THE OPERATIONAL AND ECONOMIC EFFECTS OF NEW LARGE AIRPLANES ON UNITED STATES AIRPORTS

Prepared by the Federal Aviation Administration
Office of Airport Safety and Standards
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BACKGROUND

Historically, airframe manufacturers have met the demands of continued growth in passenger and cargo traffic with the development of larger and more efficient airplanes. The aviation industry and the flying public witnessed such development during the late 1960s with the introduction of the first wide-bodied aircraft in 1969, namely, the Boeing 747. Succeeding years saw the introduction of other wide-bodied aircraft, such as, the McDonnell-Douglas DC-10, Lockheed L-1011, and the Airbus Industrie A300. Continued growth with the ever greater emphasis placed on international service has caused airframe manufacturers to consider the introduction of a second generation of wide-bodied airplanes, which the Federal Aviation Administration (FAA) and industry refer to as new large aircraft (NLA). Proposed NLA have significantly wider wingspans, taller tail sections, longer fuselages, heavier taxiing weights, and the ability to transport a greater number of passengers than aircraft types now in service. Airframe manufacturers consider this approach as one means to fulfill the operational requirements of their airline customers. Once the Boeing Airplane Company or Airbus Industrie secures sufficient launch customers for NLA, actual production will proceed. Airbus Industrie has stated an expected entry service date as early as 2004. In anticipation of NLA service, the FAA and the aviation industry are answering the fundamental questions of how to safely accommodate NLA service and what costs can be anticipated.

This report provides an understanding of the operational demands imposed by NLA and the effects on airports not built to NLA design criteria. Furthermore, the report presents estimated cost figures as provided by U.S. airports to upgrade or build the necessary infrastructure to safely accommodate NLA service.

ACKNOWLEDGMENT

The FAA would like to acknowledge Mr. Richard Marchi, Senior Vice President, Technical & Environmental Affairs, Airports Council International - North America and Mr. Don Minnis, Director, Airport Planning & Development, Air Transport Association, for providing valuable input in the development of the survey used to gather estimated costs for this report. Furthermore, we acknowledge Mr. Marchi's staff, primarily Ms. Michele Kimmet, for collecting and forwarding reported data.

PART I. GENERAL BACKGROUND

1. Physical Characteristics of NLAs.

The larger sizes and operating weights of NLA will cause varying magnitudes of operational restrictions at airports that lack the appropriate airfield and terminal infrastructure to safely accommodate NLA. Imposed operational restrictions are primarily a direct consequence of the physical characteristics of the airplane. Working with the aviation industry, the FAA in 1983 promulgated airport design criteria for NLA in Advisory Circular 150/5300-13, *Airport Design,* under the category airplane design group (ADG) VI. Presently, only a handful of U.S. airports have been built to or have had a portion of their airfield built to ADG VI criteria.

Figure 1 illustrates the dimensional difference between the largest Boeing 747 in service today and the proposed Boeing NLA 747-600 derivative. Figure 2 illustrates the proposed Airbus Industrie NLA designated as A3XX. Both proposals basically have the same wingspan but differ in other significant respects. The Boeing proposal has a longer fuselage while the Airbus Industrie proposal has a full upper passenger deck and taller tail section. In particular, the figures illustrate three predominant physical characteristics that can lead to the imposition of operational restrictions on the airplane or on the airport, namely, wider wingspans, longer fuselages, and taller tail sections. The proposed operational taxiing weight of 1.4 million pounds (635,000 kg) is another primary factor that may impact the airfield. At such taxiing weights, bridges and culverts will certainly need reinforcement.

2. U.S. Airports Targeted for Possible NLA Service.

The aviation industry reasonably assumes that introductory service of NLA in the United States will commence at U.S. airports that now have significant Boeing 747 service. In the case of neighboring airports with significant Boeing 747 service, industry foresees only one airport in the cluster as actually receiving NLA service. Newark International Airport, with Boeing 747 traffic volumes comparable to Chicago O'Hare International Airport and Miami International Airport, is one such case not expected to see NLA service primarily because of its close proximity to John F. Kennedy International Airport.

Use of the Official Airline Guide (OAG) as a planning guide by the U.S. aviation industry and the FAA helps to focus planning efforts more appropriately and effectively. Figure 3, based on the May 1996 and 1997 OAG, illustrates the monthly commercial and cargo operations of Boeing 747 at U.S. airports. As a reference to figures and remaining text, attachment #1 lists the three-letter airport identifier for airports. Figure 3 clearly shows that fewer than 15 U.S. airports accommodate 95 percent of the commercial Boeing 747 traffic in the United States. Furthermore, the figure illustrates that the top five airports, when ranked in accordance with the May 1996 OAG, account for nearly 80 percent of the traffic. Incidentally, these five airports have strong market ties with the

international airports serving the Pacific Rim. The latter observation has economic importance to the United States. Given the fact that several Pacific Rim nations are in the process of upgrading or have built new international airports to accommodate NLA service, United States markets could experience some competitive disadvantage unless suitable planning efforts are taken.

However, the basic assumption that NLA will serve airports now served by Boeing 747s may have a deficiency worth monitoring. It does not account for the consequences resulting from the purchase of NLA by major U.S. air carriers that presently do not operate Boeing 747 aircraft, namely American Airlines, Delta Airlines, and US Airways. Additional infrastructure costs, therefore, may result if any of these major airlines commence NLA service at hub airports, such as, Dallas/Fort. Worth International Airport, William B. Hartsfield Atlanta International Airport, and Pittsburgh International Airport. Hence, estimated costs to accommodate NLA at several airports currently not receiving Boeing 747 service were gathered for completeness.

Cargo service is another factor that could cause additional airfield and facility expenditures. Cargo versions of NLA are a possibility since Federal Express formally announced it would be a launch customer for a freighter version of the Airbus A3XX. Figure #4 illustrates U.S. airports with significant cargo service. Hence, estimated costs to accommodate NLA at such airports were gathered for completeness.

3. **Fact Gathering Survey**.

The FAA, in cooperation with the Airports Council International – North America and the Air Transport Association, jointly prepared a survey to evaluate the extent of the financial impact to U.S. airports lacking the necessary infrastructure to safely accommodate NLA (see attachment #2). The scope of the survey covered five general areas deemed to have the greatest (1) overall financial impact to U.S. airports and (2) probabilities to impose operational restrictions to the airports. Keeping in line with industry's assumptions and other factors worth monitoring, the survey was mailed primarily to airports receiving Boeing 747 service. In all, just over 20 airports returned estimated costs. Part II, *Operational Restrictions*, describes in detail the operational restrictions, if any, to airfields and terminals imposed by NLA operations. Part III, *Financial Summary*, tabulates the financial impacts reported by U.S. airports. Additionally, Part III provides short narratives highlighting key observations.

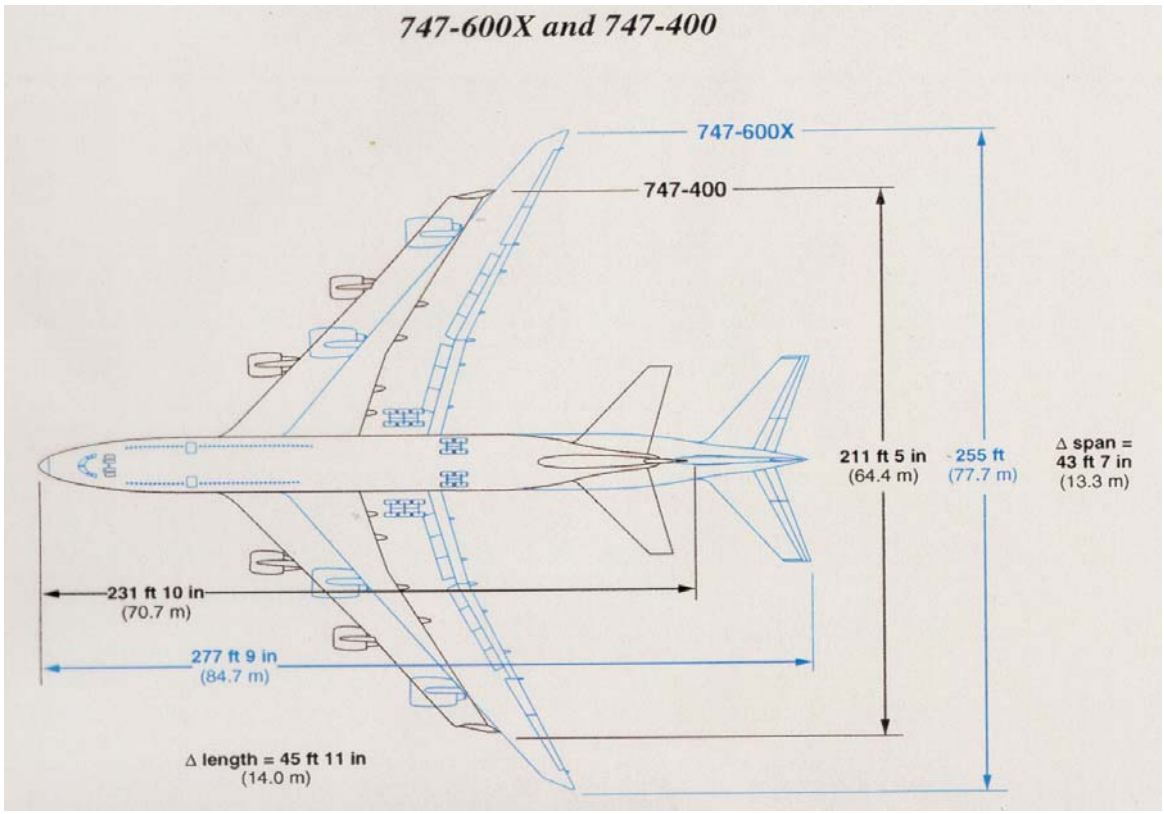

Figure 1. Physical Differences between In-service Boeing 747-400 and Proposed NLA Boeing 747-600.

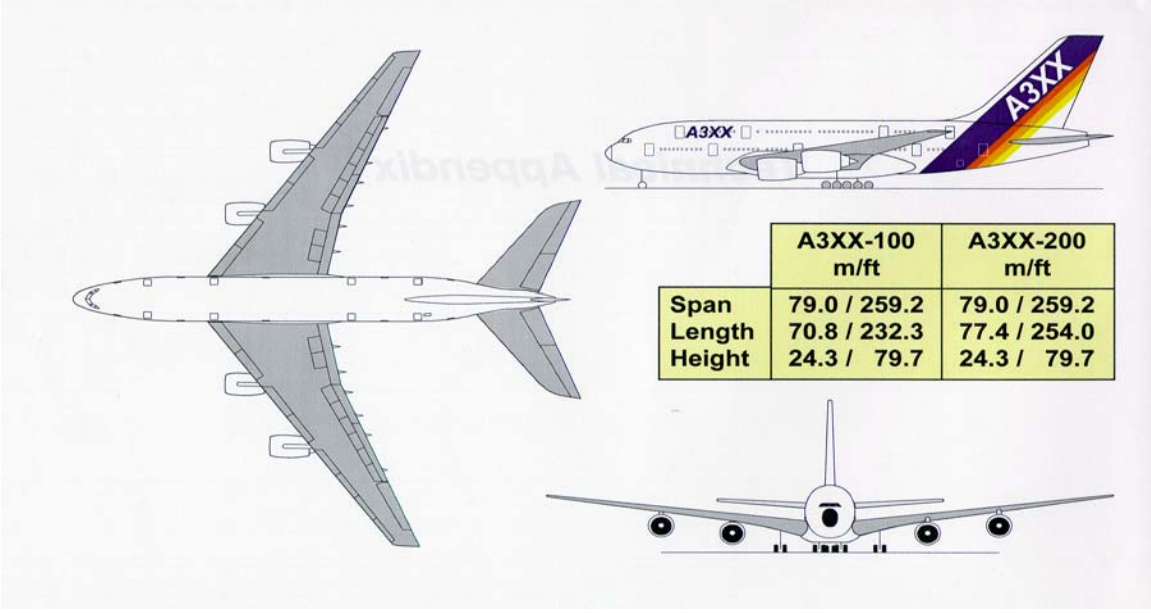

Figure 2. Physical Characteristics of Proposed NLA Airbus 3XX.

