35	26	26	32	21	21	32
B1/B1b/B1c/B5	27L	27	27	34	22	22	33	25	25	30	20	20	30
B4	27L	26	26	32	22	22	32	25	25	30	20	20	30
C1	27L	28	28	33	22	23	35	26	26	32	21	21	32
D1	27L	26	26	32	22	22	32	25	25	30	20	20	30
D2	27L	27	27	34	22	22	33	25	25	30	20	20	30

Source: FAA Advisory Circular 150/5600 and Landrum & Brown analysis, 2006.

Table F-9
HOURLY CAPACITY ESTIMATES – TOTAL AIRFIELD
Fort Lauderdale-Hollywood International Airport

	MAXIMUM CAPACITY					PRACTICAL CAPACITY[7]
	East Flow		West Flow		All Weather	All Weather
	VFR	IFR	VFR	IFR	Average	Average
No Action	115	106	105	100	113	84
B1/B1b/B1c/B5	108	104	102	98	107	107
B4	108	104	102	98	107	107
C1	134	116	127	101	131	101
D1	130	113	124	99	128	128
D2	130	113	124	99	128	128
Percent of Annual	75%	6%	18%	1%	100%	100%

Source: FAA Advisory Circular 150/5600 and Landrum & Brown analysis, 2006.

[7] **Practical Capacity takes into consideration actual demand able to use available runways according to the aircraft types and runway length characteristics. The practical capacity has been calculated based on the results of the queue modeling methodology developed in Section F.4.**

F.4. DEMAND/CAPACITY ANALYSIS

Aircraft operation delay was calculated for each alternative for the 2012 and 2020 demand levels. Aircraft operations delay for Alternatives D1 and D2 was only calculated for the 2020 demand level because these alternatives would not be fully operational by 2012. By 2012, only the first phase of Alternatives D1 and D2 would be operational (i.e., Alternative B1b and B4 respectively). Delay was computed using a queue modeling methodology. Demand, defined in terms of counts of arrivals and departures in five-minute intervals, was modeled against the estimated capacity of each alternative in good (VFR), and poor (IFR) weather conditions. Both east and west operating flows were analyzed. The resulting annual average delay per operation for each alternative is summarized in Table F-10 *Alternatives Delay Summary*.

Table F-10
ALTERNATIVES DELAY SUMMARY
Fort Lauderdale-Hollywood International Airport

	2012		2020	
	Average Minutes of Delay	Benefit Over No Action	Average Minutes of Delay	Benefit Over No Action
No Action	10.7	-	26.2	-
Alternative B1/B1b/B5	1.2	9.5	3.1	23.1
Alternative B1c	3.9	6.8	3.1	23.1
Alternative B4	2.2	8.5	4.7	21.5
Alternative C1	1.9	8.8	5.0	21.2
Alternative D1			1.2	25.0
Alternative D2			1.5	24.7

Source: Landrum & Brown analysis, 2007.

The benefit that each alternative provides over the No Action Alternative is also presented in Table F-10 *Alternatives Delay Summary*. This is computed by subtracting each alternative's delay from the No Action Alternative delay. As shown, Alternative D1 provides the greatest delay benefit in 2020, followed by Alternative D2, Alternatives B1/B1b/B1c/B5, and Alternative B4. Alternative C1 provides the least benefit. All alternatives, except for the No Action, provide significant benefit at the 2012 demand level.

When modeled with an unconstrained 2020 demand, delay for the No Action Alternative exceeded reasonable levels. It is assumed that airlines would adjust service patterns in four distinct ways to accommodate demand. First, the demand at the airport would flatten, as airlines increase operations in the periods that currently have fewer operations, essentially filling in the valleys of the schedule. Second, the airlines would move operations to the early morning and late evening hours to lengthen the operational day. Third, the peak operational season would extend to include additional days and or weeks. Finally, the airlines would increase the gauge (i.e., seating capacity differences within one aircraft size) of aircraft on

specific routes to provide more lift with the same frequency of operations. For example, the airline would replace a B737-400 aircraft with a larger B737-800 to increase the number of available seats.

