

GAO

Report to the Chairman, Subcommittee  
on Aviation, Committee on  
Transportation and Infrastructure,  
House of Representatives

May 2006

# COMMERCIAL AVIATION

## Costs and Major Factors Influencing Infrastructure Changes at U.S. Airports to Accommodate the New A380 Aircraft



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# Highlights

Highlights of [GAO-06-571](#), a report to Chairman, Subcommittee on Aviation, Committee on Transportation and Infrastructure

## Why GAO Did This Study

Airbus S.A.S (Airbus), a European aircraft manufacturer, introduced a new aircraft, the A380 that will be the largest passenger aircraft in the world with expected delivery to its first customers in late 2006. The A380 has a double deck and is expected to seat between 555 and 853 passengers. The A380 is much larger than its competitors with a wingspan of 262 feet, a tail fin about 80 feet high, and a maximum takeoff weight of over 1.2 million pounds. A freight version of the A380 is scheduled for delivery in 2008.

Because of the size of the A380, U.S. airports have to make changes to accommodate the aircraft. This may include widening runways and taxiways, or restructuring gate areas to accommodate the additional passengers. This report examines (1) the costs and nature of the changes U.S. airports are making to their infrastructure to accommodate the A380, (2) the funding sources being used to finance these changes, and (3) the major factors influencing the changes being made.

The Federal Aviation Administration (FAA) and Airbus provided technical comments on the report. Airbus also commented on the 18 airports' cost estimates of the changes being made for the A380 and estimated \$720 million for these changes. Based on the costs airports reported initially and our subsequent reconfirmation efforts, we did not change the cost estimates provided by the airports.

[www.gao.gov/cgi-bin/getrpt?GAO-06-571](http://www.gao.gov/cgi-bin/getrpt?GAO-06-571).

To view the full product, including the scope and methodology, click on the link above. For more information, contact Gerald Dillingham at (202) 512-2834, or [dillingham@gao.gov](mailto:dillingham@gao.gov).

## COMMERCIAL AVIATION

# Costs and Major Factors Influencing Infrastructure Changes at U.S. Airports to Accommodate the New A380 Aircraft

## What GAO Found

The 18 U.S. airports that GAO identified as making changes to accommodate the Airbus A380 estimated that they would spend about \$927 million in completed, ongoing, or planned infrastructure projects. About 83 percent of the costs reported were identified for runway or taxiway projects. The remaining costs were for changes at gates, terminals, or support services. Some airports noted that if FAA changed the current runway requirements for accommodating the A380, their plans and estimates would change. For example, if FAA allows the aircraft to operate on 150-foot-wide runways under certain conditions, this would reduce costs at most airports. However, if FAA decided that more stringent standards should apply, at least half of the airports could face costs in excess of those reported.

Airport officials reported using several sources to finance the infrastructure changes. About 50 percent of the costs would be financed through federal grants under the Airport Improvement Program, they said. Passenger facility charges were identified as the source of financing for about 21 percent of the costs, with 29 percent from airport revenues, bonds, and other sources.

FAA's design standards and market considerations have been two major factors influencing the A380 changes at airports. For example, airports generally based their plans and estimates on either FAA standards that require 200-foot-wide runways and 100-foot-wide taxiways for this size aircraft or FAA's interim guidance. The guidance allows the conversion of existing 150-foot-wide runways to 200 feet by adding 25 feet of reduced strength pavement to each side and extending the shoulders and allows use of 75-foot taxiways by widening shoulders and adding center lights. Airports are also making changes based on the market they serve. For example, Los Angeles, Miami, New York, and San Francisco are major gateway airports that had little choice but to make changes to receive the A380 if they were to maintain their competitive status. Other airports have been approached with plans for future A380 passenger or freight service and weighed the costs of making infrastructure changes against the potential impact on their business. Still others have not been approached for A380 service but are making changes to accommodate it so that they can market their availability for this aircraft and potentially increase their international market presence.

The Airbus A380 in Flight



Source: Airbus.

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## **Abbreviations**

DOT	Department of Transportation
FAA	Federal Aviation Administration

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United States Government Accountability Office  
Washington, DC 20548

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May 19, 2006

The Honorable John Mica  
Chairman  
Subcommittee on Aviation  
Committee on Transportation and Infrastructure  
House of Representatives

Dear Mr. Chairman:

Airbus S.A.S. (Airbus), a European aircraft manufacturer, is introducing a new aircraft called the A380 that will be the largest passenger aircraft in the world.<sup>1</sup> The A380 has a double deck and is expected to seat from about 555 to 853 passengers. The largest commercial aircraft in use today, the Boeing 747, generally seats 416 passengers. The A380 is much larger than its competitors, with a wingspan of about 262 feet, a tail fin reaching 80 feet high, and a maximum takeoff weight in excess of 1.2 million pounds. The A380 is currently undergoing certification tests prior to its expected delivery to air carriers in late 2006. A freight version of the aircraft, the A380F, is to follow in 2008. Airbus has orders from 16 air carriers for 159 passenger and freight aircraft. The only U.S. air carrier customers to date are Federal Express and UPS, which have each ordered 10 A380F aircraft.<sup>2</sup>

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<sup>1</sup>Airbus is incorporated as a simplified joint stock company or S.A.S. (Société par Actions Simplifiée).

<sup>2</sup>The International Lease Finance Corporation, a U.S. company, ordered five A380 passenger and five A380F freight aircraft and plans to lease these aircraft to air carriers across the world. No U.S. customers have been announced.

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**Figure 1: Depiction of the Airbus A380 Aircraft**



Source: Airbus.

Because of the size of the A380, it is subject to the Federal Aviation Administration's (FAA) design standards for the largest aircraft (Airplane Design Group VI standards), which require 200-foot-wide runways and 100-foot-wide taxiways. However, FAA has reviewed the specification of the A380 and in 2003 issued interim guidance—Engineering Briefs 65 and 63—which would allow airports to convert existing 150-foot-wide runways to 200 feet by widening them 25 feet on each side at a lesser strength than required under Design Group VI standards and widening runway shoulders. FAA's guidance also allows the A380 aircraft to operate at airports with 75-foot-wide taxiways, if they widen the shoulders and impose certain operating restrictions on the aircraft.

In 2002, we reported that 14 airports had estimated that it would cost them more than \$2 billion dollars to upgrade their infrastructure to receive new large aircraft like the A380.<sup>3</sup> However, at that time, we noted that determining the cost to serve these aircraft was difficult because a number of important issues affecting the infrastructure changes that airports

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<sup>3</sup>GAO, *Airport Infrastructure: Unresolved Issues Make It Difficult to Determine the Cost to Serve New Large Aircraft*, [GAO-02-251](#) (Washington, D.C.: Feb. 4, 2002).

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needed to make were unresolved. Since that time, FAA has issued interim guidance to airports addressing some of these issues and has granted Modifications of Standards to some airports planning to receive the A380.<sup>4</sup> Air carriers have also placed orders and contacted a number of U.S. airports about their plans for the A380 arrival.

With the first scheduled A380 flights to the U.S. expected in 2007, a number of airports have made, or are planning to make, changes to their infrastructure to better accommodate this aircraft. You asked us to review and identify the impact of the Airbus A380 on U.S. airports. In examining this issue, we addressed the following questions: (1) What are the costs and nature of changes that U.S. airports are making to their infrastructure to accommodate the A380 aircraft? (2) What funding sources are being used to finance the infrastructure changes at U.S. airports? (3) What major factors influence the changes being made by airports to accommodate the A380 aircraft? On March 16, 2006, we briefed your staff on the results of our work to date. Appendix I contains an updated and modified version of the materials we presented at that time.

To answer these questions, we sent a survey in August 2005 to officials at 18 airports that we identified as making preparations to receive the A380. We asked airport officials to estimate the costs for those infrastructure changes that have been completed, are ongoing, or are planned to accommodate the A380. We also asked officials at each airport to identify the sources of funding used to make the changes identified. We received responses from all 18 airports. We did not verify the accuracy of the airports' estimates. However, after we received the responses to our surveys, we visited officials at each airport to review the cost estimates, the assumptions that the airports used in developing their estimates, and the major factors affecting their cost estimates. In addition, we contacted each airport again to update and validate its costs as of March 1, 2006. We also reviewed the 68 requests for modifications to FAA's standards that 11 airports had submitted as of March 1, 2006, to identify what was being proposed and what FAA had approved or denied. We also interviewed aviation association representatives, FAA officials, and aviation experts. We performed our work from May 2005 through April 2006 in accordance with generally accepted government auditing standards. Additional details on our scope and methodology can be found in appendix II.

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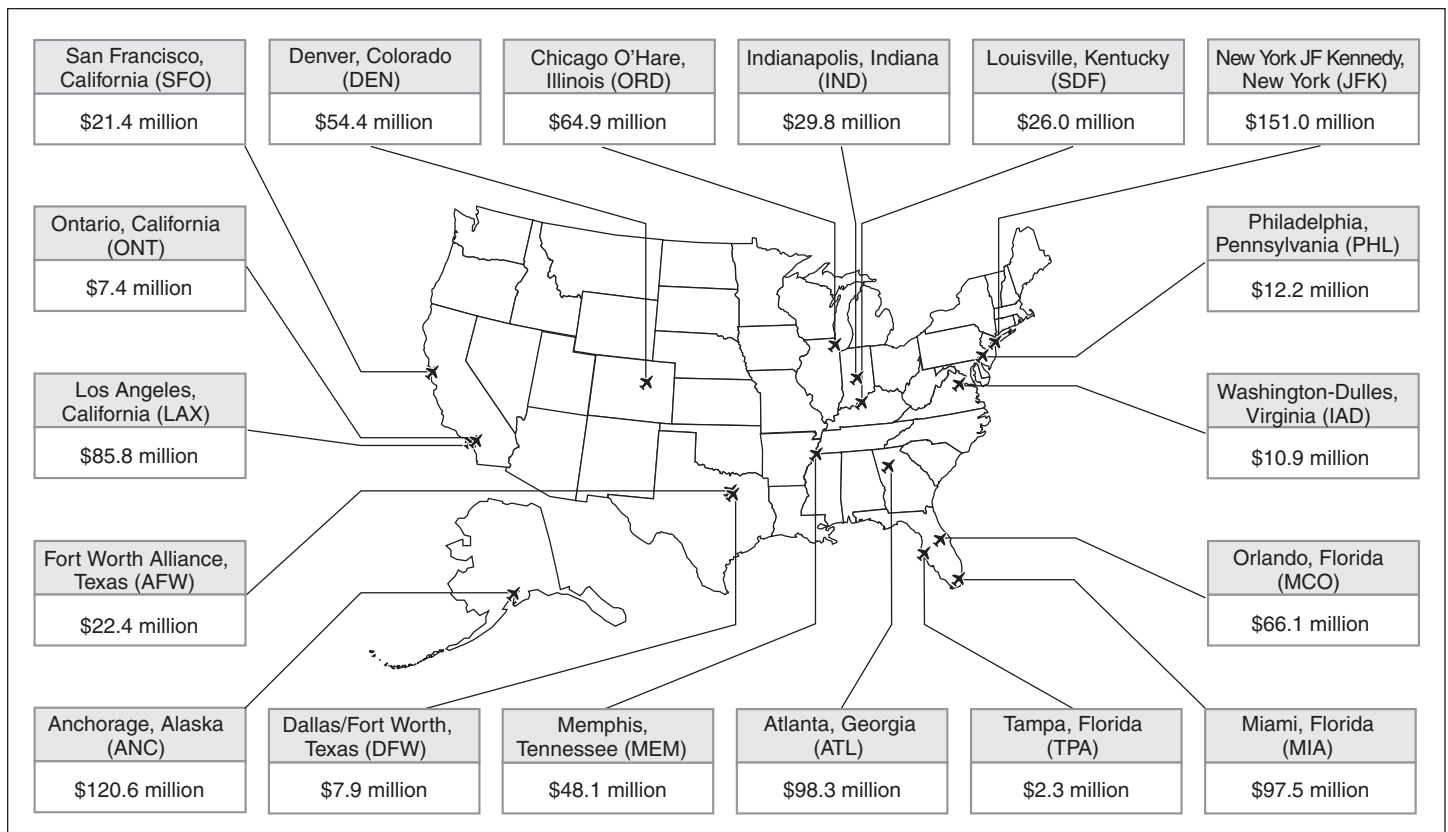
<sup>4</sup>A Modification of Standard is any deviation from the established FAA standards to accommodate a unique condition that must be reviewed and approved by FAA.