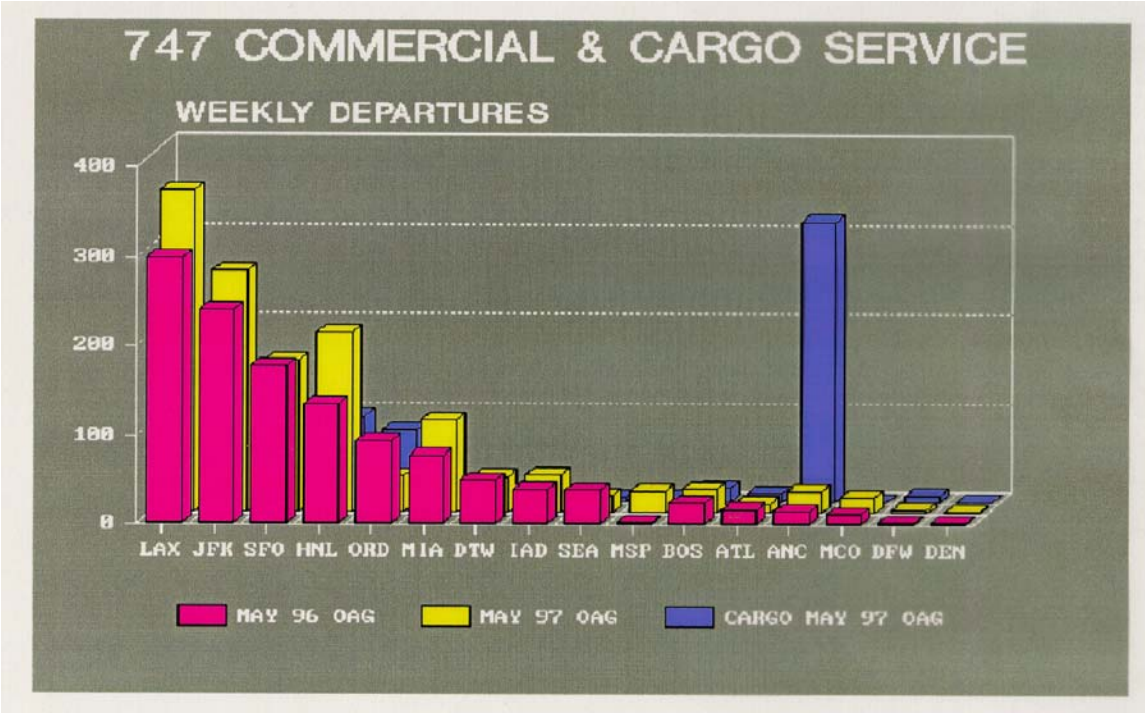

Figure 3. Distribution of Boeing 747 Service at U.S. Airports; May 1996 and 1997.

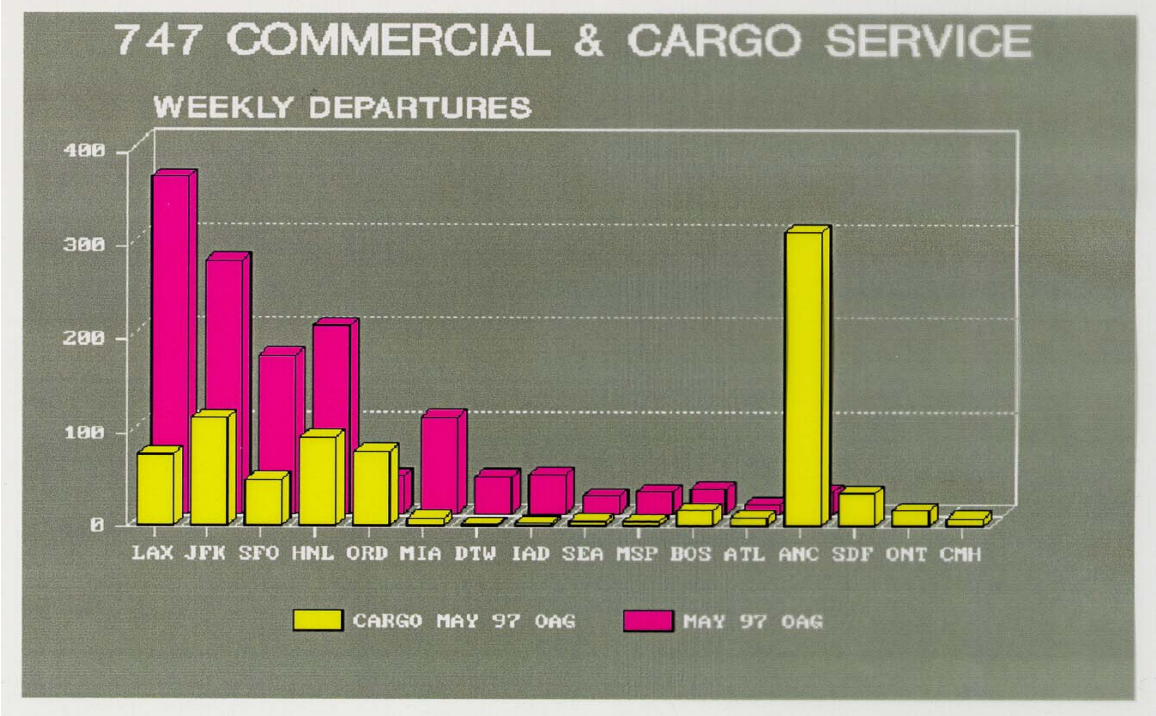

Figure 4. Comparison between Boeing 747 Cargo and Commercial Service at U.S. Airports; May 1997.

PART II. OPERATIONAL RESTICTIONS

Nearly all of U.S. airports identified in figures 3 and 4 were built to less demanding airport design criteria than that appropriate for NLA service, namely ADG VI criteria. Although ADG VI criteria fully accommodate the operational requirements of NLA, some existing airfield infrastructure built to the lesser ADG V criteria can accommodate certain operational demands. The following paragraphs describe the negative consequences of this situation on airfield infrastructure and terminals on the basis of the (1) physical dimensions of existing airfield components, (2) clearance of fixed/movable objects from taxiing NLA, and (3) separations between taxiing NLA. To recapitulate the discussion on design features, table 1 summarizes the numerical differences between ADG V and VI standards and the percentage increase to physical design features and reduction to safety margins.

1. Physical Dimensions of Airfield Infrastructure.

a. Unaffected ADG V Airfield Infrastructure.

(1) Runway Length. The improved high lift wing designs in combination with the proposed engine trust ratings allow NLA continual usage of existing runways serving Boeing 747. Hence, runways do not require an increase in length.

(2) Runway Blast Pad Length. The proposed engines for NLA have comparable trust ratings to engines used on current wide-bodied aircraft. Hence, blast pads beyond the ends of ADG V runways do not require an increase in length.

b. Effected ADG V Airfield Infrastructure.

(1) Runway and Shoulder Widths. The widths for runways and shoulders are increased from 150 feet (45 m) to 200 feet (60 m) for runways and from 35 feet (10.5 m) to 40 feet (12 m) for runway shoulders. The items were included in the survey.

(2) Runway Blast Pad Width. The width of the blast pad, which equals the width of the runway and its shoulders, is increased from 220 feet (66 m) to 280 feet (84 m). The item was included in the survey.

(3) Runway/Taxiway Bridges and Culverts. The proposed maximum design taxiing weight for NLA is in the neighborhood of 1.4 million pounds (635,000 kg). The value represents an approximate 60 percent increase from the certified maximum design taxi weight for the Boeing 747-400 of 877,000 pounds (397,800 kg). Clearly, reinforcement is necessary for existing bridges and culverts not built to support the significant increase. The items were included in the survey.

(4) Taxiway and Shoulder Widths. The widths for taxiways and shoulders are increased from 75 feet (23 m) to 100 feet (30 m) for taxiways and from 15 feet (4.5 m) to 20 feet (6 m) for taxiway shoulders. The items were included in the survey.

(5) Taxiway Fillets. An airport safety design feature used in the design of taxiway fillets (including straight taxing sections) is the provision for a taxiway edge safety margin (TESM). Its function is to provide actual pavement for aircraft main gears during straight taxiing and turning operations. The TESM standard is increased from 15 feet (4.5 m) to 20 feet (6 m). The item was included in the survey.

2. **Clearances**.

a. Unaffected ADG V Airfield Facilities.

(1) Runway Safety Area (RSA). At this time, the dimensions of the RSA for ADG V runways do not require an increase in length or width.

(2) Runway Object Free Areas (ROFA). The dimensions of the ROFA for ADG V runways do not require an increase in length or width.

b. **Effected ADG V Airfield Facilities**.

(1) Taxiway Safety Area (TSA) Width. Widths of TSAs are based on the wingspan of the design airplane being accommodated. Since NLA have significantly wider wingspans, TSA width is increased from 214 feet (65 m) to 262 feet (80 m). The item was included in the survey.

(2) Taxiway and Taxilane Object Free Area (OFA) Width. Taxiing airplanes require a cleared area free from fixed or movable objects. The cleared area, termed the OFA, has a width based on the wingspan of the airplane design group being accommodated and whether air traffic controls or does not control taxiing aircraft. In terms of airport design, taxiway design criteria are used for the former operation were as, taxilane design criteria are used for the latter. Regardless of the design approach, both approaches contain a built in minimum wingtip clearance safety margin, that is, a distance between the wingtip of the airplane and the nearest object. The key difference between the two taxi design approaches is that taxilane operations allow smaller wingtip clearances than taxiway operations due to slower taxiing operations or extra safety measures. Taxiway OFA criteria are generally applicable to the airfield while taxilane criteria are commonly applied in the terminal gate areas of airports. For taxiways, the OFA width is increased from 320 feet (97 m) to 386 feet (118 m). For taxilanes, the OFA width is increased from 276 feet (84 m) to 334 feet (102 m).

(i) Safety Margin for Airfield Taxiway OFA. During airfield taxiing operations, the taxiway OFA design standard maintains a minimum wingtip clearance safety margin of 62 feet (19m) between the wingtip and any object, whether fixed or movable. It is worth noting that the safety margin assumes no deviation from the

centerline by an airplane during taxiing. When NLA taxi on taxiways built to the lesser ADG V standards, the safety margin is reduced approximately 54 percent. That is, the 62-foot (19m) safety margin is lowered to a 29-foot (9 m) wingtip clearance.

(ii) Safety Margin for Terminal Taxilane OFA. For non-ATCT controlled terminal gate operations, the taxilane OFA design standard maintains a minimum wingtip clearance safety margin of 36 feet (11m) between the wingtip and any object, whether fixed or movable. Figure 5 illustrates the separation standard for ADG VI. In similar fashion to taxiway design, the safety margin assumes no deviation from the centerline by the airplane during taxiing. Figure 6 illustrates the significant reduction to the safety margin when NLA taxi at airports built to the lesser ADG V standard. It distinctly shows an 81 percent reduction to the safety margin from 36 feet (11m) down to only a 7-foot (2m) wingtip clearance. Clearly, NLA taxiing operations in the terminal gate and apron areas will experience severe taxiing restrictions. An operational restriction imposed on the terminal gate area may be restricting certain gates to aircraft having short fuselage lengths as a mean to provide adequate wingtip clearance for the passage of NLA. If this or another option does not overcome the less than standard clearance problem, then parking of NLA will most likely be at designated hard stands away from the terminal.

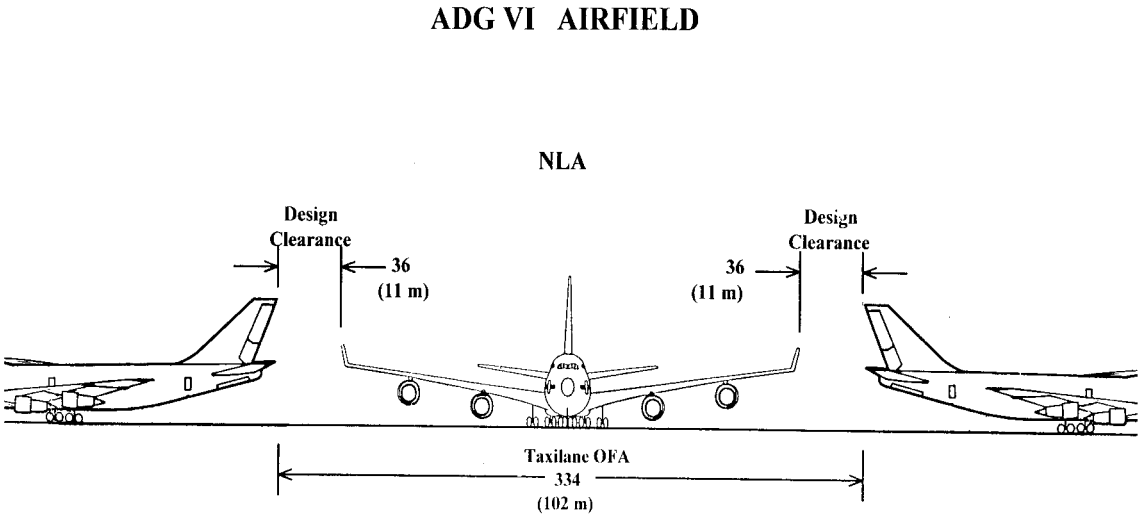

Figure 5. Terminal Taxilane with Full Wingtip Safety Margin .