Based on the results of the analysis presented in Table F-10 *Alternatives Delay Summary,* all alternatives, except the No Action Alternative, can accommodate future 2012 and 2020 demand at desirable delay levels. In 2020, Alternatives B4 and C1 result in the highest delays of approximately five minutes per operation. These delays are below the Airport Sponsor's desirable range of six to ten minutes of delay per operation, and therefore are acceptable.

Tables F-11 *Alternatives Delay Detail – Year 2012*, and F-12 *Alternatives Delay Detail – Year 2020*, provide the detailed delay breakdown of each case modeled. The breakdown includes:

- **Arrival and departure operations**
- **North and south runways**
- **East and west flows**
- **VFR and IFR conditions**

From the delay analysis presented in this section, the capacity of the various alternatives is summarized in Table F-13 *Annual Capacity at 6 and 10 Minutes Delay per Operation* based on a desirable delay of six to ten minutes per operation. Due to the fact that 2020 delays are below six minutes for all alternatives except the No Action Alternative, it was necessary to estimate delays beyond 2020 to calculate the capacity at six and ten minutes of delay. For this purpose, demand for 2030 was extrapolated from 2020 using the FAA 2006 TAF projected growth rate. The delay models were then applied to estimate 2030 delays using the same methodology as described for 2012 and 2020. The results are illustrated on Exhibit F-5 *Alternatives Delay Curve*.

Table F-11
ALTERNATIVES DELAY DETAIL – YEAR 2012
Fort Lauderdale-Hollywood International Airport

			Arivals				Departures				Total	
			North Runway(s)		South Runway		North Runway(s)		South Runway			
Alternative	Direction	VFR/IFR	Ops	Delay	Ops	Delay	Ops	Delay	Ops	Delay	Ops	Delay
No Action	East	VFR	379	10	157	0	386	9	150	0	1072	6.8
	West	VFR	371	19	165	0	396	45	140	0	1072	23.4
	East	IFR	379	18	157	0	386	32	150	0	1072	17.8
	West	IFR	371	32	165	0	396	56	140	0	1072	32.1
	Average										1072	10.7
B1/B1b/B5	East	VFR	284	1	252	1	276	1	260	1	1072	1.1
	West	VFR	281	2	255	1	337	3	199	1	1072	1.7
	East	IFR	284	2	252	1	276	2	260	1	1072	1.4
	West	IFR	281	2	255	2	337	3	199	1	1072	2.4
	Average										1072	1.2
B1c	East	VFR	462	4	74	3	147	4	389	2	1072	3.1
	West	VFR	145	2	391	9	452	2	84	4	1072	4.9
	East	IFR	462	14	74	1	147	4	389	3	1072	7.7
	West	IFR	145	1	391	46	452	7	84	4	1072	20.2
	Average										1072	3.9
B4	East	VFR	316	3	220	1	354	3	182	0	1072	2.0
	West	VFR	338	4	198	1	341	5	195	1	1072	3.0
	East	IFR	316	3	220	1	354	4	182	1	1072	2.5
	West	IFR	338	5	198	1	341	7	195	1	1072	4.1
	Average										1072	2.2
C1	East	VFR	379	1	157	0	399	2	137	0	1072	1.4
	West	VFR	371	1	165	0	407	1	129	0	1072	1.0
	East	IFR	379	2	157	0	399	19	137	0	1072	7.8
	West	IFR	371	20	165	0	407	52	129	0	1072	26.6
	Average										1072	1.9