## Results in Brief

The 18 U.S. airports that we identified as making changes to accommodate the Airbus A380 estimated that they would spend about \$927 million in completed, ongoing, or planned infrastructure projects. Figure 2 shows the costs reported by each airport. Additional details on each airport's estimated costs and the assumptions used in developing the cost estimates can be found in appendix III.

**Figure 2: Costs Reported by Airports for Infrastructure Changes Needed to Accommodate the A380 (as of March 1, 2006)**



Source: GAO.

About 83 percent of the costs reported by airports were identified for runway or taxiway projects. The remaining costs were for changes at gates, terminals, or support services. Of the A380 costs reported, about 18 percent had been spent on completed projects, about 22 percent were allocated to ongoing projects, and about 60 percent were identified for planned projects. As a result, some airports noted that if FAA changed the current requirements for accommodating the A380, their estimates could

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change. For example, should FAA allow the aircraft to operate on 150-foot-wide runways under certain conditions, this would reduce costs at most airports. However, if FAA decided during the certification process, or later, that Design Group VI standards should apply, at least half of the airports could face costs in excess of those reported.

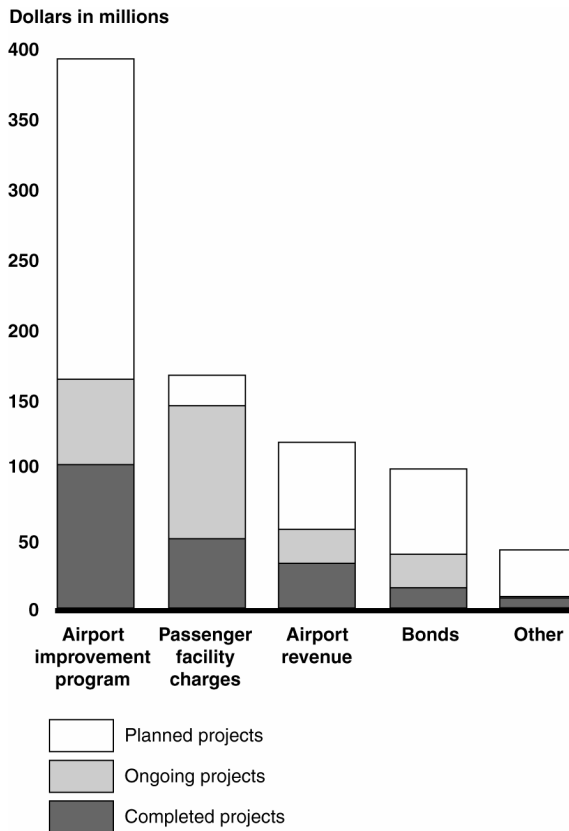
Airport officials reported using several funding sources to finance their infrastructure changes. As shown in Figure 3, about half of the funds would be provided through the Airport Improvement Program, they said.<sup>5</sup> Passenger facility charges were identified as the source of funding for about 21 percent of the costs, with revenues the airports generate, bonds, and other sources, such as local government funds, making up the remainder.<sup>6</sup>

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<sup>5</sup>Airport Improvement Program funding is a federal grant-in-aid program that represents a major source of funding for airport development and planning.

<sup>6</sup>Passenger facility charges are fees of up to \$4.50 for every enplaned passenger at commercial airports, which fund airport projects that enhance safety, security, capacity, reduce noise, or increase air carrier competition.

**Figure 3: Sources of Funding Reported by Airports for Changes to Accommodate the A380**



Source: GAO analysis of costs reported by the airports.

Note: The figure shows sources of funding for about \$813 million of the \$927 million in infrastructure changes reported by airports. Airports did not report the sources for the remaining \$114 million.

FAA’s design standards and market considerations have been two major factors influencing the changes airports are making or planning to make to accommodate the A380. For example, in identifying the infrastructure changes, airports generally based their plans on either (1) the 200-foot-wide runway and 100-foot-wide taxiway requirements for this size aircraft under Airplane Design Group VI standards or (2) the Engineering Brief guidance FAA issued, allowing airports to widen narrower runways to 200 feet albeit at reduced strength and requiring widened runway and taxiway shoulders and operational restrictions. A number of airport officials noted that they might revise their plans if FAA makes decisions later this year as part of the certification process for the A380 that allows them to use

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existing 150-foot-wide runways and 75-foot-wide taxiways for the A380. In addition, FAA has been using a Modification of Standards process to review and approve A380-related infrastructure changes with some airports. As of March 1, 2006, 11 airports had submitted 68 requests for Modifications of Standards to FAA, of which 47 were approved, 10 disapproved, and 11 were under consideration. Appendix IV contains further information on the requested Modifications of Standards. We also found that some airports are making changes to accommodate the A380 based on the market they serve and their future plans for the airport. For example, Los Angeles, Miami, New York, and San Francisco are major gateway airports that had little choice but to make changes to receive the A380 if they were to maintain their competitive status as international hubs. A number of other airports have been approached by air carriers with plans for future A380 passenger or freight service. These airports have considered the costs of making the necessary infrastructure changes against the potential impact on their business of receiving (or not receiving) A380 flights. Some other airports that have not been approached for A380 service are also making changes to accommodate it. Some of these airports want to market their availability for this aircraft in hopes of increasing their presence in the international market.

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## Agency Comments and Our Evaluation

We provided a draft of this report to the Department of Transportation (DOT) and Airbus North America Holdings, Inc. (Airbus) for their review and comment. FAA (which is part of DOT) and Airbus provided technical comments which we incorporated into the report as appropriate.

The Programs Director of Safety and Technical Affairs – Airbus, also provided written comments that are included in appendix V. Airbus commended us for our efforts in providing a comprehensive assessment of the infrastructure changes the U.S. airports have undertaken, or may undertake, to accommodate the A380. The Airbus response also included comments on each of the 18 airports in this report. It provided a total cost estimate for A380 modifications at these airports of \$720 million, compared to the \$927 million we are reporting.

We recognize that it was difficult for airports to estimate the cost of infrastructure changes being made to accommodate the A380. For example, airports had to decide which projects were being done for the A380, while recognizing that some changes would also benefit other aircraft. In developing our \$927 million estimate, we sent a survey to the 18 airports, which completed the document and returned it. After analyzing the responses, we visited each airport to discuss the basis for their

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responses and to ensure that the appropriate costs were included. We again contacted each airport to confirm the information as of March 1, 2006. We also recognize that the estimates contained in this report could change over time. As the report notes, should FAA allow the aircraft to operate on existing 150-foot-wide runways under certain conditions, costs could be reduced at most airports. However, if FAA should decide during the certification process, or later, that Design Group VI standards should apply, at least half of the airports could face costs in excess of those reported. Based on the information that we originally received from the airports and subsequent reconfirmation efforts, we have not changed the costs estimates provided to GAO by the airports.

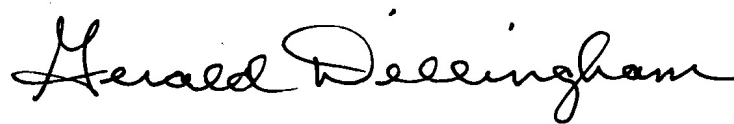
The Airbus comments can be found in appendix V.

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As agreed with your office, unless you publicly announce the contents of this report earlier, we plan no further distribution until 10 days from the report date. At that time, we will send copies of this report to appropriate congressional committees, the Secretary of Transportation, and representatives of Airbus. We also will make copies available to others upon request. In addition, this report will be available at no charge on the GAO Web site at <http://www.gao.gov>.

If you have any questions about this report, please contact me at (202) 512-2834 or by e-mail at [dillingham@gao.gov](mailto:dillingham@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Contributors to this report are listed in appendix VI.

Sincerely yours,



Gerald Dillingham, Ph.D.  
Director, Physical Infrastructure Issues

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# Appendix I: Infrastructure Changes at U.S. Airports to Accommodate the A380 Aircraft

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## Infrastructure Changes at U.S. Airports to Accommodate the A380

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Source: Airbus.

Briefing for House Committee on Transportation and Infrastructure

March 16, 2006

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Research Questions

1. What are the costs and nature of changes that U.S. airports are making to their infrastructure to accommodate the A380 aircraft?
2. What funding sources are being used to finance the infrastructure changes at U.S. airports?
3. What major factors influence the changes being made by airports to accommodate the A380 aircraft?



## Methods

- Identified a universe of potential A380 airports by calling selected airports to determine if they were making changes to infrastructure in anticipation of receiving the A380. Eighteen airports indicated that they had made or were planning to make such infrastructure changes.
- Surveyed the 18 U.S. airports that were making or planning to make infrastructure changes to obtain information on nature and costs of the changes.
- Visited and interviewed airport management at 18 airports and met with Federal Aviation Administration (FAA) officials to identify the infrastructure changes and funding to accommodate the A380.
- Reviewed the design standards (Airplane Design Group VI standards and those contained in Engineering Briefs 63 and 65) that FAA applies to the airports receiving the A380 and results of FAA's process for reviewing and approving Modifications of Standards, while maintaining safety at those airports.
- Interviewed FAA airport and certification officials; aviation experts; and representatives from Airbus, Boeing, and various trade associations.