ADG V AIRFIELD

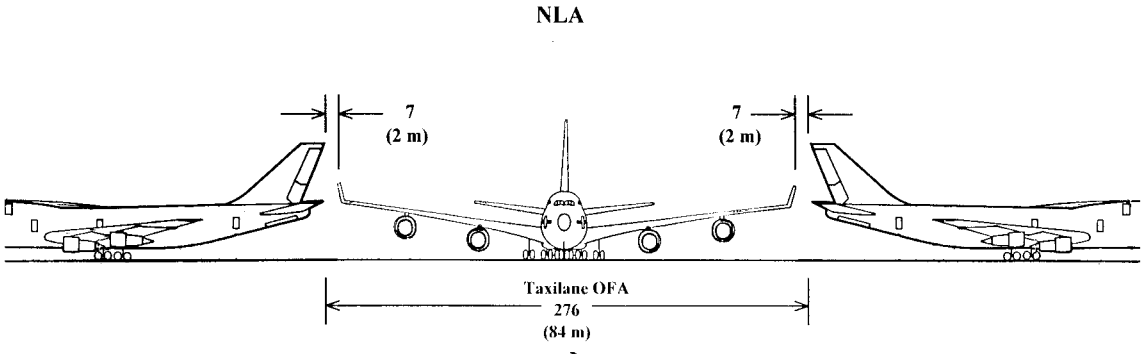

Figure 6. Terminal Taxilane with Reduced Wingtip Safety Margin.

3. Separations.

a. Unaffected ADG V Airfield Facilities.

(1) Holdline Location on Taxiway Entrance. Before taxiing onto a departure runway, airplanes hold on an entrance taxiway at a specified distance away from the runway centerline, i.e., the holdline. Figure 7 illustrates that when a NLA is on approach, NLA can simultaneously hold perpendicular to a precision runway under the applicable holdline criterion for ADG V runways at sea level.

(2) Parallel Runways. At this time, the current separation standards between the centerlines of parallel runways remain the same under visual and instrument flight rules.

ADG V AIRFIELD

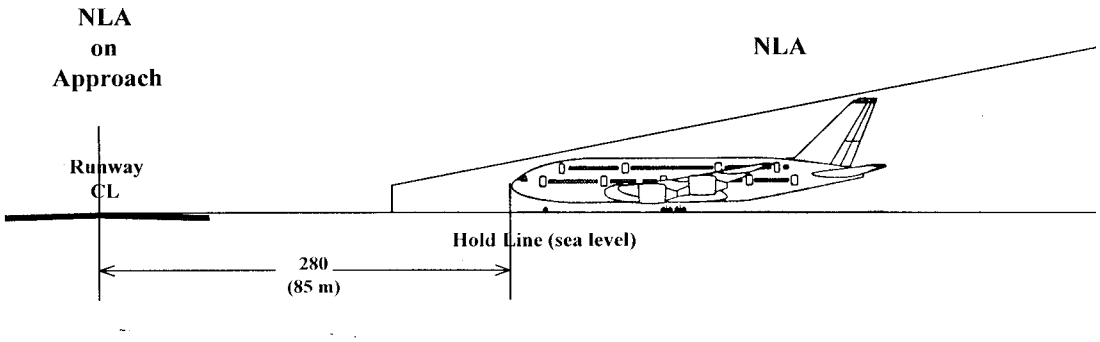

Figure 7. NLA Holding Safely Under the Obstacle Free Zone (OFZ).

b. Effected ADG V Airfield Facilities.

(1) Parallel Runway/Taxiway and the Obstacle Free Zone (OFZ). Insufficient separation between a runway and a parallel taxiway will impose one of the more restrictive operational restrictions to the airplane or airport. Runways require a volume of airspace, termed the OFZ, to provide an object free protected airspace. By definition the OFZ is the volume of airspace below 150 feet (45 m) above the established airport elevation and along the runway and the extended runway centerline that is required to be clear of objects in order to provide clearance protection for aircraft landings or takeoffs from the runway and for missed approaches. Figure 8 illustrates the 3-dimensional OFZ protected airspace off to one side of a precision runway and inclined over a parallel taxiway. The illustrated parallel taxiway is separated in accordance with the ADG VI separation standard of 600 feet (180 m). The significance of the 600-foot standard is that it allows the simultaneous operations of NLA landings/takeoffs while another NLA safely taxis underneath the inclined portion of the OFZ. Furthermore, the 600-foot standard allows airframe manufacturers the flexibility to design future NLA derivatives without airport authorities having to reconstruct airfields or impose additional operational restrictions. That is, airport design standards consider longevity of design. Violations to the OFZ protected airspace and the available operational restrictions to overcome inadequate taxiing separations are discussed in the following subparagraphs. The item was included in the survey.

(i) Violations to Obstacle Free Zones (OFZ). The determining factors for the shape of the OFZ are the (1) wingspan of the approach airplane, (2) airport elevation, and (3) approach capability of the runway, such as, CAT I or CAT II/III. Once the OFZ geometry is defined, the separation between the centerlines of the parallel taxiway and the runway is determined. The determination is based primarily on the physical characteristics of the taxiing airplane instead of the airplane on approach. The key factors are the height of tail section and the width of wingspan for the airplane design group being accommodated. Figure 9 illustrates that when a NLA is landing and a Boeing 747-400 is taxiing parallel to a runway separated in accordance with the lesser ADG V separation standard of 400 feet (122 m), a violation to the OFZ protected airspace results. As stated above, airport elevation effects the geometry of the OFZ. At rather high elevations above sea level, current models of the Boeing 747 landing at runways/parallel taxiways separated in accordance with the 400-foot separation standard will sustain OFZ violations when another Boeing 747 airplane taxis. In other words, FAA design standards further note additional separation at higher elevation airports.

ADG VI AIRFIELD

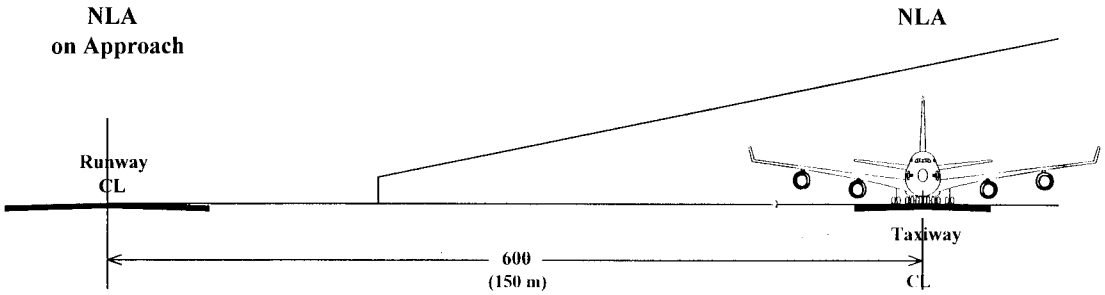

Figure 8. Runway/Parallel Taxiway at Full Separation Standard .

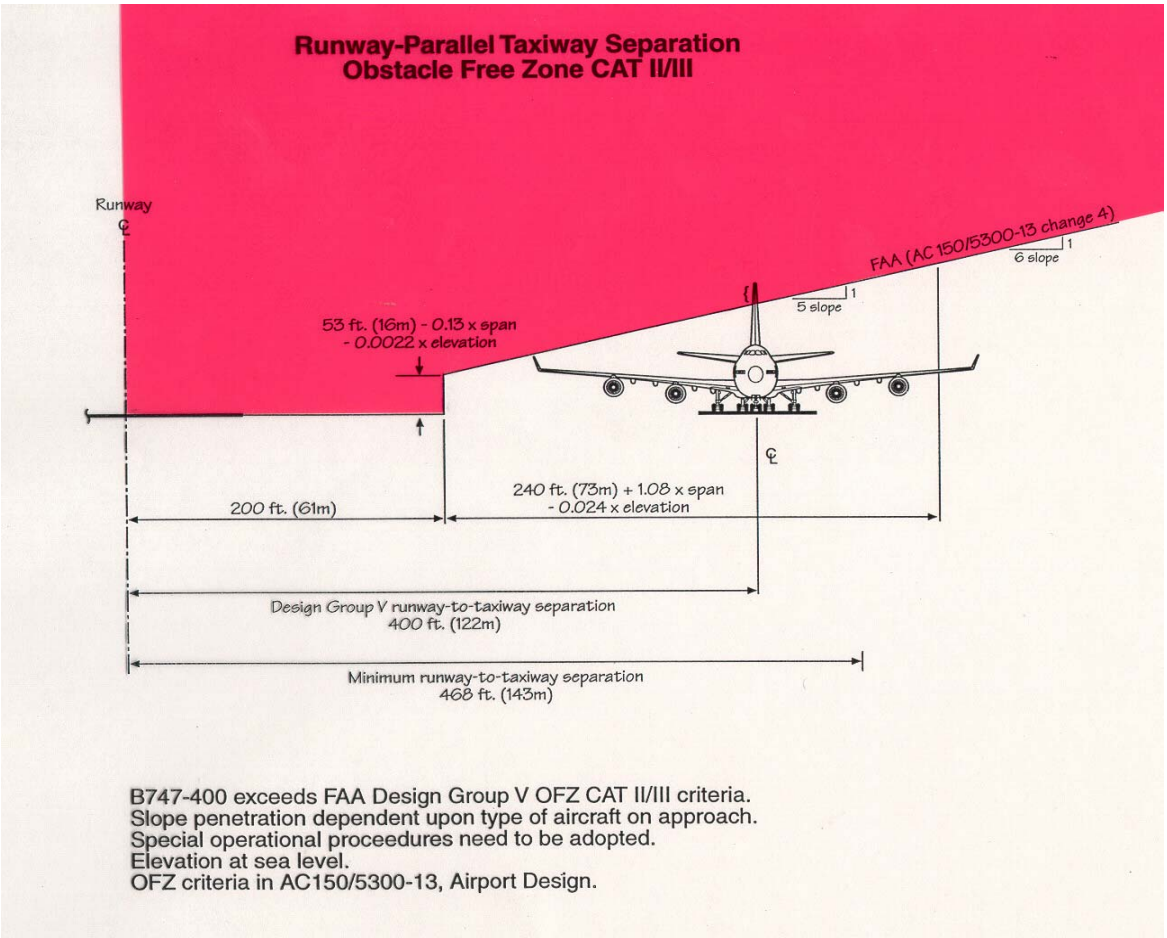

Figure 9. Violation of the Obstacle Free Zone during NLA Approach.

(ii) Operational Restrictions. Airport authorities have two means at their disposal to retain the safety function of the OFZ. They can either operationally restrict the usage of the taxiway or the runway. In other words, restrict the size of the taxiing airplane or the airplane on approach.

(1) Taxiing Restriction. When a NLA is on approach, restricting the tail height (and wingspan) of the taxing aircraft eliminates violations to the OFZ.

(2) Approach Restriction. Figure 10 illustrates that when a NLA is taxiing, restricting the wingspan width of the airplane on approach to greater than 100 ft (30 m) eliminates a violation to the OFZ.

(2) Parallel Taxiways/Taxilanes Separations. The separation between parallel taxiways is based on the wingspan of the airplane design group being accommodated. Figure 11 illustrates the design separation standard between parallel taxiways to accommodate simultaneous NLA operations. The design standard maintains a minimum wingtip safety margin of 62 feet (19m) between taxiing airplanes. This safety margin is achieved by the construction of parallel taxiways having centerlines spaced at a minimum distance of 324 feet (99m). It is worth mentioning that the safety margin assumes no taxing deviation from either centerline by taxing airplanes. Figure 12 illustrates the significant impact to the safety margin when NLA taxi at airports built to the lesser ADG V standard of 267 feet (81 m). It shows an approximate 92 percent reduction to the 62-foot (19m) safety margin down to a 5-foot (1 1/2m) wingtip separation. Figure 13 illustrates the operational restriction of limiting the wingspan of the smaller airplane as a means to retain the full safety standard. Since the wingspans of the illustrated DC-8-62/63 equal 148 feet (45 m), narrow-bodied airplanes are able to taxi unrestricted. In terms of taxilane design as compared to taxiway design, the design approach is not available since the 262-foot (80 m) wingspan of ADG VI exceeds the actual available physical centerline separation by 17 feet (5.5 m). The separation between the centerlines of parallel taxilanes is only 245 feet (74.5 m).