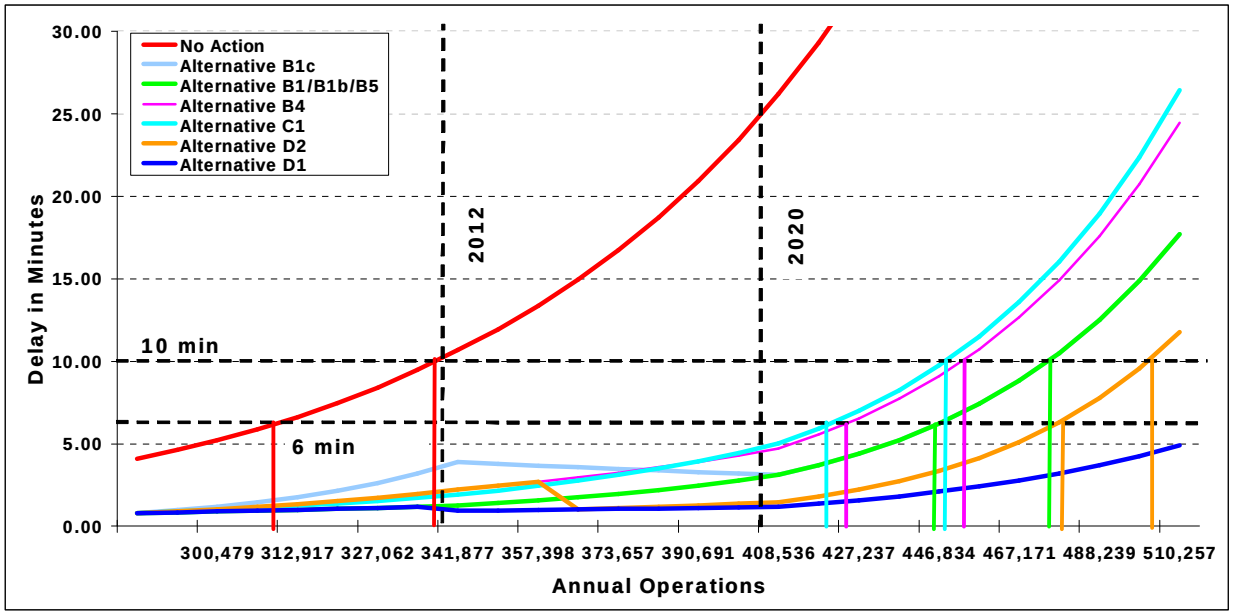
Source: Landrum & Brown analysis, 2007.

Table F-12
ALTERNATIVES DELAY DETAIL – YEAR 2020
Fort Lauderdale-Hollywood International Airport

			Arivals				Departures				Total	
			North Runway(s)		South Runway		North Runway(s)		South Runway			
Alternative	Direction	VFR/IFR	Ops	Delay	Ops	Delay	Ops	Delay	Ops	Delay	Ops	Delay
No Action	East	VFR	470	47	164	1	470	9	164	1	1268	20.9
	West	VFR	470	50	164	1	470	52	164	0	1268	37.8
	East	IFR	470	67	164	1	470	69	164	0	1268	50.4
	West	IFR	470	98	164	1	470	100	164	0	1268	73.6
	Average										1268	26.2
B1/B1b/B1c/B5	East	VFR	345	4	289	2	350	3	284	1	1268	2.6
	West	VFR	357	4	277	2	366	11	268	1	1268	4.8
	East	IFR	345	5	289	2	350	4	284	2	1268	3.2
	West	IFR	357	5	277	3	366	20	268	2	1268	8.3
	Average										1268	3.1
B4	East	VFR	333	4	301	1	397	6	237	1	1268	3.2
	West	VFR	366	6	268	2	388	26	246	1	1268	10.3
	East	IFR	355	7	279	2	397	9	237	1	1268	5.2
	West	IFR	366	6	268	2	388	35	246	2	1268	13.1
	Average										1268	4.7
C1	East	VFR	470	3	164	0	470	3	164	0	1268	2.5
	West	VFR	470	3	164	1	470	5	164	0	1268	3.0
	East	IFR	470	4	164	1	470	83	164	0	1268	32.2
	West	IFR	470	125	164	1	470	88	164	0	1268	79.1
	Average										1268	5.0
D1	East	VFR	383	1	251	1	359	1	275	1	1268	1.0
	West	VFR	285	0	349	3	393	1	241	1	1268	1.4
	East	IFR	383	2	251	2	359	3	275	1	1268	2.1
	West	IFR	285	1	349	5	393	2	241	2	1268	2.6
	Average										1268	1.2
D2	East	VFR	392	1	242	1	444	2	190	0	1268	1.2
	West	VFR	371	1	263	1	474	1	160	1	1268	0.9
	East	IFR	392	4	242	1	444	9	190	1	1268	4.6
	West	IFR	371	5	263	2	474	34	160	1	1268	14.6
	Average										1268	1.5

Source: Landrum & Brown analysis, 2007.