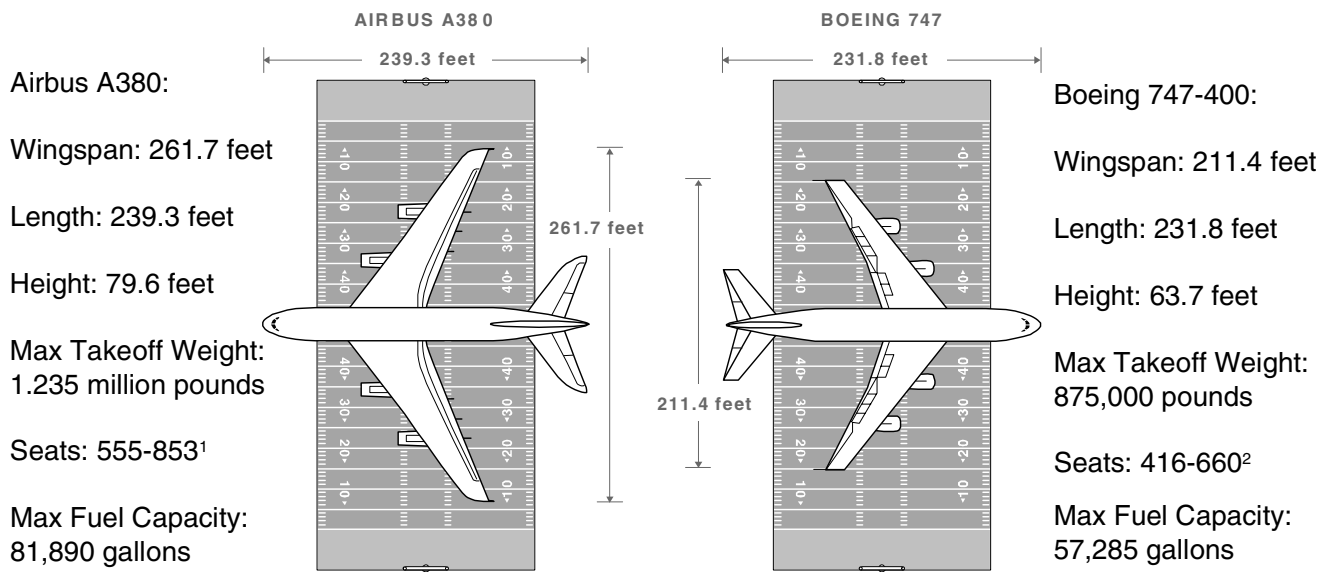


- A380 passenger aircraft characteristics
  - Maximum takeoff weight: 1.235 million pounds
  - Range: 8,000 nautical miles
  - Estimated in-service date: End of 2006
  
- A380F freighter aircraft characteristics
  - Payload: 331,000 pounds
  - Maximum takeoff weight: 1.3 million pounds
  - Range: 5,600 nautical miles
  - Estimated in-service date: 2<sup>nd</sup> half of 2008



Source: Airbus.

Figure 1: Comparison of the Airbus A380 and the Boeing 747-400



Source: GAO.

<sup>1</sup> The A380 is designed to seat 555 passengers in a 3-class cabin configuration. Airbus plans to certify the A380 to seat a maximum of 853 passengers. The actual number of seats on the aircraft will vary depending on the desires of the airline owners.

<sup>2</sup> The 747-400 typically seats 416 passengers in a 3-class cabin configuration. The 747-400 is certified to seat a maximum of 660 passengers.



Background

- Sixteen air carriers worldwide have ordered the passenger and freight versions of the A380.
- No U.S. carriers have ordered the passenger version of the A380.
- Two U.S. carriers, Federal Express and UPS, have each ordered 10 of the freight (A380F) aircraft.

Figure 2: A380 passenger and freight version orders, as of January 27, 2006

Customer	Orders	
	A380	A380F
Air France	10	
China Southern Airlines Group	5	
Emirates	41	2
Etihad Airways	4	
Federal Express		10
International Lease Finance Corporation	5	5
Kingfisher Airlines	5	
Korean Air	5	
Lufthansa	15	
Malaysia Airlines	6	
Qatar Airways	2	
Qantas Airways	12	
Singapore Airlines	10	
Thai Airways	6	
UPS		10
Virgin Atlantic	6	
	132 A380	27 A380F
<b>16 customers</b>	<b>159 orders</b>	

Source: Airbus.



- Advantages of the A380 cited by Airbus, include:
  - More cost-effective (lower cost per seat and more fuel efficient)
  - Increased airport capacity (more passengers per flight)
  - Half the noise of existing large aircraft and lower emissions



Source: Airbus.



- The introduction of the A380 is expected to generate benefits to airports and nearby communities in increased revenue from concessions and parking fees from the additional passengers that the A380 is expected to carry. However, airport authorities will incur costs to alter their runways, taxiways, and gates to accommodate the aircraft.
- The Port Authority of New York and New Jersey contracted for an assessment of the A380's impact on New York's Kennedy airport.<sup>3</sup> The study, which included a primary analysis and two sensitivity analyses to test the effect of alternative assumptions, found that:
  - The project would generate positive net benefits (benefits minus costs) of about \$55 million (in present value terms). For example, the study estimated that the additional revenue generated by the project would equal about \$163 million while the costs associated with airfield improvements would be about \$108 million.
  - The study also found that the magnitude of the estimated net benefits are sensitive to the planned schedule of the project. In one sensitivity analysis, delays of 2 years in the state-of-good-repair and new-large-aircraft projects would result in estimated costs outweighing benefits by \$4.5 million. In the second sensitivity analysis, a delay in only the new-large-aircraft portion of the project would result in estimated benefits outweighing costs by about \$6.3 million.
- The Florida Department of Transportation has authorized an assessment of the A380's impact on state and local economies. It would focus on measuring the impact of the project on construction jobs and revenue, aircraft operations, and visitors.

<sup>3</sup>Economic Assessment of the Airfield Improvements Necessary to Accommodate the New Large Aircraft at John F. Kennedy International Airport (Ricondo and Associates, February, 2004).



## Background

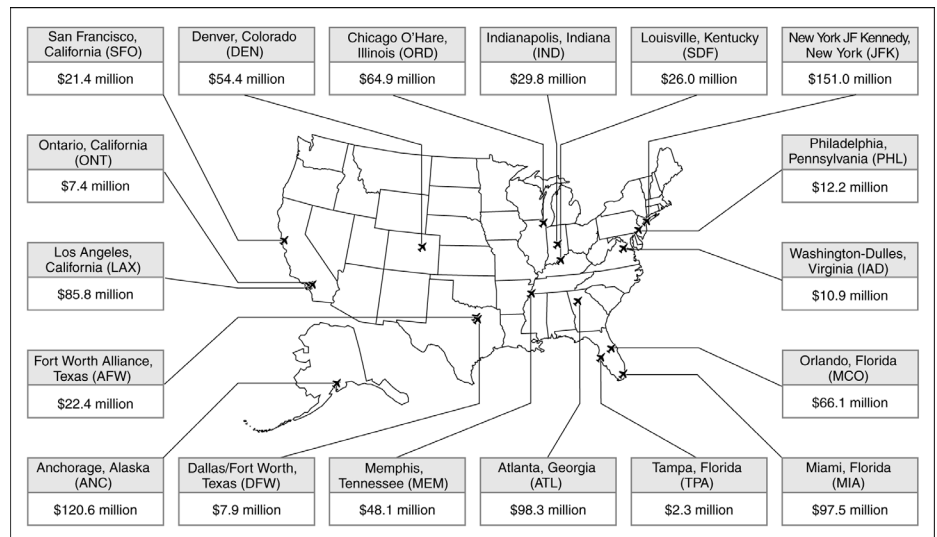
- The size of the A380 makes U.S. airports that receive it subject to FAA's Airplane Design Group VI standards, which require, among other things, greater separation between taxiways, taxiways and runways, and in terms of infrastructure, 200-foot-wide runways and 100-foot-wide taxiways. Many of the U.S. airports that anticipate receiving the A380 do not meet FAA's Design Group VI standards, although half of the A380 airports we surveyed have at least one 200-foot-wide runway.
- FAA developed guidance (called Engineering Briefs) for airports that allow a reduced-cost means of creating a 200-foot-wide runway by adding 25 feet to each side of existing 150-foot-wide runways at a reduced strength, widening shoulders, and moving existing runway edge lighting and edge markings outward. Existing 75-foot-wide taxiways can be used under specified conditions, such as widening shoulders and installing additional centerline lighting. The Engineering Brief regarding taxiways indicates that the guidance is good for 5 years.
- Officials at the FAA have been examining aspects of the standards that could impact the A380 requirements. For example,
  - In February, FAA decided to remove the 15-mile-per-hour taxiing speed restriction for the A380 that it had imposed under the Engineering Brief. The FAA took this step based on field research conducted at JFK, ANC, and other international airports expected to serve the A380.
  - FAA reduced the Design Group VI distance between runway and taxiway centerlines from 600 to 500 feet in good weather and from 600 to 550 feet for operations in more restricted weather conditions. FAA took these steps because simulated tests indicated that the 747 and the A340 aircraft, which are similar to the A380, generally do not deviate significantly from the runway centerline.
  - During the airplane certification process, FAA will determine operating requirements that may apply to the A380 on runways less than 200 feet wide. A decision is expected in late 2006.



Nature and Cost of U.S. Airports' Changes to Accommodate the A380

- We identified 18 U.S. airports that are making or planning to make infrastructure changes to accommodate the A380.
- Costs reported by the airports for these changes total about \$927 million.

Figure 3: Cost Reported by Airports for Infrastructure Changes Needed to Accommodate the A380, as of March 1, 2006



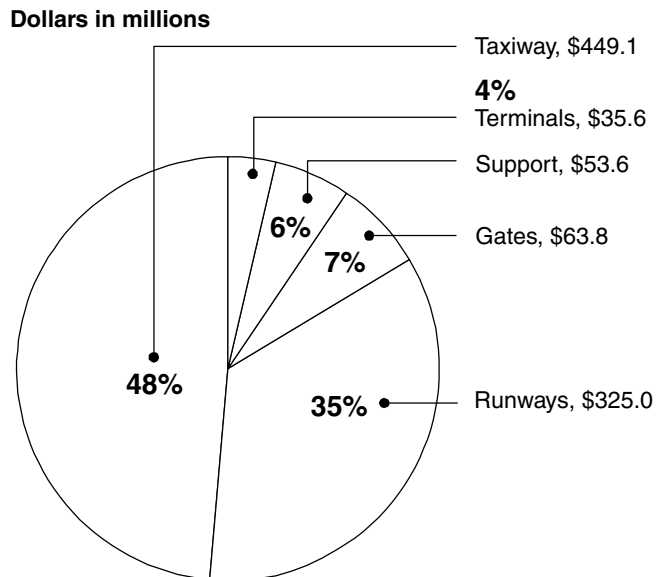
Source: GAO.



Nature and Cost of U.S. Airports' Changes to Accommodate the A380

- About 83 percent of the costs reported by airports were for runway and taxiway projects.
- Remaining cost, reported for changes to terminals, support services, and gates, were 4, 6, and 7 percent of the total cost, respectively.

Figure 4: Airport Costs by Type of Infrastructure Change Reported



Source: GAO analysis of costs reported by the airports.

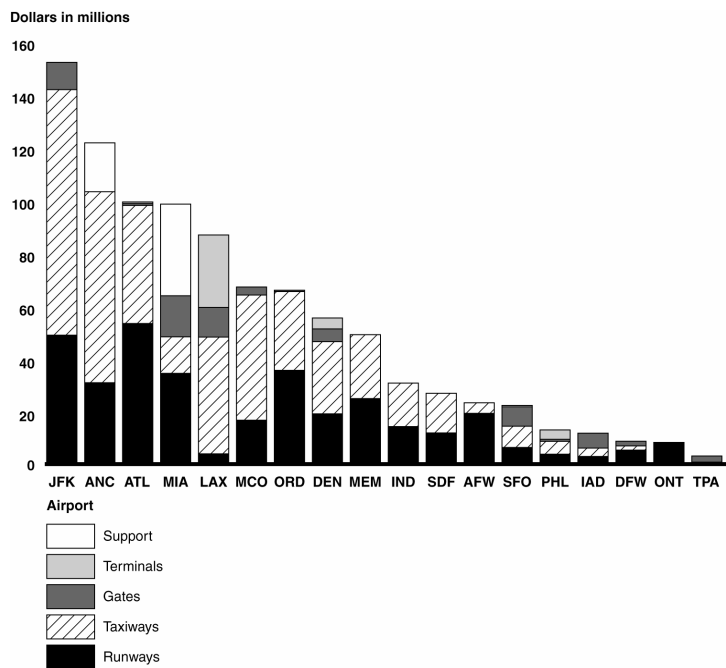




Nature and Cost of U.S. Airports' Changes to Accommodate the A380

- Airports in New York, Anchorage, Atlanta, Miami, and Los Angeles reported the highest costs for A380-related projects.
- To accommodate the A380, 17 airports reported runway projects and 16 reported taxiway projects.