ADG V AIRFIELD

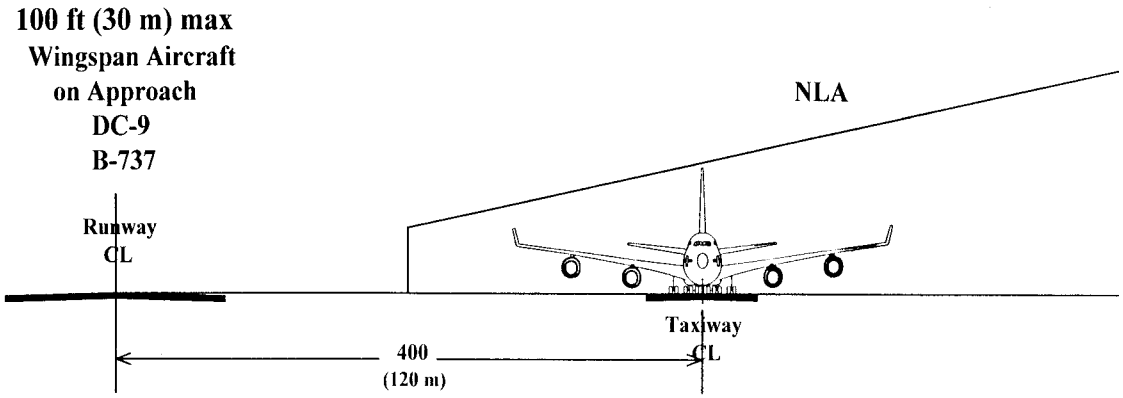

Figure 10. Operational Restriction on the Wingspan of the Approach Airplane.

ADG VI AIRFIELD

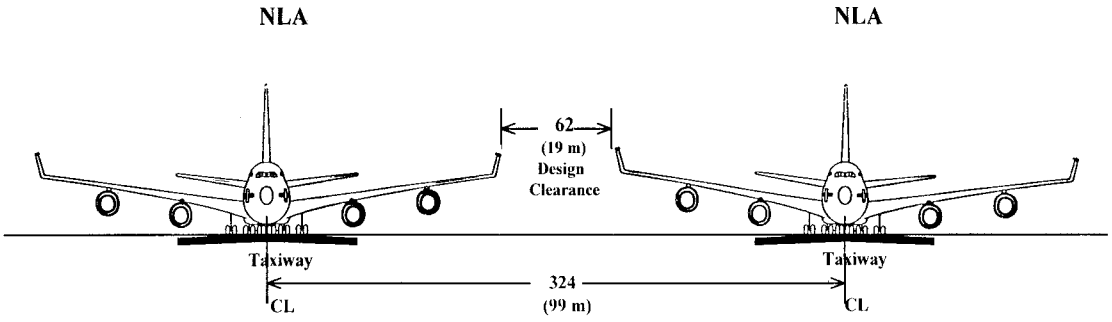

Figure 11. Parallel Taxiways at Full Wingtip Safety Margin .

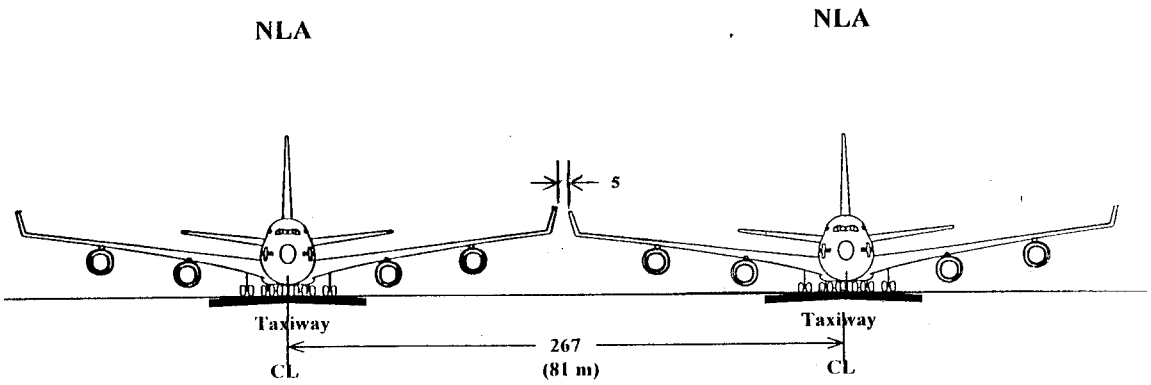

Figure 12. Parallel Taxiways at Reduced Wingtip Safety Margin .

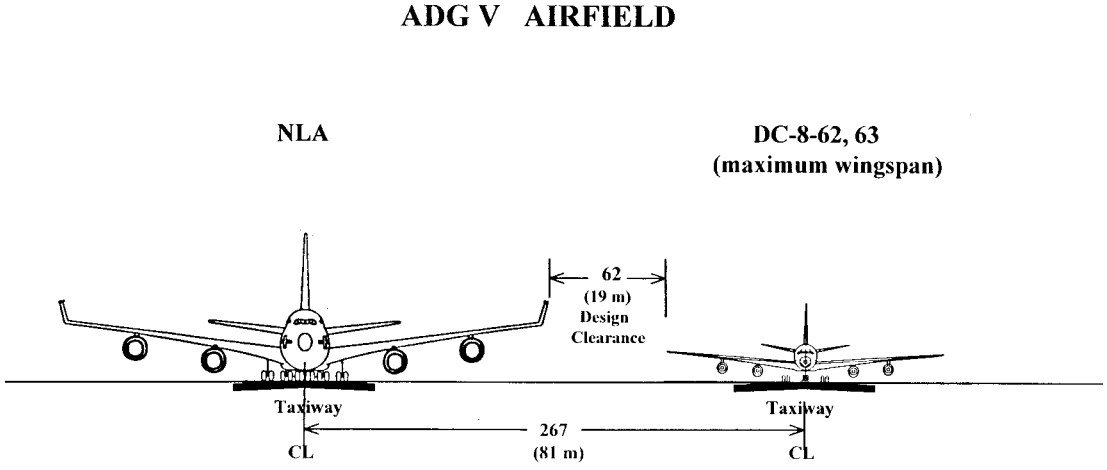

Figure 13. Operational Restriction to the Wingspan of Non-NLA Airplane .

TABLE 1. Comparison of Airport Design Standards for Airplane Design Groups V and VI.

Design Feature		Airplane Design Group V	Airplane Design Group VI	Percentage Increase & Safety Margin Reductions
Runway Environment				
	Length			None
	Width	150 ft	200 ft	33%
	Shoulder Width	35 ft	40 ft	14%
	Blast Pad Length	200 ft	200 ft	None
	Blast Pad Width	220 ft	280 ft	27%
	Runway Safety Area Length	1000 ft	1000 ft	None
	Runway Safety Area Width	500 ft	500 ft	None
	Runway Object Free Area Length	1000 ft	1000 ft	None
	Runway Object Free Area Width	800 ft	800 ft	None
Bridges and Culverts: Taxiing Weights				
		Up to 877,000 pounds	Up to 1,400,000 pounds	60%
Taxiway Environment				

	Width	75 ft	100 ft	33%
	Shoulder Width	35 ft	40 ft	14%
	Taxiway Edge Safety Margin	15 ft	20 ft	33%
	Safety Area Width	214 ft	262 ft	22%
	Airfield Taxiway Object Free Area & Safety Margin	320 ft	386 ft	21% 54% Safety Reduction
	Terminal Taxilane Object Free Area & Safety Margin	276 ft	334 ft	21% 81% Safety Reduction
Separations				
	Holdline	280 ft	280 ft	None
	Parallel Runways			None
	Runway to Parallel Taxiway	400 ft	600 ft	50%
	Parallel Taxiways & Safety Margin	267 ft	324 ft	21% 92% Safety Reduction
	Parallel Taxilanes & Safety Margin	245 ft NLA Design Wingspan equals 262 ft	298 ft	22% Wingtip Collision

Table 1. Continuation

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PART III. Financial Impacts.

This part summarizes the financial costs as reported by airport authorities to upgrade or build infrastructure to safely accommodate NLA. As previously stated in section 3 of Part I, the survey consisted of five separate areas deemed the most significant to be impacted by NLA service. Two of the five areas dealt with the runway environment. Hence, four separate sections follow.

1. Runway Environment.

This section covers the estimated costs to upgrade primary runways, crosswind runways, and to construct new ADG VI runways with parallel taxiways. Reported costs are attributed to runway widths, shoulder widths, blast pad width, entrance taxiway fillets, and the category "Other Costs." Items under the category "Other Costs" include new or relocation of signs, lights, electrical systems, new drainage, etc. Reported costs for parallel taxiways supporting new ADG VI runways are found in section 2. Attachment 3 provides cost breakdowns by design features and total estimated costs by individual airports.

a. **Tables 2 and 3.** Tables 2 and 3 show the total estimated cost for all airports as a group and for individual airports. Furthermore, the tables present the same information alphabetically and by rank order. The ranking associated with each airport is based on the May 1997 OAG commercial service operations handled by the airport. It is worth noting that, rankings fluctuate from year to year. For example, tabulations from the May 1996 OAG placed ORD in 4th place as compared to 6th for the following year.

(1) For the category "Primary Runways," the average estimated costs for upgrades is slightly less than $10 million per airport. In terms of the highest percentages of the total estimated cost, BOS, JFK, and MEM reported 14 percent, 10 percent, and 10 percent respectively.

(2) For the category "Crosswind Runways," two-thirds of the reporting airports declared the need to upgrade both the primary and crosswind runways. DEN and DFW reported only upgrade costs to their crosswind runways. The average estimated costs for all upgrades with one exception is slightly less than $10 million per airport. ORD reported upgrade costs of $57.5 million or 35 percent of all such costs. In comparison, the succeeding highest percentages reported were BOS at 13 percent followed by JFK at 5 percent.

(3) For the category "New ADG VI Runway," tables show that LAX, ranked #1, reported this as its only alternative to accommodate NLA service. As a monetary comparison, the LAX alternative is approximately 52 percent of the total estimated cost for upgrading all of the other primary runways. In similar fashion, SFO, ranked #4, reported basically two alternatives, one being to build a new DG VI runway at an estimated cost of $2.7 billion. Only two other airports, JKF and STL, reported costs under this alternative.

(4) For airports accommodating significant cargo service, ANC and MEM reported the need to upgrade both primary and crosswind runways at a total combined cost of $42.6 million.

Table 2. Estimated Costs by Alphabetical Order.

IDENTIFIER	RANK	PRIMARY RUNWAY	CROSSWIND RUNWAY	NEW ADG VI RUNWAY
ANC	11	$8,300,000.00	$8,600,000.00	
ATL	16	$10,100,000.00	$7,300,000.00	
BDL	22	$1,300,000.00	$7,500,000.00	
BOS	9	$25,000,000.00	$21,000,000.00	
DEN	19	$0.00	$12,700,000.00	
DFW	18	$0.00	$3,834,200.00	
DTW	8	$2,052,890.00		
HNL	3			
IAD	6	$11,400,000.00	$10,400,000.00	
IAH	17	$7,500,000.00	$5,500,000.00	$0.00
JFK	2	$18,300,000.00	$14,300,000.00	$10,600,000.00
LAX	1			$95,857,000.00
MCO	13			
MEM	20	$15,200,000.00	$10,500,000.00	
MIA	5	$6,350,000.00	$6,000,000.00	
MSP	10	$440,000.00		
ORD	7	$15,000,000.00	$57,500,000.00	
PHL	14	$4,700,000.00		
PHX	21	$9,400,000.00		
SEA	12	$12,700,000.00		
SFO	4	$10,000,000.00		$2,760,000,000.00
STL	15	$6,600,000.00		$576,000,000.00
TOTAL:		**$164,342,890.00**	**$165,134,200.00**	**$3,442,457,000.00**

Table 3. Estimated Costs by Rank Order.

IDENTIFIER	RANK	PRIMARY RUNWAY	CROSSWIND RUNWAY	NEW ADG VI RUNWAY
LAX	1			$95,857,000.00
JFK	2	$18,300,000.00	$14,300,000.00	$10,600,000.00
HNL	3			
SFO	4	$10,000,000.00		$2,760,000,000.00
MIA	5	$6,350,000.00	$6,000,000.00	
IAD	6	$11,400,000.00	$10,400,000.00	
ORD	7	$15,000,000.00	$57,500,000.00	
DTW	8	$2,052,890.00		
BOS	9	$25,000,000.00	$21,000,000.00	
MSP	10	$440,000.00		
ANC	11	$8,300,000.00	$8,600,000.00	
SEA	12	$12,700,000.00		
MCO	13			
PHL	14	$4,700,000.00		
STL	15	$6,600,000.00		$576,000,000.00
ATL	16	$10,100,000.00	$7,300,000.00	
IAH	17	$7,500,000.00	$5,500,000.00	$0.00
DFW	18	$0.00	$3,834,200.00	
DEN	19	$0.00	$12,700,000.00	
MEM	20	$15,200,000.00	$10,500,000.00	
PHX	21	$9,400,000.00		
BDL	22	$1,300,000.00	$7,500,000.00	
TOTAL:		**$164,342,890.00**	**$165,134,200.00**	**$3,442,457,000.00**

(5) For the category "Other Costs," the average estimated cost was $12 million per airport. The items with the highest contribution were associated with electrical systems and new or relocation of signs and lights. Reported costs were ORD at $3.5 million and SEA at $7.6 million. JFK and BOS reported the highest percentage.

b. Table 4. Table 4 shows estimated cost for the runway categories of Primary Runway, Crosswind Runway, and New ADG VI Runway.