Exhibit F-5
ALTERNATIVES DELAY CURVE
Fort Lauderdale-Hollywood International Airport



Source: FAA 2006 Terminal Area Forecasts published in January 2007 and Landrum & Brown analysis, 2007.

Table F-13
ANNUAL CAPACITY AT 6 AND 10 MINUTES DELAY PER OPERATION
Fort Lauderdale-Hollywood International Airport

Alternative	Capacity @6 min delay Annual	Capacity @10 min delay Annual
No Action	310,000	340,000
B1/B1b/B1c/B5	445,000	475,000
B4	420,000	450,000
C1	420,000	450,000
D1	over 510,000	over 510,000
D2	475,000	500,000

Source: Landrum & Brown analysis, 2007.

F.5. NET BENEFITS ANALYSIS

The net benefits analysis of the proposed FLL alternatives is presented in this section. This analysis entails the quantification of annual costs and benefits of each alternative through the year 2030. The net present value of costs and benefits is then calculated and expressed in 2006 dollars. Net present value of benefits divided by the net present value of costs yields a benefit/cost ratio (BCA ratio) than can be used to compare the relative benefit of each alternative. A BCA ratio with a value greater than one (1.0) indicates that the benefits yielded by the project outweigh the costs of developing the project. A BCA ratio of 2.0, for example, indicates that the benefits are twice as large as the costs. The higher the BCA ratio, the greater the benefits provided by the project.

Table F-14 *Net Benefits versus Costs* presents the BCA Ratio (NPV of benefits over NPV of costs) by alternative. The BCA ratio is presented for two evaluation periods: 2006 to 2020 and 2006 to 2030. The 2020 BCA ratio indicates the project's ability to provide a positive return on investment over a shorter period of time (from the end of construction to 2020) while the 2030 BCA ratio represents the benefits accrued over the life of the project (from the end of construction to 2030). These ratios provide a comparison of projects that differ significantly in terms of cost, time to be fully implemented, benefits in the near term, and ability to deliver benefits in the long term.

Table F-14
NET BENEFITS VERSUS COSTS
Fort Lauderdale-Hollywood International Airport

Alternative	Year	Benefit [1]	Cost [1]	BCA Ratio	Capacity @6-min delay	Capacity @10-min delay
No Action	2020	N/A	N/A	N/A	310,000	340,000
	2030	N/A	N/A	N/A		
B1	2020	$1,067,662,000	$ 491,228,000	2.17	445,000	475,000
	2030	$2,171,621,000	$ 499,268,000	4.35		
B1b	2020	$1,067,662,000	$ 493,967,000	2.16	445,000	475,000
	2030	$2,171,621,000	$ 500,488,000	4.34		
B1c	2020	$1,018,563,000	$ 493,967,000	2.06	445,000	475,000
	2030	$2,122,522,000	$ 500,488,000	4.24		
B4	2020	$1,325,986,000	$ 373,124,000	3.55	420,000	450,000
	2030	$2,125,243,000	$ 377,594,000	5.63		
B5	2020	$1,067,662,000	$ 503,049,000	2.12	445,000	475,000
	2030	$2,171,621,000	$ 509,853,000	4.26		
C1	2020	$ 981,240,000	$ 334,460,000	2.93	420,000	450,000
	2030	$1,698,860,000	$ 340,412,000	4.99		
D1	2020	$1,147,769,000	$ 803,366,000	1.43	over 510,000	over 510,000
	2030	$2,790,944,000	$ 812,407,000	3.44		
D2	2020	$1,478,292,000	$ 670,620,000	2.20	475,000	500,000
	2030	$2,857,504,000	$ 677,298,000	4.22		

[1.] Net Present Value of total benefits and costs over evaluation period expressed in 2006 U.S. dollars

Source: Landrum & Brown analysis, 2007

The following sections present the calculation of benefits, costs, and the net benefits financial analysis.