Figure 5: Infrastructure Cost by Airport and Type of Project



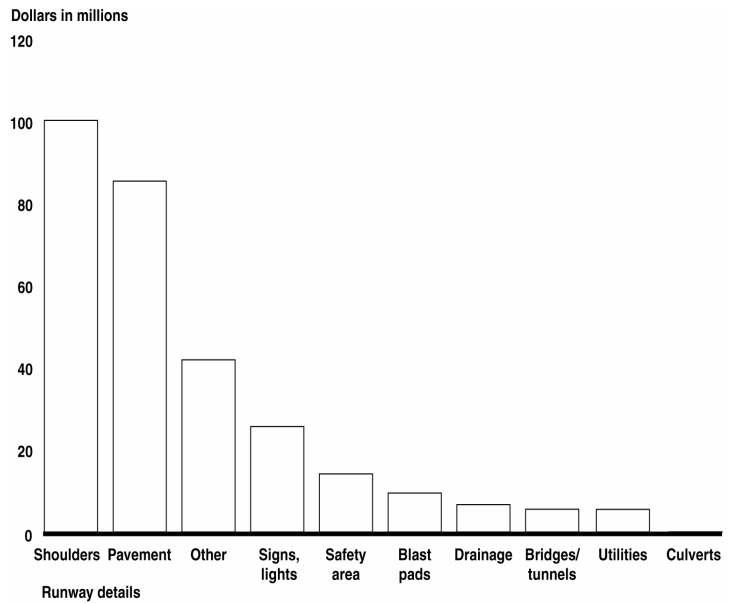
Source: GAO analysis of costs reported by the airports.



Nature and Cost of U.S. Airports' Changes to Accommodate the A380

- Of the costs reported by airports for runway projects, about 63 percent were for changes to shoulders and pavement.

Figure 6: Runway Infrastructure Changes Identified by Airports for Accommodating the A380



Source: GAO analysis of costs reported by the airports.

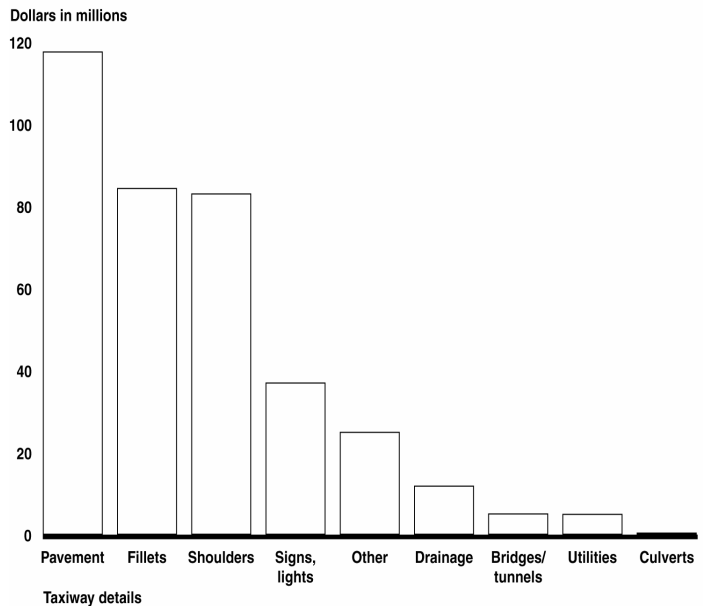
Note: The figure shows details on about \$295 million of the \$325 million in runway changes reported by airports.



Nature and Cost of U.S. Airports' Changes to Accommodate the A380

- Of the costs reported by airports for taxiway projects, about 77 percent were for changes to pavement, shoulders, and fillets (the additional paved areas at runway or taxiway intersections that ensure that the aircraft have adequate pavement for turning).

Figure 7: Taxiway Changes Reported by Airports for Accommodating the A380



Source: GAO analysis of costs reported by the airports.

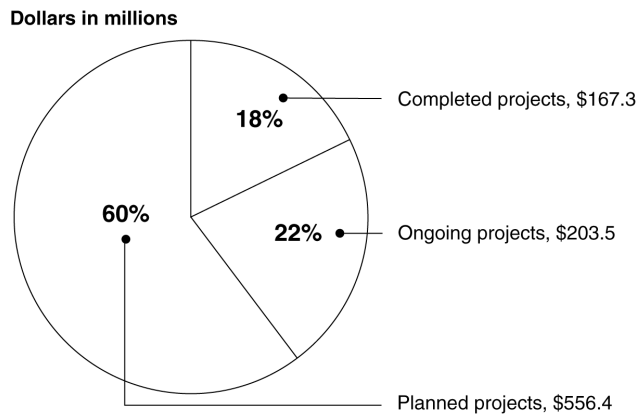
Note: The figure shows details on about \$368 million of the \$449 million in taxiway changes reported by airports.



Nature and Cost of U.S. Airports' Changes to Accommodate the A380

- Most of the costs reported by airports for accommodating the A380 were for projects that have not yet been undertaken.

Figure 8: Status of Infrastructure Changes Reported by Airports for Accommodating the A380



Source: GAO analysis of costs reported by the airports.

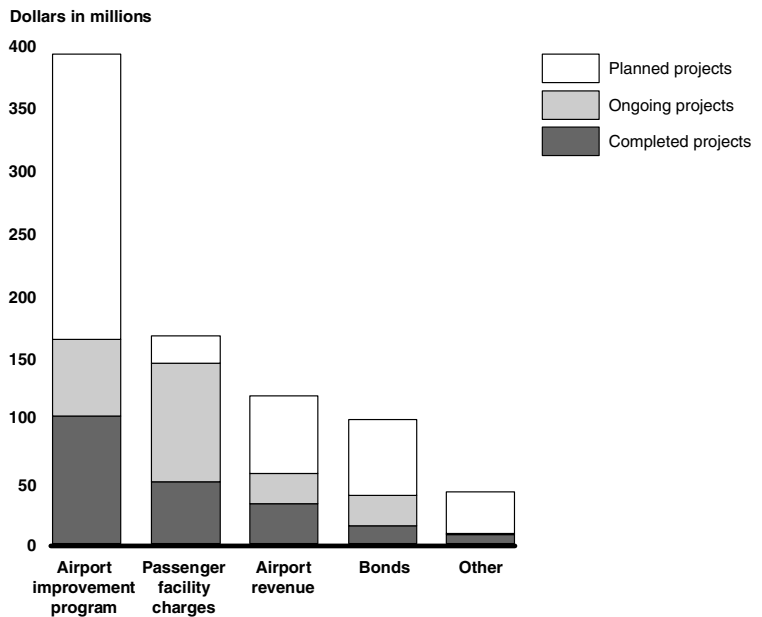
Note: The completed projects total includes \$12.5 million of completed costs from airports' ongoing projects. The ongoing projects total represents only the cost of unfinished work for airports' ongoing projects.



Funding Sources Used by Airports to Make Infrastructure Changes to Accommodate the A380

- Airport Improvement Program funds were identified as the largest funding source for airport changes, followed by passenger facility charges, airport revenues, and bonds.

Figure 9: Sources of Funding Reported by Airports for Changes to Accommodate the A380



Source: GAO analysis of costs reported by the airports.

Note: The figure shows sources of funding for about \$813 million of the \$927 million in infrastructure changes reported by airports.



Major Factors Influencing the Changes Being Made  
at Airports

The runway and taxiway standards that airports must meet to receive the A380 will significantly affect the proposed changes and costs at airports. Airports have three basic options:

- Comply with FAA Design Group VI standards. This requires, among other things, greater separations between parallel taxiways, taxiways and objects, and runways/to parallel taxiways and, in terms of infrastructure, 200-foot-wide runways and 100-foot-wide taxiways. This is the most expensive option for airports.
- Comply with FAA guidelines (Engineering Briefs 65 and 63). This would allow airports receiving the A380 to (1) convert existing 150-foot-wide runways to 200 feet by adding 25 feet of asphalt to each side of the runway, widening shoulders, and moving existing runway edge lighting and edge markings outward, and (2) use existing 75-foot-wide taxiways by widening shoulders, adding centerline lighting and restricting operations. This approach would reduce airports' costs by their not having to build runways and taxiways to meet all Design Group VI standards.
- Wait for FAA's decision on the adequacy of 150-foot-wide runways that is expected later this year. Should FAA allow the aircraft to operate on 150-foot-wide runways under certain conditions, this would be the lowest-cost option for those airports that lack a 200-foot-wide runway. However, if FAA decided during the certification process, or later, that Design Group VI standards should apply, half of the airports could face costs in excess of those reported.



Major Factors Influencing the Changes Being Made  
at Airports

The A380's anticipated arrival time influences when airports need to decide on the changes to infrastructure needed to accommodate the aircraft.

- Some airports that are expected to receive the A380 the earliest have had to decide on what changes they are going to make in order to be ready in time. Chicago (O'Hare), Los Angeles, Memphis, Miami, New York, San Francisco, and Washington D.C. (Washington-Dulles) are anticipating the arrival of the A380 as early as 2007 or 2008.
- The Anchorage, Atlanta, Louisville, and Ontario airports anticipate that they may receive the A380 in 2009 or 2010. They have reviewed their needs and planned for the changes they will be making. However, these airports have some time to alter their plans if FAA makes decisions that affect airport requirements for the A380.
- Other airports that will be receiving the A380 after 2010 have time to wait for FAA's decisions on airport standards before making major changes specifically for the A380.



Major Factors Influencing the Changes Being Made  
at Airports

FAA's process for approving exceptions to airport design standards (Modification of Standards process) affects what airports must do to safely receive the A380. Airports that cannot or do not plan to meet the design criteria required to accommodate the A380 must obtain approval through this process.

- As of March 1, 2006, 11 airports had requested 68 Modifications of Standards from FAA, of which 47 had been approved, 10 had been disapproved, and 11 were under consideration by FAA.<sup>4</sup>
- Many of the approved Modifications of Standards follow the Engineering Briefs' guidance for runways and taxiways or establish operating restrictions on the ground.

<sup>4</sup> Miami International Airport submitted 32 individual requests for Modifications of Standards. The remaining 10 airports submitted a total of 36 requests.





Major Factors Influencing the Changes Being Made  
at Airports

Airports' decisions on what changes to make to accommodate the A380 are affected by the market they serve and their future plans.

- Los Angeles, Miami, New York, and San Francisco are major international gateway airports and had little choice but to make changes to be ready for the A380 if they were to maintain their status. Major freight airports like those in Anchorage, Memphis, and Louisville have to be ready to receive the A380 since Federal Express and UPS each have contracted for 10 of the freight version of the aircraft.
- Other airports have been approached by air carriers planning to begin A380 passenger and/or cargo service in the future. These airports weigh the cost of making changes to accommodate the A380 and the potential impact on their business of receiving or not receiving A380 flights. Airports that are not ready or turn down the A380 could lose flights and carriers to competing airports.
- Some airports that have not been approached for A380 service are also making changes to accommodate it. These airports want to market their availability for this aircraft, hoping to increase their presence in the international market and benefit from the resulting increase in connecting domestic flights. For example, the Dallas/Fort Worth and Orlando airports hope to attract A380 passenger service while the Ontario and Fort Worth Alliance airports plan to be ready for the freight version of the A380 should Federal Express or UPS decide to use them.