(1) For the categories "Primary Runway" and "Crosswind Runway," upgrades to runway width and shoulders represented the bulk of the estimated costs, i.e., 75 percent and 78 percent respectively.

(2) For the category "New ADG VI Runway," SFO and STL skew the dollar figures due to their reported costs.

Table 4. Estimated Costs for Design Features by Runway Types.

Primary Runway

DESIGN FEATURE	Count	Sum	Average
Blast Pads	11	$6,872,890.00	$624,808.18
Other Costs	18	$40,420,000.00	$2,245,555.56
Shoulders	18	$59,850,000.00	$3,325,000.00
Width	11	$77,200,000.00	$7,018,181.82
TOTAL:	**58**	**$184,342,890.00**	

Crosswind Runway

DESIGN FEATURE	Count	Sum	Average
Blast Pads	5	$10,100,000.00	$2,020,000.00
Other Costs	14	$25,069,200.00	$1,790,657.14
Shoulders	10	$33,665,000.00	$3,366,500.00
Width	9	$96,300,000.00	$10,700,000.00
TOTAL:	**38**	**$165,134,200.00**	

New ADG VI Runway

DESIGN FEATURE	Count	Sum	Average
Blast Pads	1	$2,000,000.00	$2,000,000.00
Other Costs	6	$2,758,982,000.00	$459,830,333.33
Shoulders	2	$10,400,000.00	$5,200,000.00
Width	3	$671,075,000.00	$223,691,666.67
TOTAL:	12	$3,442,457,000.00	

2. Taxiway Environment.

This section covers the estimated costs to upgrade or build new DG VI taxiways and to widen the taxiway safety area. For this topic, the survey was written to separate the costs associated with taxiway intersections (fillets) from straight portions of the taxiway system. The division provides a means to priorities airfield construction. Reported costs are attributed to widening existing taxiway widths, shoulders, fillets, and safety areas, relocation/installation of lights and signs, etc. Attachment 4 provides cost breakdowns by design features and total estimated costs by individual airports.

a. **Tables 5 and 6**. Tables 5 and 6 show the total estimated cost for all airports as a whole and for individual airports. Furthermore, the tables present the same information alphabetically and by rank order. Six airports reported dual costs to upgrade the existing taxiway and to build a new ADG VI taxiway. Of those six, SFO reported the largest percent of all such costs, i.e., 20 percent. In terms of only upgrading existing taxiways, ORD reported the largest costs at $94.5 million. The average cost to upgrade an existing taxiway system is $22.5 million. The average cost to build a new ADG VI taxiway system is $28.7 million.

b. **Table 7**. Table 7 reports cost breakdowns by design feature. Three design features generated the majority of all costs. In terms of percentages, widening paved sections records 32 percent followed by widening shoulder widths 29 percent and fillets at 24 percent or a total of 85 percent.

c. **Table 8**. Table 8 shows that the bulk of all reported cost was attributed to the straight portions of the airfield taxiway system, i.e., 75 percent. The percentage, however, excludes the costs, 28%, attributed to parallel taxiways that support the runway. Those costs deal with providing an adequate centerline separation between the two so that the OFZ airspace is not violated. The remaining 4 percent are attributed to the intersecting taxiways and the category “Other.”

Table 5. Estimated Costs by Alphabetical Order.

IDENTIFIER	RANK	UPGRADE EXISTING TAXIWAY	NEW ADG VI TAXIWAY
ANC	11	$18,800,000.00	
ATL	16	$1,300,000.00	
BDL	22	$12,750,000.00	$29,850,000.00
BOS	9	$12,500,000.00	
DEN	19	$22,300,000.00	
DFW	18		
DTW	8	$6,320,000.00	
IAH	17	$10,200,000.00	$2,600,000.00
IAD	6	$17,500,000.00	
JFK	2	$62,200,000.00	
LAX	1		$43,333,000.00
MEM	20	$12,600,000.00	$4,200,000.00
MIA	5	$51,370,000.00	
MSP	10	$2,700,000.00	
ORD	7	$94,500,000.00	
PHL	14	$2,500,000.00	
PHX	21	$16,600,000.00	
SEA	12	$6,600,000.00	$42,000,000.00
SFO1	4	$19,700,000.00	
SFO2	4	$43,300,000.00	
SFO3	4	$59,200,000.00	$63,300,000.00
STL	15	$11,600,000.00	$576,000,000.00
TOTAL:		**$484,540,000.00**	**$761,283,000.00**

Table 6. Estimated Costs by Rank Order.

IDENTIFIER	RANK	UPGRADE EXISTING TAXIWAY	NEW ADG VI TAXIWAY
LAX	1		$43,333,000.00
JFK	2	$62,200,000.00	
SFO1	4	$19,700,000.00	
SFO2	4	$43,300,000.00	
SFO3	4	$59,200,000.00	$63,300,000.00
MIA	5	$51,370,000.00	
IAD	6	$17,500,000.00	
ORD	7	$94,500,000.00	
DTW	8	$6,320,000.00	
BOS	9	$12,500,000.00	
MSP	10	$2,700,000.00	
ANC	11	$18,800,000.00	
SEA	12	$6,600,000.00	$42,000,000.00
PHL	14	$2,500,000.00	
STL	15	$11,600,000.00	$576,000,000.00
ATL	16	$1,300,000.00	
HIA	17	$10,200,000.00	$2,600,000.00
DFW	18		
DEN	19	$22,300,000.00	
MEM	20	$12,600,000.00	$4,200,000.00
PHX	21	$16,600,000.00	
BDL	22	$12,750,000.00	$29,850,000.00
TOTAL:		**$484,540,000.00**	**$761,283,000.00**

Table 7. Estimated Costs by Design Features.

DESIGN FEATURE	UPGRADE EXISTING TAXIWAY	NEW ADG VI TAXIWAY
Fillets	$138,000,000.00	$580,300,000.00
Light & Signs (fillet sections)	$33,200,000.00	$3,750,000.00
Lights & Signs (straight sections)	$35,220,000.00	$1,000,000.00
Other	$1,000,000.00	$45,658,000.00
Paved Width	$139,500,000.00	$111,875,000.00
Shoulder Width	$128,020,000.00	$16,800,000.00
Taxiway Object Free Area	$3,000,000.00	$1,500,000.00
Taxiway Safety Area	$6,600,000.00	$400,000.00
TOTAL:	**$484,540,000.00**	**$761,283,000.00**

Table 8. Estimated Costs by Intersecting, Straight and Combination Runway/Parallel Taxiway.

DESIGN FEATURE	UPGRADE EXISTING TAXIWAY	NEW DG VI TAXIWAY
Intersecting Taxiways	$23,600,000.00	$2,900,000.00
Other	$1,000,000.00	$45,658,000.00
Runway/Parallel Taxiway	$149,620,000.00	$578,400,000.00
Straight Taxiway Sections	$310,320,000.00	$134,325,000.00
TOTAL:	**$484,540,000.00**	**$761,283,000.00**

3. Bridges and Culverts.

This section covers the estimated costs to strengthen the load bearing capacity of bridges and culverts to support the taxiing, landing, and takeoff operational weights of NLA. High construction costs are expected since the width of bridges equals the width of the safety area(s) associated with the runway or/and taxiway. Three basic cases arise. If only a taxiway is involved, then the bridge width equals the width of the taxiway safety area. If only a runway is involved, then the bridge width equals the width of the runway safety area. If a runway and a parallel taxiway are involved, then the bridge width equals the combined full and continuous width of the runway and taxiway safety areas. On the other hand, culvert widths may in a few cases be less than the width of the safety area. The category "Other Costs" includes costs attributed to structural reinforcement, retaining walls, road excavation, electrical systems, and drainage.

a. Tables 9 and 10. Tables 9 and 10 show cost breakdowns by airport alphabetically and according to rank order. Eight airports reported necessary upgrades. Two airports, SEA and ANC, reported the need to upgrade for two of three reporting categories. No airports reported need upgrades for the Runway Only category.

(1) For the runway with parallel taxiway case, seven airports reported costs. Two airports, LAX and DFW, reported upgrade costs for both bridges and culverts of approximately $135 million and $54 million, respectively. Two airports, MIA and SEA, reported costs only for bridges of approximately $47 million and $32 million, respectively. Three airports, STL, IAH, and ANC, reported costs only for culvert upgrades of approximately $3 million, $3 million, and $1.5 million, respectively.

(2) For the taxiway only case, three airports reported estimated costs. JFK reported upgrades to both bridges and culverts at a cost of $25 million. SEA and ANC report costs of $24 million and $1½ million respectively.

(3) For the runway only case, no airports reported costs.

b. Table 11. Table 11 shows the estimated costs by design features. The average cost for taxiway bridges is $24 million and for combination runway and parallel taxiway is $86 million. Culvert upgrades averaged $9 million for taxiways and $13.5 million for combination runway/parallel taxiway.

Table 9. Estimated Cost for Bridges/Culverts by Alphabetical Order.

IDENTIFIER	RANK	COMBINATION RUNWAY WITH PARALLELTAXIWAY	RUNWAY WITHOUT PARALLEL TAXIWAY	TAXIWAY ONLY
ANC	11	$2,000,000.00		$1,500,000.00
ATL	16	$0.00	$0.00	$0.00
BDL	22			
BOS	9			
DEN	19	$0.00		
DFW	18	$53,656,250.00		
DTW	8	$0.00	$0.00	$0.00
IAH	17	$3,000,000.00		
IAD	6			
JFK	2			$25,500,000.00
LAX	1	$335,000,000.00		
MEM	20	$0.00		$0.00
MIA	5	$47,000,000.00		
MSP	10	$0.00		
ORD	7			
PHL	14	$0.00		
PHX	21			
SEA	12	$31,500,000.00		$23,500,000.00
SFO	4			
STL	15	$2,500,000.00		
TOTAL:		**$474,656,250.00**	**$0.00**	**$50,500,000.00**

Table 10. Estimated Cost for Bridges/Culverts by Rank Order.

IDENTIFIER	RANK	COMBINATION RUNWAY WITH PARALLEL TAXIWAY	RUNWAY WITHOUT PARALLEL TAXIWAY	TAXIWAY
LAX	1	$335,000,000.00		
JFK	2			$25,500,000.00
SFO	4			
MIA	5	$47,000,000.00		
IAD	6			
ORD	7			
DTW	8	$0.00	$0.00	$0.00
BOS	9			
MSP	10	$0.00		
ANC	11	$2,000,000.00		$1,500,000.00
SEA	12	$31,500,000.00		$23,500,000.00
PHL	14	$0.00		
STL	15	$2,500,000.00		
ATL	16	$0.00	$0.00	$0.00
IAH	17	$3,000,000.00		
DFW	18	$53,656,250.00		
DEN	19	$0.00		
MEM	20	$0.00		$0.00
PHX	21			
BDL	22			
TOTAL:		**$474,656,250.00**	**$0.00**	**$50,500,000.00**

Table 11. Estimated Costs for Bridges & Culverts.

Runway /Parallel Taxiway

DESIGN FEATURE	Count	Sum	Average
Bridges	4	$344,000,000.00	$86,000,000.00
Culvert(s)	5	$67,656,250.00	$13,531,250.00
Other	2	$63,000,000.00	$31,500,000.00
TOTAL:	**11**	**$474,656,250.00**	

Taxiway Only

DESIGN FEATURE	Count	Sum	Average
Bridges	1	$24,000,000.00	$24,000,000.00
Culvert(s)	3	$26,500,000.00	$8,833,333.33
TOTAL:	**4**	**$50,500,000.00**	

4. Terminal and Apron Environments.

This section covers the reported estimated costs to upgrade terminals and aprons. Reported costs for terminals and aprons were grouped under the category of either a single main international terminal or more than one international terminal. With the exception of SFO, airports reported upgrades under the category Single Main Terminal. Costs are attributed to modification/new passenger lounges, passenger boarding bridges, apron extensions, and aircraft ground service, such as, relocation/new fuel hydrant systems, Customs & Immigration facilities, baggage processing, and the category "Other Costs." Items under the category "Other Costs" include new or relocation of signs, lights, electrical systems, new drainage, etc. Attachment 5 provides cost breakdowns by design features and total estimated costs by individual airports.

a. **Table 12**. Table 12 shows the reported costs alphabetically by airport. Two-thirds of all reported costs were for IAH, LAX, and SEA respectively at $364 million, $176 million, and $116 million. For the remaining 12 airports, the average cost is $28 million. SFO was the only airport reporting upgrade costs under the category "Separate Facility."

b. **Tables 13 and 14**. Table 13 divides costs into eight subgroups. Terminal costs were summed from the four subgroups of passenger loading bridges, gate & holding areas, Customs & Immigration, and baggage processing. Apron costs were summed from the three subgroups of parking strength, apron extension, and aircraft ground services. The category "Other" represents unlisted subgroups. The highest cost items were Customs & Immigration, and gate/holding areas, which represents 40 percent of the total costs. Table 14 assembles the eight subgroups into three cost categories, i.e., Apron, Terminal, and Other. The table clearly shows that the Terminal category represents 74 percent of all costs associated with the category Main International Terminal.