F.5.1 ALTERNATIVES BENEFITS

The benefits of each alternative were quantified in terms of reduced delays. Aircraft delays occur when demand exceeds capacity at the airport and are mainly experienced during peak hours, when a large number of flights are scheduled in a short time period. As the number of flights is expected to increase over time, the delays are also expected to increase and occur more often throughout the day. The estimated delays for each alternative are presented in Section F.4, *Demand/Capacity Analysis*.

Delay benefits can be quantified in dollars by calculating the reduction in aircraft operating costs to the airlines and the value of reduced passenger travel time. Reduced aircraft operating costs are calculated by multiplying the delay benefit (reduction) of each alternative, expressed in minutes, by the amount that it costs, on average, to operate an aircraft for one minute. Aircraft operating costs were calculated based on U.S. Department of Transportation, Form 41 Airline Financial

Statistics and are presented in Table F-15 *Aircraft Direct Operating Expenses*. The value of reduced passenger time is calculated by multiplying the delay reduction by the FAA's established guideline of $26 per minute of passenger time.

Table F-15
AIRCRAFT DIRECT OPERATING EXPENSES
Fort Lauderdale-Hollywood International Airport

Demand Level	Activity Type	Number of Operations		Cost Weight
2004	Air Carrier	510	$	24.80
	Air Taxi	65	$	0.60
	Commuter	159	$	1.85
	Charter	6	$	0.31
	Cargo	24	$	1.64
	GA/Military	222	$	2.32
	Total	986	**$**	**31.52**
2012	Air Carrier	630	$	25.06
	Air Taxi	62	$	0.56
	Commuter	152	$	1.18
	Charter	4	$	0.26
	Cargo	20	$	2.13
	GA/Military	200	$	2.00
	Total	1068	**$**	**31.20**
2020	Air Carrier	768	$	27.65
	Air Taxi	66	$	0.50
	Commuter	168	$	1.08
	Charter	6	$	0.23
	Cargo	22	$	2.16
	GA/Military	236	$	1.98
	Total	1266	**$**	**33.59**

Sources: U.S. DOT, Form 41; Landrum & Brown analysis, 2007

F.5.2 PROJECT COSTS

Costs associated with the alternatives proposed at FLL include capital investment costs and annual operation and maintenance (O&M) costs. Detailed capital costs were developed for each alternative and include all costs associated with the construction of the proposed alternative. Costs are expressed in 2006 dollars and also include soft costs and contingency, but do not included escalation. O&M costs were estimated taking into consideration the increased amount of pavement and new facilities (i.e., terminal space, NAVAIDs, etc) that would require maintenance and incur additional operational costs. Total project costs are presented in Table F-16 *Estimated Project Costs*.

Table F-16
ESTIMATED PROJECT COSTS
Fort Lauderdale-Hollywood International Airport