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# Appendix II: Objectives, Scope, and Methodology

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You asked us to review and identify the impact of the Airbus A380 on U.S. airports. In examining this issue, we addressed the following questions: (1) What are the costs and nature of changes that U.S. airports are making to their infrastructure to accommodate the A380 aircraft? (2) What funding sources are being used to finance the infrastructure changes at U.S. airports? (3) What major factors influence the changes being made by airports to accommodate the A380 aircraft?

To determine the costs and nature of changes that U.S. airports are making to their infrastructure to accommodate the A380 aircraft, we developed and administered a survey to 18 U.S. airports that are making or planning to make changes to accommodate the A380 aircraft. We then visited each of the airports to discuss their responses. We interviewed FAA, Airbus, and U.S. airport officials; trade associations; and aviation experts to identify the regulations governing aircraft certification and airport operations.

In creating the survey of airports, we developed questions to obtain information on the changes that have been made, are ongoing, or are planned to accommodate the A380 and the costs of the component parts of each project. We segmented the survey into five airport areas: runways, taxiways, terminals, gates, and support facilities such as hangars or fire and rescue equipment. We developed the airport survey document in consultation with FAA, airport officials, and aviation experts. Because these were not sample surveys, there are no sampling errors. However, the practical difficulties of conducting any survey may introduce errors, commonly referred to as nonsampling errors. For example, differences in how a particular question is interpreted, in the sources of information that are available to respondents, or how the data are entered into a database can introduce unwanted variability into the survey results. We took steps in the development of the survey, the data collection, and data analysis to minimize these nonsampling errors. For example, prior to administering the survey, we pretested the content and format with FAA officials, airport officials, and several aviation experts to determine whether (1) the survey questions were clear, (2) the terms used were precise, (3) respondents were able to provide the information we were seeking, and (4) the questions were unbiased. Based on these results, we made changes to the content and format of the final survey instrument.

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To determine which U.S. airports to survey, we identified 29 airports that had received regular 747 service, were included in our prior review as potentially receiving the A380,<sup>1</sup> or had been identified by Airbus or in literature as potentially receiving the aircraft for regularly-scheduled service. We called officials at these 29 airports and identified 18 that were making or planned to make changes to their infrastructure to accommodate the A380 by 2015.

We administered the survey to 18 airports in August 2005 via the internet. All airports responded to the survey. However, after we had sent the surveys, St. Louis International Airport officials informed us that they were no longer planning to make changes for the A380; therefore we dropped St. Louis from our survey list. During the course of our work, we were informed that Tampa International and San Bernadio International Airports were also making changes to accommodate the A380. After Tampa officials confirmed that they were making some A380-related changes, we invited them to complete our survey. But while Tampa completed the survey, San Bernadino officials told us that the changes they were making were not A380-specific and that they would be making these changes even if the A380 did not exist. As a result, we did not include them in the survey.

After reviewing the airport responses, we visited each airport and interviewed officials regarding the projects and costs they had identified. We wanted to understand the necessity for the construction and its relationship to other airport capital-improvement projects. We also met with FAA regional and local officials regarding the infrastructure changes, and any Modification of Standards requested by airports that did not plan to meet Design Group VI standards. We did not verify the accuracy of the cost estimates airports provided.

In addition to the survey, to obtain information on the cost and nature of changes, we reviewed and discussed with FAA officials Airport Design Group VI and V standards and their application at U.S. airports. We interviewed FAA, Airbus, trade association officials, and aviation experts to identify the regulations governing aircraft certification and airport operations. We also obtained and analyzed any requests for Modifications of Standards requested by the 18 airports and summarized FAA decisions

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<sup>1</sup>GAO, *Airport Infrastructure: Unresolved Issues Make It Difficult to Determine the Cost to Service New Large Aircraft*, [GAO-02-251](#) (Washington, D.C.: Feb. 2002).

regarding the infrastructure and operational impacts to the airports. We also discussed—with FAA and airport officials—the effect that Modifications of Standards would have on airports' infrastructure.

To identify the funding sources used to finance the A380-related infrastructure changes at U.S. airports, we also used the internet survey discussed above. We included questions regarding the source of funds for the various segments of projects such as shoulders and lighting for runways and taxiways. Specifically, we asked airports to identify funding from the Airport Improvement Program, passenger facility charges, airport revenue, airport revenue bonds, or other sources such as local government funds. We asked airports to provide funding information for projects that were completed, ongoing, and planned. We also discussed airport project funding with FAA program, regional, and local officials.

To identify the major factors that influenced the changes being made by airports to accommodate the A380 aircraft, we interviewed FAA officials and officials at each of the 18 survey airports. We obtained the views of trade association officials and aviation experts to identify the reasons for making the infrastructure changes. We also reviewed literature and assessments of the impact of airport construction and expansion on airport revenues and regional economic benefits.

During the review, the following aviation experts reviewed our methods and a draft of the report for accuracy and balance: Ms. Rose Agnew, Aviation Innovation, LLC; Mr. Cedric Curtis, Carter-Burgess, Inc.; Dr. John Kasarda, University of North Carolina at Chapel Hill; and Mr. Richard Marchi, Airports Council International-North America.

We performed our work from May 2005 through April 2006 in accordance with generally accepted government auditing standards.

# Appendix III: Summary Costs Reported by Airports to Accommodate the A380

**Table 1: Ted Stevens Anchorage International Airport's Estimated A380-Related Costs as of March 1, 2006**

(Dollars in thousands)

Project type	Cost of completed projects	Cost of ongoing projects	Cost of planned projects	Total estimated costs
Completed runway projects	\$0.0			\$0.0
Ongoing runway projects	\$0.0	\$0.0		\$0.0
Planned runway projects			\$30,000.0	\$30,000.0
<b>Total runway projects</b>				<b>\$30,000.0</b>
Completed taxiway projects	\$36,237.0			\$36,237.0
Ongoing taxiway projects	\$0.0	\$35,899.0		\$35,899.0
Planned taxiway projects			\$0.0	\$0.0
<b>Total taxiway projects</b>				<b>\$72,136.0</b>
Completed gate projects	\$0.0			\$0.0
Ongoing gate projects	\$0.0	\$0.0		\$0.0
Planned gate projects			\$0.0	\$0.0
<b>Total gate projects</b>				<b>\$0.0</b>
Completed terminal projects	\$0.0			\$0.0
Ongoing terminal projects	\$0.0	\$0.0		\$0.0
Planned terminal projects			\$0.0	\$0.0
<b>Total terminal projects</b>				<b>\$0.0</b>
Completed support projects	\$0.0			\$0.0
Ongoing support projects	\$0.0	\$16,974.0		\$16,974.0
Planned support projects			\$1,498.0	\$1,498.0
<b>Total support projects</b>				<b>\$18,472.0</b>
<b>Total airport</b>	<b>\$36,237.0</b>	<b>\$52,873.0</b>	<b>\$31,498.0</b>	<b>\$120,608.0</b>

Source: GAO analysis of costs reported by the airport.

Anchorage airport officials provided the following information regarding A380-related infrastructure project costs:

- Airport officials expect the airport to serve as a flight destination for the freight version of the A380. Federal Express and UPS have both contracted for 10 A380F aircraft. Anchorage expects to begin receiving the Federal Express flights in 2009 with two daily A380 flights initially and a maximum of five A380 daily flights by 2020.
- The airport's estimate assumed that it would reconstruct an existing runway to meet Design Group VI standards for runway pavement width, object-free area, and safety area. They anticipate that construction will

begin in 2007. The estimate also included the construction of a taxiway that was completed in 2004 to accommodate A380 traffic flow. Airport officials also included the costs of reconstructing two other taxiways to Design Group VI width. Airport officials noted that if FAA were to approve lesser standards for the A380 they may alter their plans, which could reduce costs. In estimating the support costs, airport officials said they included plans to purchase two new Aircraft Rescue and Fire Fighting vehicles and the cost associated with building two new remote parking positions for A380 cargo aircraft.

- Airport officials have requested—and been approved for—two Modifications of Standards from FAA.
- Airport officials estimated that projects would be funded with about 93 percent from Airport Improvement Program funds, 1 percent through airport revenue, and 6 percent through airport bonds.

**Appendix III: Summary Costs Reported by  
Airports to Accommodate the A380**

**Table 2: Fort Worth Alliance Airport's Estimated A380-Related Costs as of March 1, 2006**

(Dollars in thousands)

<b>Project type</b>	<b>Cost of completed projects</b>	<b>Cost of ongoing projects</b>	<b>Cost of planned projects</b>	<b>Total estimated costs</b>
Completed runway projects	\$0.0			\$0.0
Ongoing runway projects	\$0.0	\$0.0		\$0.0
Planned runway projects			\$18,392.1	\$18,392.1
<b>Total runway projects</b>				<b>\$18,392.1</b>
Completed taxiway projects	\$0.0			\$0.0
Ongoing taxiway projects	\$0.0	\$0.0		\$0.0
Planned taxiway projects			\$3,985.9	\$3,985.9
<b>Total taxiway projects</b>				<b>\$3,985.9</b>
Completed gate projects	\$0.0			\$0.0
Ongoing gate projects	\$0.0	\$0.0		\$0.0
Planned gate projects			\$0.0	\$0.0
<b>Total gate projects</b>				<b>\$0.0</b>
Completed terminal projects	\$0.0			\$0.0
Ongoing terminal projects	\$0.0	\$0.0		\$0.0
Planned terminal projects			\$0.0	\$0.0
<b>Total terminal projects</b>				<b>\$0.0</b>
Completed support projects	\$0.0			\$0.0
Ongoing support projects	\$0.0	\$0.0		\$0.0
Planned support projects			\$0.0	\$0.0
<b>Total support projects</b>				<b>\$0.0</b>
<b>Total airport</b>	<b>\$0.0</b>	<b>\$0.0</b>	<b>\$22,378.0</b>	<b>\$22,378.0</b>

Source: GAO analysis of costs reported by the airport.

Fort Worth airport officials provided the following information regarding A380-related infrastructure project costs:

- As of March 1, 2006, no air carriers had identified Alliance Fort Worth for A380 service. However, the airport is a freight center for Federal Express, which purchased 10 aircraft. The airport wants to be ready to receive flights after 2008 when the freight aircraft is expected to be certified. In addition, airport officials expect that Alliance Fort Worth could be an alternate airport if an A380 were unable to land at Dallas/Fort Worth.
- The airport estimate assumed that planned runway construction would widen one existing 150-foot runway to 200 feet and add shoulders to meet

Design Group VI standards. In addition, it assumed that construction would widen the shoulders on the 75-foot taxiways to comply with Engineering Brief 63 requirements. The airport also plans to lengthen the 200-foot-wide runway from 9,600 feet to 13,000 feet to allow a fully loaded A380 freighter to take off during hot weather. The runway extension requires moving a railroad line and road at a substantial cost that is not included in the estimate. Airport officials said the project was conceived long before the A380 was being planned, and that the runway extension is not exclusive to the A380 because other aircraft would also benefit. Airport officials noted that construction will not begin before A380 certification so they can modify projects to comply with whatever runway and taxiway standards FAA applies to the A380.