Table 12. Terminal and Apron Improvements.

IDENTIFIER	RANK	MAIN INTERNATIONAL TERMINAL	SEPARATE FACILITY
ANC	11	$9,400,000.00	
ATL	16	$12,400,000.00	
BDL	22		
BOS	9	$27,000,000.00	
DEN	19	$1,800,000.00	
DFW	18		
DTW	8	$0.00	
IAH	17	$364,000,000.00	
IAD	6		
JFK	2		
LAX	1	$175,640,000.00	
MEM	20	$27,000,000.00	
MIA	5	$22,000,000.00	
MSP	10	$30,000,000.00	
ORD	7	$63,750,000.00	
PHL	14	$13,350,000.00	
PHX	21	$28,700,000.00	
SEA	12	$116,000,000.00	
SFO	4		$56,000,000.00
STL	15	$48,500,000.00	
TOTAL:		**$939,540,000.00**	**$56,000,000.00**

Table 13. Improvement Costs Breakdown by Design Features.

DESIGN FEAUTURE	MAIN INTERNATIONAL TERMINAL	SEPERATE FACILITY
Aircraft Ground Service	$26,650,000.00	$94,000,000.00
Apron Extension	$82,540,000.00	
Baggage Processing	$43,450,000.00	
Customs & Immigration	$360,500,000.00	
Gate & Holding Area	$226,800,000.00	
Other	$86,400,000.00	$18,000,000.00
Parking Strength	$51,000,000.00	
Passenger Loading Bridges	$62,200,000.00	

Table 14. Improvement Costs Grouped under Apron, Terminal and Other.

AREA	MAIN INTERNATIONAL TERMINAL	SEPARATE FACILITY
Apron	$160,190,000.00	$94,000,000.00
Other	$86,400,000.00	$18,000,000.00
Terminal	$692,950,000.00	

SUMMARY

New large airplanes (NLA) can operate on U.S. airports designed to ADG VI standards without the imposition of operational restrictions to the airport or the airplane. The present situation, however, finds the majority of the U.S. airports anticipated to receive initial NLA service around the year 2004, built to ADG V standards, which are applicable to aircraft up to the Boeing 747-400 dimensions. At these airports, NLA can adversely affect the capacity and current levels of delays. For airport authorities at these airports, new construction is the only means to unrestricted operations of NLA.

The total estimated cost reported by surveyed airports on the issue was approximately $6.6 billion. It is worth noting, however, that the figure does include some cost estimates associated with planned projects that are not a direct consequence of NLA. The runway environment accounted for approximately $3.8 billion of the total. The majority of this value, however, is due to the most expensive alternative submitted by San Francisco International Airport. The alternative for a new ADG VI runway has an estimated cost of $2.76 billion. The taxiway environment accounted for approximately $1.2 billion. Over 60 percent of the value were earmarked for new taxiway systems instead of upgrading existing taxiway systems. Bridges and culverts accounted for approximately $525 million. Los Angeles International Airport accounted for 63 percent of the reported value for bridges and culverts. Terminals and aprons accounted for approximately $1.0 billion. Houston Intercontinental Airport reported one-third of the value for terminals and aprons.

The reported $6.6 billion value covers only an introductory period of 5-to-10 years of NLA service. If the world airline industry as a whole incorporate NLA in significant numbers, then additional airfield and terminal construction costs will result. At this time, reliable long-term cost projections are not available.

Attachment #1. List of Airport Identifiers.

Identifier	Airport Name	Associated City
ANC	Anchorage International	Anchorage, AK
ATL	William B. Hartsfield	Atlanta, GA
BDL	Bradley International	Windsor Locks, CT
BOS	General Edward Lawrence Logan	Boston, MA
CMH	Port Columbus International	Columbus, OH
DEN	Denver International	Denver, CO
DFW	Dallas/Ft. Worth International	Dallas/Ft. Worth, TX
DTW	Detroit Metropolitan	Detroit, MI
HNL	Honolulu International	Honolulu, HI
IAH	Houston Intercontinental	Houston, TX
IAD	Washington Dulles International	Loudon, VA
JFK	John F. Kennedy International	New York, NY
LAX	Los Angeles International	Los Angeles, CA
MCO	Orlando International	Orlando, FL
MEM	Memphis International	Memphis, TN
MIA	Miami International	Miami, FL
MSP	Minneapolis-St. Paul International	Minneapolis, MN
ONT	Ontario International	Ontario, CA
ORD	Chicago O'Hare International	Chicago, IL
PHL	Philadelphia International	Philadelphia, PA
PHX	Phoenix Sky Harbor International	Phoenix, AZ
SDF	Louisville International	Louisville, KY
SEA	Seattle-Tacoma International	Seattle, WA
SFO	San Francisco International	San Francisco, CA
STL	Lambert-St. Louis International	St. Louis, MO

Attachment #2. Industry Cover Letter and Survey.

NORTH AMERICA ACI

AIRPORTS COUNCIL INTERNATIONAL

"The Voice of Airports"

To: Selected ACI-NA Official Representatives
From: R. Marchi
Subject: New Large Aircraft Survey
Date: September 16, 1997

FAA has been asked by Senator McCain to prepare an estimate of the costs which would be incurred by selected U. S. airports to bring the proposed New Large Aircraft (NLA) into service. FAA has asked ACI-NA to help gather this information and we are seeking your assistance in completing the attached survey.

The term "New Large Aircraft" is generally used to describe new products being considered by Boeing and Airbus which have wingspans and lengths substantially greater than today's 747-400 aircraft, will weigh up to 1.4 Million pounds and have seating capacities up to 500 - 800 passengers. The design standards which apply to these aircraft can be found in AC 150/5300-13, Design Group VI.

Your response to the survey should be prepared at a level of detail which is appropriate to planning studies. A full engineering cost analysis is not requested, but the estimates should be based on engineering cost factors used at your airport to support documents such as master plans, AIP preapplications, capital budgets, etc.

FAA has asked that you provide the cost estimates without regard for the difficulties that may exist at your airport in meeting the DG VI standard clearances when upgrading existing runways and taxiways. Where requested, you should provide the cost to widen runways or taxiways, relocate signs, re-mark, etc., even although you may not be able to achieve the recommended clearances to adjacent taxiways, buildings, etc. You should clearly note those cases where Design Group VI clearances cannot be maintained in your response.

We have been asked to expedite the information collection on this survey and would appreciate having your response by October 6, 1997 .

ACI-NA New Large Aircraft Survey

I. PRIMARY RUNWAY ENVIRONMENT. Upgrade your existing Boeing 747 primary runway to Design Group VI (DG VI) standards (width, shoulders, blast pads, entry fillets, lights, signs, etc.). In certain cases it may be more appropriate to construct a new DG VI runway (with parallel taxiway) rather than upgrading an existing runway. If that is the case at your airport, please provide the new runway cost estimate.

ASSUMPTIONS/INFORMATION: Assume existing runway lengths are adequate. For load bearing capacity, assume (a) existing runways are adequate and (b) new runways support the maximum takeoff operating weight of the Boeing 777-300. Section IV addresses bridges and culverts. For construction of a new DG VI runway/parallel taxiway, assume the site can support it, such as, sufficient separation.

INSTRUCTIONS FOR TABLES #1 and #2: Provide estimated costs for upgrades to existing runways under "Upgrade Primary Runway" in table #1. For design features currently satisfying DG VI standards, please state "Meets Stds." For construction costs for a new DG VI runway/parallel taxiway, use the column entitled "New DG VI Runway" in table #1 and for taxiway costs use the column entitled "New DG VI Taxiway Route" in table #2. For unlisted costs, such as, relocation costs for signs, lights, etc., use the row entry entitled "Other" and list the type of cost.

II. CROSSWIND RUNWAY ENVIRONMENT. Upgrade an existing crosswind runway to DG VI standards (width, shoulders, blast pads, entry fillets, lights, etc.) only if use of a crosswind runway is currently required to provide adequate wind coverage for existing Boeing 747 operations.

ASSUMPTIONS/INFORMATION: Use the same assumptions/information noted in section I.

INSTRUCTIONS FOR TABLE #1: Provide estimated costs for the runway in table #1 under the column entitled "Upgrade Crosswind Runway." For the supporting taxiway, provide costs in table #2 under the column "New DG VI Taxiway Route.". Use the same instructions as outlined in section I."

TABLE #1

ESTIMATED UPGRADE/NEW CONSTRUCTION COSTS: RUNWAY ENVIRONMENT IN HUNDRED-THOUSAND DOLLAR UNIT			
DESIGN FEATURE	UPGRADE PRIMARY RUNWAY	UPGRADE CROSSWIND RUNWAY	NEW DG VI RUNWAY
WIDTH			
SHOULDERS			
BLAST PADS			
OTHER List type of cost. For example, cost for new signs or lights.			
OTHER List type of cost.			

III. MINIMUM TAXIWAY ROUTE. Provide a single NLA taxi route meeting DG VI standards (width, shoulders, etc.) from the primary (and crosswind runway where necessary to achieve wind coverage) to the primary NLA terminal area. The majority of designated routes should result from upgrades as compared to new construction of an entire new taxi route. A single route implies separate takeoff/entrance and landing/exit taxi routes.

ASSUMPTIONS/INFORMATION: Assume (a) the designated taxiway meets the DG VI separation standards for taxiway to fixed/movable object standard, (b) no operational limitations on existing parallel taxiways (i.e., assume, except for new DG VI taxiway construction, adequate separation exists between existing parallel taxiways), and taxiway fillet design is based on cockpit over-centerline instead of judgmental over steering operations. (c)

INSTRUCTIONS FOR TABLE #2: Provide estimated costs for upgraded taxi routes under the column entitled "Upgrade Primary Route." For those items listed that satisfy DG VI standards, please state "Meets Stds." Provide estimated costs for a new taxi route under the column entitled "New DG VI Taxiway Route." Costs item for similar design features, that is, all straight taxiway sections, all taxiway intersections, etc., should be grouped together. For estimated costs for items not listed in table #2, use the row entry entitled "Other."

TABLE #2

ESTIMATED UPGRADE/NEW COSTS: TAXIWAY ROUTE(S) IN HUNDRED-THOUSAND DOLLAR UNITS			
DESIGN FEATURE		UPGRADE EXISTING TAXIWAY ROUTE	NEW DG VI TAXIWAY ROUTE
RUNWAY/ TAXIWAY EXITS Include number of exits. Include all exits as a single cost item.	1. FILLETS		
	2. LIGHTS AND/OR SIGNS Relocated, new.		
STRAIGHT TAXIWAY SECTIONS Include number of straight sections. Include all costs for straight sections as a single costs item.	PAVED WIDTH Std = 100 feet		
	SHOULDER WIDTH Std = 40 feet		

RUNWAY/ TAXIWAY EXITS Include number of exits. Include all exits as a single cost item.	1. FILLETS		
	TAXIWAY SAFETY AREA (TSA) WIDTH. Grading, clearing, etc. Std width = 262 feet (full width)		
	TAXIWAY OBJECT FREE AREA (OFA) WIDTH. Grading, clearing, etc. Std = 386 feet.		
	LIGHTS AND/OR SIGNS. Relocated, new.		
INTERSECTING TAXIWAYS Include number of intersections. Include all costs for intersections as a single cost item.	1. FILLETS		

RUNWAY/ TAXIWAY EXITS Include number of exits. Include all exits as a single cost item.	1. FILLETS		
	LIGHTS AND/OR SIGNS Relocated, new.		
OTHER			
List type of cost separately.			

IV. TAXIWAY/RUNWAY BRIDGE/CULVERTS. Upgrade the load bearing capacity and width of any bridge or culvert traversed by the NLA.