Item Description	B1	B1b/B1c	B4	B5	C1	D1	D2
Earthwork	$ 60,058,600	$ 60,058,648	$ 9,316,729	$ 67,686,342	$ 1,794,832	$ 61,853,870	$ 11,111,561
Temporary Runway	$ 20,700,900	$ 20,700,936	$ -	$ 19,040,844	$ -	$ 20,700,936	$ -
Structures	$ 309,830,200	$ 309,830,160	$ -	$ 309,830,160	$ -	$ 309,830,160	$ -
Runway 9R/27L	$ 85,976,110	$ 91,931,971	$ 44,623,713	$ 97,143,005	$ -	$ 91,931,971	$ 44,623,713
Runway 8/26	$ -	$ -	$ -	$ -	$ 48,192,303	$ 48,192,303	$ 48,192,303
Parallel Taxiway/Runway Exits	$ 23,119,800	$ 23,119,692	$ 48,418,797	$ 20,815,709	$ 21,965,838	$ 45,085,530	$ 70,384,634
Cross Field Taxiways	$ 14,154,700	$ 14,154,682	$ 7,289,548	$ 15,405,244	$ 15,696,826	$ 14,919,275	$ 13,088,788
Miscellaneous	$ 25,487,600	$ 25,487,570	$ 14,315,229	$ 29,373,575	$ 12,443,968	$ 37,942,003	$ 26,759,198
Ancillary Development	$ 34,013,300	$ 34,013,222	$ 322,462,222	$ 28,345,152	$ 17,577,452	$ 45,569,822	$ 334,018,822
Design	$ 53,481,400	$ 53,481,349	$ 41,418,002	$ 54,004,323	$ 10,888,249	$ 62,864,664	$ 51,477,714
SUB-TOTAL (1) for Concept Estimate	**$ 626,822,610**	**$ 632,778,230**	**$ 487,844,240**	**$ 641,644,353**	**$ 128,559,469**	**$ 738,890,534**	**$ 599,656,733**
Land Acquisitions	$ 40,400,000	$ 40,400,000	$ -	$ 60,000,000	$ 16,343,800	$ 120,693,400	$ 41,987,000
Facility Relocations - Replacement-In-Kind	$ 21,678,000	$ 21,678,000	$ 35,649,700	$ 5,430,000	$ 317,819,700	$ 335,599,667	$ 353,469,300
SUB-TOTAL (2) for Concept Estimate	**$ 62,078,000**	**$ 62,078,000**	**$ 35,649,700**	**$ 65,430,000**	**$ 334,163,500**	**$ 456,293,067**	**$ 395,456,300**
TOTAL for Concept Estimate	**$ 688,900,610**	**$ 694,856,230**	**$ 523,493,907**	**$ 707,074,353**	**$ 462,722,935**	**$ 1,195,183,601**	**$ 995,113,066**

Source: The Corradino Group, 2007

Project costs range from approximately 500 million dollars for alternatives C1 and B4 to approximately 700 million dollars for the B1 and B5 alternatives, to 1 billion dollars for Alternative D2 and in excess of 1 billion for Alternative D1.

Table F-17 *Estimated Additional O&M Costs* presents the additional annual O&M costs estimated for each alternative through 2030. Costs are expressed in 2006 dollars. BCAD has indicated that Runways 9R/27L and 13/31 will require full rehabilitation in 2008 and 2009, respectively. For alternatives that consist of the redevelopment of Runway 9R/27L, Broward County will use a less costly Grip-Flex application instead of a full rehabilitation. These savings are reflected in Table F-17 *Estimated Additional O&M Costs*. Likewise, savings from Grip-Flex application are accounted for alternatives that decommission Runway 13/31.

Table F-17
ESTIMATED ADDITIONAL O&M COSTS *(In 000 2006 dollars)*
Fort Lauderdale-Hollywood International Airport

Year	B1	B1b/B1c	B4	B5	C1	D1	D2
2006	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0
2008	(9,273)	(9,273)	(9,273)	(9,273)	0	(9,273)	(9,273)
2009	(5,568)	(5,568)	0	(5,568)	(5,568)	(5,568)	0
2010	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0
2013	2,951	2,394	1,641	2,498	2,185	3,319	2,452
2014	2,951	2,394	1,641	2,498	2,185	3,319	2,452
2015	2,951	2,394	1,641	2,498	2,185	3,319	2,452
2016	2,951	2,394	1,641	2,498	2,185	3,319	2,452
2017	2,951	2,394	1,641	2,498	2,185	3,319	2,452
2018	2,951	2,394	1,641	2,498	2,185	3,319	2,452
2019	2,951	2,394	1,641	2,498	2,185	3,319	2,452
2020	2,951	2,394	1,641	2,498	2,185	3,319	2,452
2021	2,951	2,394	1,641	2,498	2,185	3,319	2,452
2022	2,951	2,394	1,641	2,498	2,185	3,319	2,452
2023	2,951	2,394	1,641	2,498	2,185	3,319	2,452
2024	2,951	2,394	1,641	2,498	2,185	3,319	2,452
2025	2,951	2,394	1,641	2,498	2,185	3,319	2,452
2026	2,951	2,394	1,641	2,498	2,185	3,319	2,452
2027	2,951	2,394	1,641	2,498	2,185	3,319	2,452
2028	2,951	2,394	1,641	2,498	2,185	3,319	2,452
2029	2,951	2,394	1,641	2,498	2,185	3,319	2,452
2030	2,951	2,394	1,641	2,498	2,185	3,319	2,452
Total	**38,277**	**28,251**	**20,265**	**30,123**	**33,762**	**44,901**	**34,863**