- If necessary, the airport will request a Modification of Standards for FAA approval to construct taxiways that meet Engineering Brief 63 requirements.
- All construction would be paid for by Airport Improvement Program funds.



**Appendix III: Summary Costs Reported by  
Airports to Accommodate the A380**

**Table 3: Hartsfield-Jackson Atlanta International Airport's Estimated A380-Related Costs as of March 1, 2006**

(Dollars in thousands)

<b>Project type</b>	<b>Cost of completed projects</b>	<b>Cost of ongoing projects</b>	<b>Cost of planned projects</b>	<b>Total estimated costs</b>
Completed runway projects	\$0.0			\$0.0
Ongoing runway projects	\$0.0	\$0.0		\$0.0
Planned runway projects			\$52,337.0	\$52,337.0
<b>Total runway projects</b>				<b>\$52,337.0</b>
Completed taxiway projects	\$0.0			\$0.0
Ongoing taxiway projects	\$0.0	\$0.0		\$0.0
Planned taxiway projects			\$44,622.0	\$44,622.0
<b>Total taxiway projects</b>				<b>\$44,622.0</b>
Completed gate projects	\$0.0			\$0.0
Ongoing gate projects	\$0.0	\$0.0		\$0.0
Planned gate projects			\$730.0	\$730.0
<b>Total gate projects</b>				<b>\$730.0</b>
Completed terminal projects	\$0.0			\$0.0
Ongoing terminal projects	\$0.0	\$0.0		\$0.0
Planned terminal projects			\$611.0	\$611.0
<b>Total terminal projects</b>				<b>\$611.0</b>
Completed support projects	\$0.0			\$0.0
Ongoing support projects	\$0.0	\$0.0		\$0.0
Planned support projects			\$0.0	\$0.0
<b>Total support projects</b>				<b>\$0.0</b>
<b>Total airport</b>	<b>\$0.0</b>	<b>\$0.0</b>	<b>\$98,300.0</b>	<b>\$98,300.0</b>

Source: GAO analysis of costs reported by the airport.

Atlanta airport officials provided the following information regarding A380-related infrastructure project costs:

- As of March 1, 2006, no air carriers have identified Atlanta's airport for A380 service. Airport officials do not expect A380 service until after 2010.
- Atlanta's cost estimates include planned runway construction to widen shoulders and blast pads, and relocation of lighting and signage to comply with Engineering Brief 65 guidance. Existing runways are 150 feet wide. Construction is not expected to begin before A380 certification later this year. As a result, airport officials noted that they may change projects to comply with whatever standards FAA applies to the A380. Atlanta's cost

estimate for taxiways includes construction to widening shoulders on their 75-foot-wide taxiways and change taxiway lighting, signage, and markings to meet Engineering Brief 63 guidance. The cost estimated for gate projects assumed that gate and terminal modifications would be undertaken to add passenger boarding bridges at two gates.

- Atlanta has not submitted any requests for Modifications of Standards, as of March 1, 2006.
- Airport officials estimated that projects would be funded from Airport Improvement Program funds (about 75 percent), passenger facility charges (about 5 percent), and general airport revenue bonds based on the projected revenues of airlines (about 20 percent). Airport officials noted that these A380-related projects must compete with other higher priority airport projects.

**Appendix III: Summary Costs Reported by  
Airports to Accommodate the A380**

**Table 4: Chicago O'Hare International Airport's Estimated A380-Related Costs as of March 1, 2006**

(Dollars in thousands)

<b>Project type</b>	<b>Cost of completed projects</b>	<b>Cost of ongoing projects</b>	<b>Cost of planned projects</b>	<b>Total estimated costs</b>
Completed runway projects	\$0.0			\$0.0
Ongoing runway projects	\$0.0	\$9,056.0		\$9,056.0
Planned runway projects			\$25,612.0	\$25,612.0
<b>Total runway projects</b>				<b>\$34,668.0</b>
Completed taxiway projects	\$0.0			\$0.0
Ongoing taxiway projects	\$0.0	\$11,258.0		\$11,258.0
Planned taxiway projects			\$18,511.0	\$18,511.0
<b>Total taxiway projects</b>				<b>\$29,769.0</b>
Completed gate projects	\$0.0			\$0.0
Ongoing gate projects	\$0.0	\$0.0		\$0.0
Planned gate projects			\$500.0	\$500.0
<b>Total gate projects</b>				<b>\$500.0</b>
Completed terminal projects	\$0.0			\$0.0
Ongoing terminal projects	\$0.0	\$0.0		\$0.0
Planned terminal projects			\$0.0	\$0.0
<b>Total terminal projects</b>				<b>\$0.0</b>
Completed support projects	\$0.0			\$0.0
Ongoing support projects	\$0.0	\$0.0		\$0.0
Planned support projects			\$0.0	\$0.0
<b>Total support projects</b>				<b>\$0.0</b>
<b>Total airport</b>	<b>\$0.0</b>	<b>\$20,314.0</b>	<b>\$44,623.0</b>	<b>\$64,937.0</b>

Source: GAO analysis of costs reported by the airport.

Chicago airport officials provided the following information regarding A380-related infrastructure project costs:

- As of March 1, 2006, one air carrier has identified O'Hare for A380 service which is expected to begin in the summer of 2008. FAA recently approved O'Hare's major modernization program with 200-foot-wide runways and some 100-foot-wide taxiways to meet Design Group VI standards by 2013.
- O'Hare's estimate includes both short term and long term costs. In the short term, through 2008, O'Hare estimated the cost of making changes to two existing runways and one taxiway that would meet either Design Group VI or Engineering Briefs 65 and 63 standards. However, airport

officials said that, should FAA approve the use of these existing runways and taxiways without any changes, their estimated costs could be reduced by about \$31 million. In estimating the longer-term costs associated with their modernization plan through 2013, O'Hare officials calculated the incremental cost of building two new 200-foot-wide runways and two new 100-foot-wide taxiways to Design Group VI standards and the lesser cost of building them to Design Group V requirements. The gate cost includes the expense of converting an unused gate in the international terminal to allow it to provide a second jetway access to an A380. Only lower-deck access is anticipated at this time.

- Airport officials said they will apply for Modifications of Standards to allow use of existing infrastructure in the short term, with only minimal changes being made to runways and taxiways. They would take mitigating operational actions to provide an equivalent level of safety for the A380 and other aircraft.
- Airport officials identified 51 percent of costs as being financed through airport bonds, 34 percent through Airport Improvement Program funds, and 13 percent through passenger facility charges.

**Appendix III: Summary Costs Reported by  
Airports to Accommodate the A380**

**Table 5: Dallas/Fort Worth International Airport's Estimated A380-Related Costs as of March 1, 2006**

(Dollars in thousands)

<b>Project type</b>	<b>Cost of completed projects</b>	<b>Cost of ongoing projects</b>	<b>Cost of planned projects</b>	<b>Total estimated costs</b>
Completed runway projects	\$0.0			\$0.0
Ongoing runway projects	\$0.0	\$0.0		\$0.0
Planned runway projects			\$4,525.0	\$4,525.0
<b>Total runway projects</b>				<b>\$4,525.0</b>
Completed taxiway projects	\$0.0			\$0.0
Ongoing taxiway projects	\$0.0	\$0.0		\$0.0
Planned taxiway projects			\$1,600.0	\$1,600.0
<b>Total taxiway projects</b>				<b>\$1,600.0</b>
Completed gate projects	\$0.0			\$0.0
Ongoing gate projects	\$0.0	\$0.0		\$0.0
Planned gate projects			\$1,745.0	\$1,745.0
<b>Total gate projects</b>				<b>\$1,745.0</b>
Completed terminal projects	\$0.0			\$0.0
Ongoing terminal projects	\$0.0	\$0.0		\$0.0
Planned terminal projects			\$0.0	\$0.0
<b>Total terminal projects</b>				<b>\$0.0</b>
Completed support projects	\$0.0			\$0.0
Ongoing support projects	\$0.0	\$0.0		\$0.0
Planned support projects			\$0.0	\$0.0
<b>Total support projects</b>				<b>\$0.0</b>
<b>Total airport</b>	<b>\$0.0</b>	<b>\$0.0</b>	<b>\$7,870.0</b>	<b>\$7,870.0</b>

Source: GAO analysis of costs reported by the airport.

Dallas/Fort Worth airport officials provided the following information regarding A380-related infrastructure project costs:

- As of March 1, 2006, no air carriers had identified Dallas/Fort Worth for A380 service. However, airport officials told us that they expect A380 service in the future. In addition, they said that to remain competitive with other airports and attract air carriers, they need to be ready for the A380.
- Airport estimates assumed that runway construction will be needed to widen shoulders and blast pads to comply with Design Group VI standards. Existing runways are 200 feet wide. In addition, they estimated costs associated with construction that would widen the taxiway

shoulders 15 feet to comply with Design Group VI requirements. Existing taxiways are 100 feet wide. The costs of three gates that will accommodate the A380 in the new international terminal were not included in the airport estimates. In addition, the estimates did not include the cost of additional aircraft rescue and fire-fighting equipment that the airport may need to purchase to better respond to incidents involving the A380. Airport officials noted that construction will not begin on these projects before A380 certification in late 2006. As a result, the airport may change projects to comply with whatever runway and taxiway standards FAA applies to the A380.

- The airport does not plan to apply for any Modification of Standards for A380 operations.
- All construction would be funded by passenger facility charges.

**Appendix III: Summary Costs Reported by  
Airports to Accommodate the A380**

**Table 6: Denver International Airport's Estimated A380-Related Costs as of March 1, 2006**

(Dollars in thousands)

<b>Project type</b>	<b>Cost of completed projects</b>	<b>Cost of ongoing projects</b>	<b>Cost of planned projects</b>	<b>Total estimated costs</b>
Completed runway projects	\$18,207.0			\$18,207.0
Ongoing runway projects	\$0.0	\$0.0		\$0.0
Planned runway projects			\$0.0	\$0.0
<b>Total runway projects</b>				<b>\$18,207.0</b>
Completed taxiway projects	\$18,318.0			\$18,318.0
Ongoing taxiway projects	\$0.0	\$0.0		\$0.0
Planned taxiway projects			\$9,000.0	\$9,000.0
<b>Total taxiway projects</b>				<b>\$27,318.0</b>
Completed gate projects	\$0.0			\$0.0
Ongoing gate projects	\$0.0	\$0.0		\$0.0
Planned gate projects			\$4,800.0	\$4,800.0
<b>Total gate projects</b>				<b>\$4,800.0</b>
Completed terminal projects	\$0.0			\$0.0
Ongoing terminal projects	\$0.0	\$0.0		\$0.0
Planned terminal projects			\$4,100.0	\$4,100.0
<b>Total terminal projects</b>				<b>\$4,100.0</b>
Completed support projects	\$0.0			\$0.0
Ongoing support projects	\$0.0	\$0.0		\$0.0
Planned support projects			\$0.0	\$0.0
<b>Total support projects</b>				<b>\$0.0</b>
<b>Total airport</b>	<b>\$36,525.0</b>	<b>\$0.0</b>	<b>\$17,900.0</b>	<b>\$54,425.0</b>

Source: GAO analysis of costs reported by the airport.