ASSUMPTIONS/INFORMATION: Assume (a) the maximum taxiing operating weight for NLA equals 1.4 million pounds and (b) the width of safety areas meet the relevant DG VI standards for (I) combination runway plus parallel taxiway, (ii) runway with no parallel taxiway, and (iii) single taxiway.

INSTRUCTIONS TABLE #3: Provide the estimated costs in table #3 to upgrade any or all of the above items. For runways and taxiways not traversing any bridge/culvert or for those items already satisfying the assumptions, please state "None Required" or "Meets Stds." For estimated costs items not listed, such as, relocation costs for signs, lights, etc., list their total cost separately under the row entry entitled "Other."

TABLE #3

ESTIMATED UPGRADE COSTS: RUNWAY/TAXIWAY BRIDGE AND/OR CULVERTS IN HUNDRED-THOUSAND DOLLAR UNITS			
DESIGN FEATURE	RUNWAY/PARALLEL TAXIWAY COMBINATION	RUNWAY WITHOUT PARALLEL TAXIWAY	TAXIWAY (Away from runway environment)
BRIDGE(S)			
CULVERT(S)			
OTHER List type of cost.			
OTHER List type of cost.			

V. TERMINAL/APRON IMPROVEMENTS. Select either (a) 2 NLA simultaneous operations or (b) more than 2 NLA simultaneous operations (state number) to provide the estimated costs for improvements to enplaning/deplaning facilities. Provide separate estimates for enplaning/deplaning facilities if international arrival facilities are NOT used for enplaning passengers. Estimated costs generally fall in two areas (a) aprons (strength, clearances, relocating taxilane/taxiways (if required), relocating fuel hydrants, etc.) and (b) terminals (larger departure lounges, additional bridges, relocation of adjacent gate positions, etc.)

ASSUMPTIONS/INFORMATION: Assume NLA will carry 500-800 passengers with the possibility to board/deplane passengers from (a) the main and upper decks and (b) forward and aft sections. Two cases for the number of NLA operations are offered to address market differences. Airports NOT expecting numerous NLA operations should use 2 NLAs for their estimated costs. Airports expecting a continued steady growth in the number of NLA operations should use a number that best fits their situation (please state the assumed number).

INSTRUCTIONS FOR TABLES #4: Provide the estimated costs in table #4. The table allows the airport authorities to report their estimated costs for either a single arrival/departure location (e.g., an international terminal used for both enplaning and deplaning) or for multiple arrival/departure locations (e.g., multiple dominant carrier operations).

TABLE #4

ESTIMATED UPGRADE COSTS: TERMINAL/APRON IN HUNDRED-THOUSAND DOLLAR UNIT			
	MAIN INTERNATIONAL TERMINAL (single facility for enplaning & deplaning)	SEPARATE CARRIER FACILITY TERMINAL #A	SEPARATE CARRIER FACILITY TERMINAL #B
AIRCRAFT PARKING POSITION STRENGTH UPGRADE			
APRON EXTENSION, For example, clearances, relocating existing taxi routes.			
AIRCRAFT GROUND SERVICING For example, fuel hydrants. List types separately.			

PASSENGER LOADING BRIDGES			
GATE AND HOLDING AREAS			
CUSTOM/ IMMIGRATION; AND WAITING AREA			
BAGGAGE PROCESSING AND CAROUSELS			
OTHER List type of cost.			
OTHER List type of cost.			

END

Attachment #3. Runway Environment.

IDENTIFIER RANK	DESIGN FEATURE	PRIMARY RUNWAY	CROSSWIND RUNWAY	NEW DG VI RUNWAY
ANC 11				
	Blast Pads	$1,000,000.00	$1,000,000.00	
	Other Costs	$1,800,000.00	$1,800,000.00	
	Shoulders	$2,000,000.00	$2,100,000.00	
	Width	$3,500,000.00	$3,700,000.00	
	Sum	**$8,300,000.00**	**$8,600,000.00**	
ATL 16				
	Blast Pads	$300,000.00		
	Other Costs	$500,000.00	$300,000.00	
	Shoulders	$1,200,000.00	$900,000.00	
	Width	$8,100,000.00	$6,100,000.00	
	Sum	**$10,100,000.00**	**$7,300,000.00**	
BDL 22				
	Blast Pads	$300,000.00	$600,000.00	
	Other Costs	$400,000.00	$400,000.00	
	Shoulders	$600,000.00	$2,500,000.00	
	Width	$0.00	$4,000,000.00	
	Sum	**$1,300,000.00**	**$7,500,000.00**	

BOS 9

Blast Pads	$1,500,000.00	$3,000,000.00	
Other Costs	$8,500,000.00	$6,000,000.00	
Shoulders	$0.00	$0.00	
Width	$15,000,000.00	$12,000,000.00	
Sum	**$25,000,000.00**	**$21,000,000.00**	

DEN 19

Blast Pads	$0.00		
Other Costs	$0.00		
Shoulders	$0.00		
Width	$0.00	$12,700,000.00	
Sum	**$0.00**	**$12,700,000.00**	

DFW 18

Blast Pads			
Other Costs		$2,599,200.00	
Shoulders		$1,235,000.00	
Width	$0.00		
Sum	**$0.00**	**$3,834,200.00**	

DTW 8

Blast Pads	$32,890.00		
Other Costs	$100,000.00		
Shoulders	$1,920,000.00		
Width	$0.00		
Sum	**$2,052,890.00**		

HNL 3

Blast Pads			
Other Costs			
Shoulders			
Width			
Sum			

IAD 6

Blast Pads			
Other Costs	$300,000.00	$300,000.00	
Shoulders	$3,600,000.00	$3,300,000.00	
Width	$7,500,000.00	$6,800,000.00	
Sum	**$11,400,000.00**	**$10,400,000.00**	

IAH 17

Blast Pads	$0.00	$0.00	$0.00
Other Costs	$0.00	$500,000.00	$0.00
Shoulders	$1,500,000.00	$1,000,000.00	$0.00
Width	$6,000,000.00	$4,000,000.00	$0.00
Sum	**$7,500,000.00**	**$5,500,000.00**	**$0.00**

JFK 2

Blast Pads			
Other Costs	$9,000,000.00	$7,000,000.00	$5,200,000.00
Shoulders	$9,300,000.00	$7,300,000.00	$5,400,000.00
Width	$0.00	$0.00	$0.00
Sum	**$18,300,000.00**	**$14,300,000.00**	**$10,600,000.00**

LAX 1

Blast Pads			
Other Costs			$35,782,000.00
Shoulders			
Width			$60,075,000.00
Sum			**$95,857,000.00**

MIA 5

Blast Pads			
Other Costs	$2,020,000.00	$1,670,000.00	
Shoulders	$4,330,000.00	$4,330,000.00	

Width			
Sum	**$6,350,000.00**	**$6,000,000.00**	

MSP 10

Blast Pads	$40,000.00		
Other Costs			
Shoulders	$400,000.00		
Width	$0.00		
Sum	**$440,000.00**		

ORD 7

Blast Pads	$0.00	$5,000,000.00	
Other Costs	$4,500,000.00	$4,500,000.00	
Shoulders	$10,500,000.00	$10,500,000.00	
Width	$0.00	$37,500,000.00	
Sum	**$15,000,000.00**	**$57,500,000.00**	

MEM 20

Blast Pads	$500,000.00	$500,000.00	
Other Costs			
Shoulders	$4,000,000.00	$500,000.00	
Width	$10,700,000.00	$9,500,000.00	
Sum	**$15,200,000.00**	**$10,500,000.00**	

MCO 13

Blast Pads			
Other Costs			
Shoulders			
Width			
Sum			

PHL 14

Blast Pads	$1,000,000.00		
Other Costs			
Shoulders	$3,700,000.00		
Width	$0.00		
Sum	**$4,700,000.00**		

PHX 21

Blast Pads	$600,000.00		
Other Costs	$900,000.00		
Shoulders	$3,300,000.00		
Width	$4,600,000.00		
Sum	**$9,400,000.00**		

SEA 12

Blast Pads	$300,000.00		
Other Costs	$7,600,000.00		
Shoulders	$2,800,000.00		
Width	$2,000,000.00		
Sum	**$12,700,000.00**		

STL 15

Blast Pads	$1,300,000.00		
Other Costs			
Shoulders	$5,300,000.00		
Width	$0.00		$576,000,000.00
Sum	**$6,600,000.00**		**$576,000,000.00**

SFO 4

Blast Pads			$2,000,000.00
Other Costs	$1,600,000.00		$2,718,000,000.00
Shoulders	$1,800,000.00		$5,000,000.00
Width	$6,600,000.00		$35,000,000.00
Sum	**$10,000,000.00**		**$2,760,000,000.00**

Grand Total	**$184,342,890.00**	**$165,134,200.00**	**$3,442,457,000.00**

Attachment #4. Taxiway Environment.

ID	RANK	DETAIL	DESIGN FEATURE	UPGRADE EXISITNG	NEW DG VI TAXIWAY
ANC	**11**				
		Fillets	Intersecting Taxiways	$4,000,000.00	
		Fillets	Runway/Taxiway	$3,000,000.00	
		Light & Signs	Straight Taxiway Sections	$300,000.00	
		Lights & Signs	Intersecting Taxiways		
		Lights & Signs	Runway/Taxiway	$500,000.00	
		Other	Other		
		Paved Width	Straight Taxiway Sections	$4,000,000.00	
		Shoulder Width	Straight Taxiway Sections	$2,000,000.00	
		Taxiway Object Free Area	Straight Taxiway Sections	$0.00	
		Taxiway Safety Area	Straight Taxiway Sections	$5,000,000.00	
		Sum		**$18,800,000.00**	
ATL	**16**				
		Fillets	Intersecting Taxiways	$1,200,000.00	
		Fillets	Runway/Taxiway	$0.00	
		Light & Signs	Straight Taxiway Sections		
		Lights & Signs	Intersecting Taxiways	$100,000.00	
		Lights & Signs	Runway/Taxiway	$0.00	
		Other	Other		
		Paved Width	Straight Taxiway Sections	$0.00	
		Shoulder Width	Straight Taxiway Sections	$0.00	
		Taxiway Object Free Area	Straight Taxiway Sections	$0.00	
		Taxiway Safety Area	Straight Taxiway Sections	$0.00	
		Sum		**$1,300,000.00**	
BDL	**22**				
		Fillets	Intersecting Taxiways		
		Fillets	Runway/Taxiway	$8,500,000.00	
		Light & Signs	Straight Taxiway Sections		$2,750,000.00
		Lights & Signs	Intersecting Taxiways		
		Lights & Signs	Runway/Taxiway	$4,250,000.00	
		Other	Other		

Paved Width	Straight Taxiway Sections		$16,200,000.00
Shoulder Width	Straight Taxiway Sections		$10,000,000.00
Taxiway Object Free Area	Straight Taxiway Sections		$500,000.00
Taxiway Safety Area	Straight Taxiway Sections		$400,000.00
Sum		**$12,750,000.00**	**$29,850,000.00**

BOS 9

Fillets	Intersecting Taxiways	$1,000,000.00	
Fillets	Runway/Taxiway	$3,000,000.00	
Light & Signs	Straight Taxiway Sections	$2,000,000.00	
Lights & Signs	Intersecting Taxiways		
Lights & Signs	Runway/Taxiway	$1,500,000.00	
Other	Other	$1,000,000.00	
Paved Width	Straight Taxiway Sections	$0.00	
Shoulder Width	Straight Taxiway Sections	$3,000,000.00	
Taxiway Object Free Area	Straight Taxiway Sections	$0.00	
Taxiway Safety Area	Straight Taxiway Sections	$1,000,000.00	
Sum		**$12,500,000.00**	

DEN 19

Fillets	Intersecting Taxiways		
Fillets	Runway/Taxiway	$0.00	
Light & Signs	Straight Taxiway Sections		
Lights & Signs	Intersecting Taxiways		
Lights & Signs	Runway/Taxiway	$0.00	
Other	Other		
Paved Width	Straight Taxiway Sections	$22,300,000.00	
Shoulder Width	Straight Taxiway Sections		
Taxiway Object Free Area	Straight Taxiway Sections		
Taxiway Safety Area	Straight Taxiway Sections		
Sum		**$22,300,000.00**	

DFW 18

Fillets	Intersecting Taxiways		
Fillets	Runway/Taxiway		
Light & Signs	Straight Taxiway Sections		
Lights & Signs	Intersecting Taxiways		

Lights & Signs	Runway/Taxiway		
Other	Other		
Paved Width	Straight Taxiway Sections		
Shoulder Width	Straight Taxiway Sections		
Taxiway Object Free Area	Straight Taxiway Sections		
Taxiway Safety Area	Straight Taxiway Sections		
Sum			