Note [1]: These O&M savings correspond to the use of Grip-Flex instead of complete rehabilitation of runways 9R/27L and 13/31

Source: The Corradino Group, 2007

F.5.3 FINANCIAL EVALUATION

The Net Benefits Analysis evaluation period is 2006 to 2030, based on the projected project construction time frame, for each alternative, and an estimated 15-year life cycle for benefits valuation purposes. The year that each alternative begins to generate benefits for purpose of this analysis is presented in Table F-18, *First Year of Estimated Project Benefit*.

Table F-18
FIRST YEAR OF ESTIMATED PROJECT BENEFIT
Fort Lauderdale-Hollywood International Airport

	9R-27L	8-26
B1/B1b/B1c	Q3 2014	N/A
B4	Q1 2012	N/A
B5	Q2 2015	N/A
C1	N/A	Q2 2015
D1	Q3 2014	Q2 2014
D2	Q1 2012	Q2 2014

Source: The Corradino Group, 2007

Project capital investment costs were spread out evenly over the years of construction starting in 2008. Runway rehabilitation costs, where applicable, are assumed to occur in 2008 at the beginning of construction. O&M costs were applied each year from the end of the project construction to 2030. Benefits were quantified for each year in the valuation period, starting with the year when the project is commissioned.

The Net Present Value (NPV) of costs and benefits was calculated using a seven percent real discount rate in accordance with the FAA guidelines. The results of the net present value analysis for each project are summarized in Table F-14 *Net Benefits versus Costs* presented in the introduction of this Section.

All of the proposed alternatives generate a positive Benefit Cost Analysis (BCA) ratio indicating that in all cases, the benefits of the alternatives over the No Action Alternative outweigh the project costs.

F.5.4 ALTERNATIVE B4 SENSITIVITY ANALYSIS

Alternative B4 includes the development of a new 6,001-foot at-grade runway (with EMAS) located 340 feet north of existing south runway to replace existing Runway 9R/27L. Because the runway length for Alternative B4 is the shortest of all of the runway development alternatives by 1,720 feet to 2,599 feet, a sensitivity analysis was performed to understand the impact on delay if a lower runway use percentage were used for departures on the 6,001-foot runway. Table F-19 *Alternative B4 Sensitivity Analysis - Delays* present the resulting delays at the 2012 and 2020 demand levels.

For the analysis of 2012 conditions, the runway suitability for all aircraft was determined using dry landing conditions with aircraft at 90 percent payload. For 2020 conditions, a runway use assumption was added. Approximately 80 daily departures of jet aircraft would opt to use the longer existing north runway instead of the 6,001-foot Runway 9R/27L to avoid taking a payload penalty.

The analysis results, provided in Table F-19, shows the consequence of that assumption is an increase in delay from 2.2 minutes per aircraft in 2012 to 3.1 minutes. And, in 2020, the delay increases from 4.7 minutes to 10.2 minutes.