Denver airport officials provided the following information regarding A380-related infrastructure project costs:

- One air carrier has indicated that it may begin A380 service at some time in the future. Airport officials said they believed that other carriers would eventually bring Design Group VI aircraft to this airport in its role as a major U.S. hub, especially if other large airports were only able to provide limited facilities to accommodate them.
- In estimating costs, airport officials included some of the costs of constructing one 200-foot-wide runway and two taxiways to meet Design Group VI standards. These projects were completed in 2003. The airport

included the incremental cost to upgrade the new runway from Design Group V standards to Design Group VI standards. Planned construction includes bringing one taxiway into compliance with Engineering Brief 63 requirements and modifying two gates to receive the A380. Airport officials also plan to expand the customs and immigration areas. Costs do not include additional aircraft rescue and fire-fighting equipment that the airport may need to purchase to better respond to incidents involving the A380.

- The airport has submitted a Modification of Standards to FAA to operate the A380 on taxiways that comply with Engineering Brief 63.
- Runway and taxiway construction have been (and will be) paid for from Airport Improvement Program funds and airport bonds. Customs and Immigration facility expansion will be funded from airport bonds.



**Appendix III: Summary Costs Reported by  
Airports to Accommodate the A380**

**Table 7: Indianapolis International Airport’s Estimated A380-Related Costs as of March 1, 2006**

(Dollars in thousands)

<b>Project type</b>	<b>Cost of completed projects</b>	<b>Cost of ongoing projects</b>	<b>Costs of planned projects</b>	<b>Total estimated costs</b>
Completed runway projects	\$0.0			\$0.0
Ongoing runway projects	\$0.0	\$0.0		\$0.0
Planned runway projects			\$13,434.3	\$13,434.3
<b>Total runway projects</b>				<b>\$13,434.3</b>
Completed taxiway projects	\$0.0			\$0.0
Ongoing taxiway projects	\$0.0	\$0.0		\$0.0
Planned taxiway projects			\$16,409.6	\$16,409.6
<b>Total taxiway projects</b>				<b>\$16,409.6</b>
Completed gate projects	\$0.0			\$0.0
Ongoing gate projects	\$0.0	\$0.0		\$0.0
Planned gate projects			\$0.0	\$0.0
<b>Total gate projects</b>				<b>\$0.0</b>
Completed terminal projects	\$0.0			\$0.0
Ongoing terminal projects	\$0.0	\$0.0		\$0.0
Planned terminal projects			\$0.0	\$0.0
<b>Total terminal projects</b>				<b>\$0.0</b>
Completed support projects	\$0.0			\$0.0
Ongoing support projects	\$0.0	\$0.0		\$0.0
Planned support projects			\$0.0	\$0.0
<b>Total support projects</b>				<b>\$0.0</b>
<b>Total airport</b>	<b>\$0.0</b>	<b>\$0.0</b>	<b>\$29,844.0</b>	<b>\$29,844.0</b>

Source: GAO analysis of costs reported by the airport.

Indianapolis airport officials provided the following information regarding A380-related infrastructure projects:

- As of March 1, 2006, no air carriers have identified this airport for A380 service. However, airport officials indicated that Federal Express plans to begin A380 flights after 2010. The airport could also serve as an alternate airport for A380s carrying either passengers or freight.
- Airport estimates assumed that because existing runways are 150 feet wide, one runway would be widened to 200 feet to comply with Engineering Brief 65—adding 40-foot erosion control shoulders, and moving the runway edge lighting to the edge of the new shoulders.

Similarly, the airport assumed that they would widen taxiway shoulders for one designated taxiway route to the new Midfield Terminal and Federal Express apron to comply with Engineering Brief 63 requirements. The new Midfield Terminal will include one gate that can serve an A380, but is designed for regular use by other aircraft; there are no terminal costs directly attributable to accommodating the A380. Airport officials said that construction timing is not definite, but will occur after A380 certification in 2006. As a result, the airport may change projects to comply with whatever runway and taxiway standards FAA applies to the A380, which could affect the cost of the projects.

- The airport has requested a Modification of Standards, to allow the A380 to operate on a runway width of 150 feet.
- Airport officials did not identify funding sources for these projects but indicated that funding would not come from the Airport Improvement Program or passenger facility charges.

**Appendix III: Summary Costs Reported by  
Airports to Accommodate the A380**

**Table 8: Los Angeles International Airport's Estimated A380-Related Costs as of March 1, 2006**

(Dollars in thousands)

<b>Project type</b>	<b>Cost of completed projects</b>	<b>Cost of ongoing projects</b>	<b>Cost of planned projects</b>	<b>Total estimated costs</b>
Completed runway projects	\$0.0			\$0.0
Ongoing runway projects	\$0.0	\$0.0		\$0.0
Planned runway projects			\$3,120.0	\$3,120.0
<b>Total runway projects</b>				<b>\$3,120.0</b>
Completed taxiway projects	\$9,099.0			\$9,099.0
Ongoing taxiway projects	\$0.0	\$0.0		\$0.0
Planned taxiway projects			\$34,999.0	\$34,999.0
<b>Total taxiway projects</b>				<b>\$44,098.0</b>
Completed gate projects	\$0.0			\$0.0
Ongoing gate projects	\$383.0	\$3,351.0		\$3,734.0
Planned gate projects			\$7,474.0	\$7,474.0
<b>Total gate projects</b>				<b>\$11,208.0</b>
Completed terminal projects	\$0.0			\$0.0
Ongoing terminal projects	\$290.0	\$6,900.0		\$7,190.0
Planned terminal projects			\$20,200.0	\$20,200.0
<b>Total terminal projects</b>				<b>\$27,390.0</b>
Completed support projects	\$0.0			\$0.0
Ongoing support projects	\$0.0	\$0.0		\$0.0
Planned support projects			\$0.0	\$0.0
<b>Total support projects</b>				<b>\$0.0</b>
<b>Total airport</b>	<b>\$9,772.0</b>	<b>\$10,251.0</b>	<b>\$65,793.0</b>	<b>\$85,816.0</b>

Source: GAO analysis of costs reported by the airport.

Los Angeles airport officials provided the following information regarding A380-related infrastructure project costs:

- As of March 1, 2006, several air carriers identified this airport for A380 service beginning in early 2007. Airport officials said that this airport would be the first in the U.S. to begin A380 service, and that it had to be ready to maintain its competitive position with other airports.
- Airport estimates assumed that construction was needed to strengthen and widen taxiway intersections, bridges and tunnels to comply with Engineering Brief 63 requirements. Taxiway construction began in 2005 to widen and strengthen intersections where the A380 could turn. Additional

taxiway and runway work to strengthen bridges and tunnels was also planned. Airport estimates also included construction on four terminal gates and four remote gates. Terminal construction for the gate areas is expected to be complete in 2006. The costs do not include the relocation of a 200-foot-wide runway 55 feet further away from another runway that officials said was to reduce runway incursions rather than to accommodate the A380.

- FAA approved Modifications of Standards that would allow the airport to operate the A380 on taxiways that met Engineering Brief 63. An existing runway is 200 feet wide and will be moved and built to comply with Design Group VI standards.
- About half of the construction would be paid for with Airport Improvement Program funds, passenger facility charges, and airport revenue. Funding for about 46 percent of costs was not identified.

**Appendix III: Summary Costs Reported by  
Airports to Accommodate the A380**

**Table 9: Louisville International Airport's Estimated A380-Related Costs as of March 1, 2006**

(Dollars in thousands)

<b>Project type</b>	<b>Cost of completed projects</b>	<b>Cost of ongoing projects</b>	<b>Cost of planned projects</b>	<b>Total estimated costs</b>
Completed runway projects	\$0.0			\$0.0
Ongoing runway projects	\$0.0	\$0.0		\$0.0
Planned runway projects			\$11,000.0	\$11,000.0
<b>Total runway projects</b>				<b>\$11,000.0</b>
Completed taxiway projects	\$0.0			\$0.0
Ongoing taxiway projects	\$0.0	\$0.0		\$0.0
Planned taxiway projects			\$15,000.0	\$15,000.0
<b>Total taxiway projects</b>				<b>\$15,000.0</b>
Completed gate projects	\$0.0			\$0.0
Ongoing gate projects	\$0.0	\$0.0		\$0.0
Planned gate projects			\$0.0	\$0.0
<b>Total gate projects</b>				<b>\$0.0</b>
Completed terminal projects	\$0.0			\$0.0
Ongoing terminal projects	\$0.0	\$0.0		\$0.0
Planned terminal projects			\$0.0	\$0.0
<b>Total terminal projects</b>				<b>\$0.0</b>
Completed support projects	\$0.0			\$0.0
Ongoing support projects	\$0.0	\$0.0		\$0.0
Planned support projects			\$0.0	\$0.0
<b>Total support projects</b>				<b>\$0.0</b>
<b>Total airport</b>	<b>\$0.0</b>	<b>\$0.0</b>	<b>\$26,000.0</b>	<b>\$26,000.0</b>

Source: GAO analysis of costs reported by the airport.

Louisville airport officials provided the following information regarding A380-related infrastructure project costs:

- Airport officials expect A380 freight service sometime in 2009. UPS, which has contracted for 10 A380s, has announced plans to use Louisville for their A380 operations. No passenger carriers have identified this airport for A380 service, as of March 1, 2006.
- Airport officials' cost estimate assumed that runway construction will be needed to widen the pavement on one runway to 200 feet and expand shoulders to comply with Design Group VI standards. In addition, the estimate assumes that the airport builds a new taxiway parallel to the A380

runway. This taxiway would be 100 feet wide and have 550 feet of separation from the A380 runway. Airport officials noted that these plans and estimates could change based on pending results of an operational planning study of the airfield. Construction of the parallel taxiway could be underway as early as the fall of 2006; however, the proposed runway widening project would come after A380 certification (expected in late 2006), providing the airport with the opportunity to change projects' priority to comply with whatever runway and taxiway standards FAA applies to the A380.

- Louisville has not requested any Modifications of Standards for A380 operations, as of March 1, 2006.
- Airport officials said that construction would be funded by Airport Improvement Program funds (95 percent) and airport revenues (5 percent). It should be noted that Louisville was identified as a medium-hub airport for federal fiscal year 2005, and was downgraded to a small-hub airport for federal fiscal year 2006. Current plans anticipate a 95/5 share on Airport Improvement Program funds, but it is possible for Louisville to return to a 75/25 rate in future years.

**Appendix III: Summary Costs Reported by  
Airports to Accommodate the A380**

**Table 10: Memphis International Airport's Estimated A380-Related Costs as of March 1, 2006**

(Dollars in thousands)

<b>Project type</b>	<b>Cost of completed projects</b>	<b>Cost of ongoing projects</b>	<b>Cost of planned projects</b>	<b>Total estimated costs</b>
Completed runway projects	\$0.0			\$0.0
Ongoing runway projects	\$0.0	\$0.0		\$0.0
Planned runway projects			\$24,000.0	\$24,000.0
<b>Total runway projects</b>				<b>\$24,000.0</b>
Completed taxiway projects	\$9,965.0			\$9,965.0
Ongoing taxiway projects	\$8,180.0	\$0.0		\$8,180.0
Planned taxiway projects			\$6,000.0	\$6,000.0
<b>Total taxiway projects</b>				<b>\$24,145.0</b>
Completed gate projects	\$0.0			\$0.0
Ongoing gate projects	\$0.0	\$0.0		\$0.0
Planned gate projects			\$0.0	\$0.0
<b>Total gate projects</b>				<b>\$0.0</b>
Completed terminal projects	\$0.0			\$0.0
Ongoing terminal projects	\$0.0	\$0.0		\$0.0
Planned terminal projects			\$0.0	\$0.0
<b>Total terminal projects</b>				<b>\$0.0</b>
Completed support projects	\$0.0			\$0.0
Ongoing support projects	\$0.0	\$0.0		\$0.0
Planned support projects			\$0.0	\$0.0
<b>Total support projects</b>				<b>\$0.0</b>
<b>Total airport</b>	<b>\$18,145.0</b>	<b>\$0.0</b>	<b>\$30,000.0</b>	<b>\$48,145.0</b>

Source: GAO analysis of costs reported by the airport.