DTW 8

Fillets	Intersecting Taxiways	$0.00	
Fillets	Runway/Taxiway	$0.00	
Light & Signs	Straight Taxiway Sections	$1,000,000.00	
Lights & Signs	Intersecting Taxiways		
Lights & Signs	Runway/Taxiway	$1,000,000.00	
Other	Other		
Paved Width	Straight Taxiway Sections	$4,200,000.00	
Shoulder Width	Straight Taxiway Sections	$120,000.00	
Taxiway Object Free Area	Straight Taxiway Sections	$0.00	
Taxiway Safety Area	Straight Taxiway Sections	$0.00	
Sum		**$6,320,000.00**	

IAH 17

Fillets	Intersecting Taxiways	$600,000.00	$600,000.00
Fillets	Runway/Taxiway	$600,000.00	$0.00
Light & Signs	Straight Taxiway Sections	$1,000,000.00	$1,000,000.00
Lights & Signs	Intersecting Taxiways		
Lights & Signs	Runway/Taxiway	$1,000,000.00	$0.00
Other	Other		
Paved Width	Straight Taxiway Sections	$4,000,000.00	
Shoulder Width	Straight Taxiway Sections	$2,000,000.00	
Taxiway Object Free Area	Straight Taxiway Sections	$1,000,000.00	$1,000,000.00
Taxiway Safety Area	Straight Taxiway Sections	$0.00	$0.00
Sum		**$10,200,000.00**	**$2,600,000.00**

IAD 6

Fillets	Intersecting Taxiways		
Fillets	Runway/Taxiway	$4,400,000.00	
Light & Signs	Straight Taxiway Sections		
Lights & Signs	Intersecting Taxiways		
Lights & Signs	Runway/Taxiway	$1,300,000.00	
Other	Other		
Paved Width	Straight Taxiway Sections	$6,800,000.00	
Shoulder Width	Straight Taxiway Sections	$5,000,000.00	
Taxiway Object Free Area	Straight Taxiway Sections		
Taxiway Safety Area	Straight Taxiway Sections		
Sum		**$17,500,000.00**	

JFK 2

Fillets	Intersecting Taxiways		
Fillets	Runway/Taxiway	$14,300,000.00	
Light & Signs	Straight Taxiway Sections	$7,200,000.00	
Lights & Signs	Intersecting Taxiways		
Lights & Signs	Runway/Taxiway	$5,600,000.00	
Other	Other		
Paved Width	Straight Taxiway Sections	$0.00	
Shoulder Width	Straight Taxiway Sections	$35,100,000.00	
Taxiway Object Free Area	Straight Taxiway Sections		
Taxiway Safety Area	Straight Taxiway Sections		
Sum		**$62,200,000.00**	

LAX 1

Fillets	Intersecting Taxiways		
Fillets	Runway/Taxiway		
Light & Signs	Straight Taxiway Sections		
Lights & Signs	Intersecting Taxiways		
Lights & Signs	Runway/Taxiway		
Other	Other		$11,658,000.00
Paved Width	Straight Taxiway Sections		$31,675,000.00
Shoulder Width	Straight Taxiway Sections		
Taxiway Object Free Area	Straight Taxiway Sections		
Taxiway Safety Area	Straight Taxiway Sections		
Sum			**$43,333,000.00**

MEM 20

Fillets	Intersecting Taxiways	$2,000,000.00	
Fillets	Runway/Taxiway	$800,000.00	$400,000.00
Light & Signs	Straight Taxiway Sections	$500,000.00	
Lights & Signs	Intersecting Taxiways		
Lights & Signs	Runway/Taxiway	$300,000.00	
Other	Other		
Paved Width	Straight Taxiway Sections	$5,300,000.00	$3,000,000.00
Shoulder Width	Straight Taxiway Sections	$3,700,000.00	$800,000.00
Taxiway Object Free Area	Straight Taxiway Sections		
Taxiway Safety Area	Straight Taxiway Sections		
Sum		**$12,600,000.00**	**$4,200,000.00**

MIA 5

Fillets	Intersecting Taxiways		
Fillets	Runway/Taxiway	$49,800,000.00	
Light & Signs	Straight Taxiway Sections	$1,200,000.00	
Lights & Signs	Intersecting Taxiways		
Lights & Signs	Runway/Taxiway	$370,000.00	
Other	Other		
Paved Width	Straight Taxiway Sections	$0.00	
Shoulder Width	Straight Taxiway Sections	$0.00	
Taxiway Object Free Area	Straight Taxiway Sections		
Taxiway Safety Area	Straight Taxiway Sections		
Sum		**$51,370,000.00**	

MSP 10

Fillets	Intersecting Taxiways		
Fillets	Runway/Taxiway	$0.00	
Light & Signs	Straight Taxiway Sections		
Lights & Signs	Intersecting Taxiways		
Lights & Signs	Runway/Taxiway	$300,000.00	
Other	Other		
Paved Width	Straight Taxiway Sections	$1,200,000.00	
Shoulder Width	Straight Taxiway Sections	$600,000.00	
Taxiway Object Free Area	Straight Taxiway Sections	$0.00	

Taxiway Safety Area	Straight Taxiway Sections	$600,000.00	
Sum		**$2,700,000.00**	

ORD 7

Fillets	Intersecting Taxiways		
Fillets	Runway/Taxiway	$24,000,000.00	
Light & Signs	Straight Taxiway Sections		
Lights & Signs	Intersecting Taxiways		
Lights & Signs	Runway/Taxiway	$9,000,000.00	
Other	Other		
Paved Width	Straight Taxiway Sections	$36,000,000.00	
Shoulder Width	Straight Taxiway Sections	$25,500,000.00	
Taxiway Object Free Area	Straight Taxiway Sections		
Taxiway Safety Area	Straight Taxiway Sections		
Sum		**$94,500,000.00**	

PHL 14

Fillets	Intersecting Taxiways	$2,500,000.00	
Fillets	Runway/Taxiway	$0.00	
Light & Signs	Straight Taxiway Sections	$0.00	
Lights & Signs	Intersecting Taxiways	$0.00	
Lights & Signs	Runway/Taxiway	$0.00	
Other	Other		
Paved Width	Straight Taxiway Sections	$0.00	
Shoulder Width	Straight Taxiway Sections	$0.00	
Taxiway Object Free Area	Straight Taxiway Sections	$0.00	
Taxiway Safety Area	Straight Taxiway Sections	$0.00	
Sum		**$2,500,000.00**	

PHX 21

Fillets	Intersecting Taxiways	$600,000.00	
Fillets	Runway/Taxiway		
Light & Signs	Straight Taxiway Sections		
Lights & Signs	Intersecting Taxiways		
Lights & Signs	Runway/Taxiway	$2,000,000.00	

Other	Other		
Paved Width	Straight Taxiway Sections	$10,300,000.00	
Shoulder Width	Straight Taxiway Sections	$3,700,000.00	
Taxiway Object Free Area	Straight Taxiway Sections	$0.00	
Taxiway Safety Area	Straight Taxiway Sections	$0.00	
Sum		**$16,600,000.00**	

SEA 12

Fillets	Intersecting Taxiways		
Fillets	Runway/Taxiway	$4,200,000.00	
Light & Signs	Straight Taxiway Sections		
Lights & Signs	Intersecting Taxiways		
Lights & Signs	Runway/Taxiway	$2,400,000.00	
Other	Other		
Paved Width	Straight Taxiway Sections		$42,000,000.00
Shoulder Width	Straight Taxiway Sections		
Taxiway Object Free Area	Straight Taxiway Sections		
Taxiway Safety Area	Straight Taxiway Sections		
Sum		**$6,600,000.00**	**$42,000,000.00**

SFO1 4

Fillets	Intersecting Taxiways	$1,300,000.00	
Fillets	Runway/Taxiway	$1,000,000.00	
Light & Signs	Straight Taxiway Sections	$3,000,000.00	
Lights & Signs	Intersecting Taxiways	$400,000.00	
Lights & Signs	Runway/Taxiway	$200,000.00	
Other	Other		
Paved Width	Straight Taxiway Sections	$6,800,000.00	
Shoulder Width	Straight Taxiway Sections	$7,000,000.00	
Taxiway Object Free Area	Straight Taxiway Sections		
Taxiway Safety Area	Straight Taxiway Sections		
Sum		**$19,700,000.00**	

SFO2 4

Fillets	Intersecting Taxiways	$3,000,000.00	
Fillets	Runway/Taxiway	$1,600,000.00	
Light & Signs	Straight Taxiway Sections	$6,000,000.00	
Lights & Signs	Intersecting Taxiways	$1,000,000.00	
Lights & Signs	Runway/Taxiway	$400,000.00	

Other	Other		
Paved Width	Straight Taxiway Sections	$16,300,000.00	
Shoulder Width	Straight Taxiway Sections	$15,000,000.00	
Taxiway Object Free Area	Straight Taxiway Sections		
Taxiway Safety Area	Straight Taxiway Sections		
Sum		**$43,300,000.00**	

SFO3 4

Fillets	Intersecting Taxiways	$3,700,000.00	$1,700,000.00
Fillets	Runway/Taxiway	$1,600,000.00	$1,600,000.00
Light & Signs	Straight Taxiway Sections	$10,000,000.00	
Lights & Signs	Intersecting Taxiways	$1,200,000.00	$600,000.00
Lights & Signs	Runway/Taxiway	$400,000.00	$400,000.00
Other	Other		$34,000,000.00
Paved Width	Straight Taxiway Sections	$22,300,000.00	$19,000,000.00
Shoulder Width	Straight Taxiway Sections	$20,000,000.00	$6,000,000.00
Taxiway Object Free Area	Straight Taxiway Sections		
Taxiway Safety Area	Straight Taxiway Sections		
Sum		**$59,200,000.00**	**$63,300,000.00**

STL 15

Fillets	Intersecting Taxiways		
Fillets	Runway/Taxiway	$1,300,000.00	$576,000,000.00
Light & Signs	Straight Taxiway Sections	$1,000,000.00	
Lights & Signs	Intersecting Taxiways	$1,000,000.00	
Lights & Signs	Runway/Taxiway	$1,000,000.00	
Other	Other		
Paved Width	Straight Taxiway Sections	$0.00	
Shoulder Width	Straight Taxiway Sections	$5,300,000.00	
Taxiway Object Free Area	Straight Taxiway Sections	$2,000,000.00	
Taxiway Safety Area	Straight Taxiway Sections	$0.00	
Sum		**$11,600,000.00**	**$576,000,000.00**

Grand Total **$484,540,000.00** **$761,283,000.00**

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ATTACHMENT #5. Terminal and Apron Environments.

IDENTIFIER	RANK	Area	Main International Terminal	Separate Facility
ANC	11			
		Apron	$5,400,000.00	
		Other		
		Terminal	$4,000,000.00	
ATL	16			
		Apron	$100,000.00	
		Other		
		Terminal	$12,300,000.00	
BDL	22			
		Apron		
		Other		
		Terminal		
BOS	9			
		Apron	$14,000,000.00	
		Other	$6,000,000.00	
		Terminal	$7,000,000.00	
DEN	19			
		Apron	$200,000.00	
		Other		
		Terminal	$1,600,000.00	
DFW	18			
		Apron		
		Other		
		Terminal		
DTW	8			
		Apron	$0.00	
		Other		
		Terminal	$0.00	

IDENTIFIER	RANK	Area	Main International Terminal	Separate Facility
IAH	17			
		Apron	$29,000,000.00	
		Other		
		Terminal	$335,000,000.00	
IAD	6			
		Apron		
		Other		
		Terminal		
JFK	2			
		Apron		
		Other		
		Terminal		
LAX	1			
		Apron	$17,040,000.00	
		Other	$4,600,000.00	
		Terminal	$154,000,000.00	
MEM	20			
		Apron	$13,000,000.00	
		Other		
		Terminal	$14,000,000.00	
MIA	5			
		Apron	$7,300,000.00	
		Other	$6,300,000.00	
		Terminal	$8,400,000.00	
MSP	10			
		Apron	$200,000.00	
		Other	$29,800,000.00	
		Terminal		

IDENTIFIER	RANK	Area	Main International Terminal	Separate Facility
ORD	7			
		Apron	$9,750,000.00	
		Other	$33,000,000.00	
		Terminal	$21,000,000.00	
PHL	14			
		Apron	$1,100,000.00	
		Other		
		Terminal	$12,250,000.00	
PHX	21			
		Apron	$6,100,000.00	
		Other	$1,700,000.00	
		Terminal	$20,900,000.00	
SEA	12			
		Apron	$40,000,000.00	
		Other	$5,000,000.00	
		Terminal	$71,000,000.00	
SFO	4			
		Apron		$47,000,000.00
		Other		$9,000,000.00
		Terminal		
STL	15			
		Apron	$17,000,000.00	
		Other		
		Terminal	$31,500,000.00	