The higher delay numbers are attributable to the assumption that airlines would not take a payload penalty to use Runway 9R/27L at a lower level of delay. The delay numbers calculated on the 90 percent payload conditions were presented earlier in Table F-11 *Alternatives Delay Detail–Year 2012* and Table F-12 *Alternatives Delay Detail–Year 2020.*

Table F-19
ALTERNATIVE B4 SENSITIVITY ANALYSIS - DELAYS
Fort Lauderdale-Hollywood International Airport

				Arivals				Departures				Total	
				North Runway(s)		South Runway		North Runway(s)		South Runway			
Demand	Alternative	Direction	VFR/IFR	Ops	Delay	Ops	Delay	Ops	Delay	Ops	Delay	Ops	Delay
2012	B4	East	VFR	270	2	266	1	402	5	134	0	1072	2.7
2012		West	VFR	295	3	241	1	386	9	150	0	1072	4.4
2012		East	IFR	270	2	266	2	402	7	134	0	1072	3.6
2012		West	IFR	295	3	241	1	386	13	150	0	1072	5.8
		Average										1072	3.1
2020	B4	East	VFR	252	2	382	3	482	17	152	1	1268	8.0
2020		West	VFR	300	3	334	2	457	45	177	1	1268	17.6
2020		East	IFR	252	2	382	5	482	32	152	1	1268	14.0
2020		West	IFR	300	4	334	3	457	60	177	1	1268	23.2
		Average										1268	10.2

Source: Landrum & Brown analysis, 2007

Using the same methodology as presented previously in Section F.4 *Demand/ Capacity Analysis* and F.5 *Net Benefits Analysis*, new capacity numbers and a new BCA ratio were calculated for Alternative B4. Table F-20 *Net Benefits versus Costs Showing Alternative B4 Sensitivity Analysis,* shows the new capacity and BCA ratios comparison between alternatives based on this sensitivity analysis. The numbers in Table F-20 are the same as shown in Table F-14 for all alternatives, except for Alternative B4.

Table F-20
NET BENEFITS VERSUS COSTS SHOWING ALTERNATIVE B4 SENSITIVITY ANALYSIS
Fort Lauderdale-Hollywood International Airport

Alternative	Year	Benefit [1]	Cost [1]	BCA Ratio	Capacity @6-min delay	Capacity @10-min delay
No Action	2020	N/A	N/A	N/A	310,000	340,000
	2030	N/A	N/A	N/A		
B1	2020	$1,067,662,000	$ 491,228,000	2.17	445,000	475,000
	2030	$2,171,621,000	$ 499,268,000	4.35		
B1b	2020	$1,067,662,000	$ 493,967,000	2.16	445,000	475,000
	2030	$2,171,621,000	$ 500,488,000	4.34		
B1c	2020	$1,018,563,000	$ 493,967,000	2.06	445,000	475,000
	2030	$2,122,522,000	$ 500,488,000	4.24		
B4	2020	$1,051,551,000	$ 373,124,000	2.82	375,000	450,000
	2030	$1,662,737,000	$ 377,594,000	4.40		
B5	2020	$1,067,662,000	$ 503,049,000	2.12	445,000	475,000
	2030	$2,171,621,000	$ 509,853,000	4.26		
C1	2020	$ 981,240,000	$ 334,460,000	2.93	420,000	450,000
	2030	$1,698,860,000	$ 340,412,000	4.99		
D1	2020	$1,147,769,000	$ 803,366,000	1.43	over 510,000	over 510,000
	2030	$2,790,944,000	$ 812,407,000	3.44		
D2	2020	$1,478,292,000	$ 670,620,000	2.20	475,000	500,000
	2030	$2,857,504,000	$ 677,298,000	4.22		

[1] Net Present Value of total benefits and costs over evaluation period expressed in 2006 U.S. dollars.

Source: Landrum & Brown analysis, 2007

The sensitivity analysis indicates that Alternative B4 provides adequate capacity to serve 2012 demand, even with the reduced utilization of Runway 9R/27L to avoid payload penalties. However, it is likely that as delays increase before 2020 to six and ten minutes per operation, airlines would opt to operate on Runway 9R/27L with some payload penalty to avoid higher delay. Therefore, Alternative B4 would provide the least long-term capacity when compared to of all the runway development alternatives.

The sensitivity analysis also shows that even with reduced utilization of Runway 9R/27L Alternative B4 yields a positive BCA ratio of 2.82 in 2020 and 4.4 in 2030. This is a direct result of the lower development cost for Alternative B4 as compared to the other runway development alternatives.