Memphis airport officials provided the following information regarding A380-related infrastructure projects:

- Airport officials expect the airport to serve as a cargo A380 flight destination for Federal Express beginning in 2008. Federal Express, which is headquartered in Memphis, has purchased 10 A380F freight aircraft and expects to use the Memphis airport for A380 service.
- Memphis plans to widen runway shoulders and modify lighting and markers on two runways for A380 service to meet Engineering Brief 65 requirements. Construction is expected to be accomplished in 2007. Taxiway improvements include widening certain taxiway shoulders to

meet Engineering Brief 63 requirements. Other costs cited by Memphis airport officials include the difference between what it would have cost to build a 75-foot-wide taxiway and the 100-foot-wide taxiways that were built. Construction began in 2000 and will be completed in 2007. These costs do not include Federal Express costs for construction of cargo areas and aprons.

- Airport officials requested five Modifications of Standards and FAA approved four. The modification that was not approved requested approval to operate the A380 on their existing 150-foot-wide runways. As a result, their estimate includes costs associated with meeting the Engineering Brief 65 requirements.
- The airport plans to fund about 75 percent of its construction projects through Airport Improvement Program funds and 25 percent through airport bonds.



**Appendix III: Summary Costs Reported by  
Airports to Accommodate the A380**

**Table 11: Miami International Airport's Estimated A380-Related Costs as of March 1, 2006**

(Dollars in thousands)

<b>Project type</b>	<b>Cost of completed projects</b>	<b>Cost of ongoing projects</b>	<b>Cost of planned projects</b>	<b>Total estimated costs</b>
Completed runway projects	\$0.0			\$0.0
Ongoing runway projects	\$0.0	\$0.0		\$0.0
Planned runway projects			\$33,511.0	\$33,511.0
<b>Total runway projects</b>				<b>\$33,511.0</b>
Completed taxiway projects	\$0.0			\$0.0
Ongoing taxiway projects	\$0.0	\$0.0		\$0.0
Planned taxiway projects			\$13,812.0	\$13,812.0
<b>Total taxiway projects</b>				<b>\$13,812.0</b>
Completed gate projects	\$0.0			\$0.0
Ongoing gate projects	\$0.0	\$11,502.0		\$11,502.0
Planned gate projects			\$4,000.0	\$4,000.0
<b>Total gate projects</b>				<b>\$15,502.0</b>
Completed terminal projects	\$0.0			\$0.0
Ongoing terminal projects	\$0.0	\$0.0		\$0.0
Planned terminal projects			\$0.0	\$0.0
<b>Total terminal projects</b>				<b>\$0.0</b>
Completed support projects	\$34,641.0			\$34,641.0
Ongoing support projects	\$0.0	\$0.0		\$0.0
Planned support projects			\$0.0	\$0.0
<b>Total support projects</b>				<b>\$34,641.0</b>
<b>Total airport</b>	<b>\$34,641.0</b>	<b>\$11,502.0</b>	<b>\$51,323.0</b>	<b>\$97,466.0</b>

Source: GAO analysis of costs reported by the airport.

Miami airport officials provided the following information regarding A380-related infrastructure projects:

- Airport officials expect to receive A380 passenger flights initially from three air carriers from 2008 through 2010.
- Miami airport officials' estimate included plans to widen runway pavement and shoulders and modify lighting, signage, and markers on two runways to meet Engineering Brief 65 requirements for the A380. Officials assumed that they would need to make taxiway improvements by adding shoulder pavement, and modifying signage, lighting, and markings. The estimate also assumed modifications would be made for A380 parking at three

terminal gates and two hard-stand parking positions. Construction is expected to begin after A380 certification later this year and, as a result, airport officials noted that the airport may change projects to comply with whatever runway and taxiway standards FAA applies to the A380. According to airport officials, Engineering Brief 63 and 65 have been approved by the FAA on an interim 5-year (evaluation) basis. However, they said that implementing Engineering Brief 65 and Engineering Brief 63 (and their associated high costs) is an unwarranted risk due to the interim nature of the approval and the low level of expected A380 operations at the airport.

- Airport officials have requested 32 Modifications of Standards of which FAA has approved 26. Those projects not approved involved runway pavement and shoulder width, runway blast-pad width, and taxiway-to-vehicle service road separation.
- The airport estimated that it would pay about 75 percent of its construction projects from Airport Improvement Program funds, 12.5 percent from airport revenue, and 12.5 percent from Florida Department of Transportation matching funds.

**Appendix III: Summary Costs Reported by  
Airports to Accommodate the A380**

**Table 12: New York John F. Kennedy International Airport's Estimated A380-Related Costs as of March 1, 2006**

(Dollars in thousands)

<b>Project type</b>	<b>Cost of completed projects</b>	<b>Cost of ongoing projects</b>	<b>Cost of planned projects</b>	<b>Total estimated costs</b>
Completed runway projects	\$19,600.0			\$19,600.0
Ongoing runway projects	\$0.0	\$0.0		\$0.0
Planned runway projects			\$28,340.0	\$28,340.0
<b>Total runway projects</b>				<b>\$47,940.0</b>
Completed taxiway projects	\$3,800.0			\$3,800.0
Ongoing taxiway projects	\$0.0	\$72,200.0		\$72,200.0
Planned taxiway projects			\$16,800.0	\$16,800.0
<b>Total taxiway projects</b>				<b>\$92,800.0</b>
Completed gate projects	\$0.0			\$0.0
Ongoing gate projects	\$0.0	\$10,300.0		\$10,300.0
Planned gate projects			\$0.0	\$0.0
<b>Total gate projects</b>				<b>\$10,300.0</b>
Completed terminal projects	\$0.0			\$0.0
Ongoing terminal projects	\$0.0	\$0.0		\$0.0
Planned terminal projects			\$0.0	\$0.0
<b>Total terminal projects</b>				<b>\$0.0</b>
Completed support projects	\$0.0			\$0.0
Ongoing support projects	\$0.0	\$0.0		\$0.0
Planned support projects			\$0.0	\$0.0
<b>Total support projects</b>				<b>\$0.0</b>
<b>Total airport</b>	<b>\$23,400.0</b>	<b>\$82,500.0</b>	<b>\$45,140.0</b>	<b>\$151,040.0</b>

Source: GAO analysis of costs reported by the airport.

New York airport officials provided the following information regarding A380-related infrastructure project costs:

- Airport officials expect A380 service to begin in early 2007 because this airport has more foreign-carrier traffic than domestic. To maintain their market position, officials said that they had to prepare for the A380 and other large aircraft. Six carriers that purchased the A380 could begin service at the airport.
- The cost estimates were based on the assumption that major reconstruction was necessary for runways, taxiways, and some gate projects. Some of the runway projects were completed in 2002, but other

work is scheduled to continue until 2013. One of the ongoing projects is widening a 150-foot runway to 200 feet. It is scheduled for completion in 2008. One of the planned projects is to widen another 150-foot runway to 200 feet. This project is part of a 2012 rehabilitation project. Another major ongoing project is to increase separation on a heavily used taxiway that circles the terminals. In the gate area, changes include an apron extension, jetways, and fuel hydrant projects.

- FAA approved a Modification of Standards for taxiways meeting Engineering Brief 63 requirements.
- Most of the construction funds (86 percent) came from passenger facility charges. The remainder, about 13 percent, came from Airport Improvement Program grants.

**Appendix III: Summary Costs Reported by  
Airports to Accommodate the A380**

**Table 13: Ontario International Airport's (Ontario, California) Estimated A380-Related Costs as of March 1, 2006**

(Dollars in thousands)

<b>Project type</b>	<b>Cost of completed projects</b>	<b>Cost of ongoing projects</b>	<b>Cost of planned projects</b>	<b>Total estimated costs</b>
Completed runway projects	\$0.0			\$0.0
Ongoing runway projects	\$3,600	\$3,816.6		\$7,416.6
Planned runway projects			\$0.0	\$0.0
<b>Total runway projects</b>				<b>\$7,416.6</b>
Completed taxiway projects	\$0.0			\$0.0
Ongoing taxiway projects	\$0.0	\$0.0		\$0.0
Planned taxiway projects			\$0.0	\$0.0
<b>Total taxiway projects</b>				<b>\$0.0</b>
Completed gate projects	\$0.0			\$0.0
Ongoing gate projects	\$0.0	\$0.0		\$0.0
Planned gate projects			\$0.0	\$0.0
<b>Total gate projects</b>				<b>\$0.0</b>
Completed terminal projects	\$0.0			\$0.0
Ongoing terminal projects	\$0.0	\$0.0		\$0.0
Planned terminal projects			\$0.0	\$0.0
<b>Total terminal projects</b>				<b>\$0.0</b>
Completed support projects	\$0.0			\$0.0
Ongoing support projects	\$0.0	\$0.0		\$0.0
Planned support projects			\$0.0	\$0.0
<b>Total support projects</b>				<b>\$0.0</b>
<b>Total airport</b>	<b>\$3,600.0</b>	<b>\$3,816.6</b>	<b>\$0.0</b>	<b>\$7,416.6</b>

Source: GAO analysis of costs reported by the airport.

Ontario airport officials provided the following information regarding A380-related infrastructure projects:

- Airport officials expect A380 freight service to begin in 2009 or later. UPS, which has contracted for 10 A380F aircraft, uses this airport for many of its flights to Asia. In addition, officials expect that there may be an A380 alternate for the Los Angeles Airport, if an A380 were unable to land there.
- In estimating costs, airport officials assumed that the A380 flights would use a runway that is currently being reconstructed. When construction is complete later in 2006, this runway will be 150 feet wide with 65-foot-wide structural shoulders that will comply with Engineering Brief 65. However,

because the runway reconstruction was necessary to continue using it for any flights, the estimated costs include only the incremental costs of runway construction specifically for the A380. For example, construction of fillets and a fast-exit taxiway are included in the runway costs. The airport did not include the cost of additional aircraft rescue and fire-fighting equipment that the airport may need to purchase to better respond to incidents involving the A380. The estimate also does not include the costs that UPS will incur for a taxiway extension and apron for a new UPS facility.

- The airport requested Modifications of Standards from Design Group VI standards for runways and taxiways, seeking FAA approval to use a runway built to Engineering Brief 65 and use of existing taxiways.
- Airport officials identified funding sources as 75 percent from the Airport Improvement Program with the matching 25 percent from sources other than passenger facility charges, airport revenue, or bonds.

**Appendix III: Summary Costs Reported by  
Airports to Accommodate the A380**

**Table 14: Orlando International Airport's Estimated A380-Related Costs as of March 1, 2006**

(Dollars in thousands)

<b>Project type</b>	<b>Cost of completed projects</b>	<b>Cost of ongoing projects</b>	<b>Cost of planned projects</b>	<b>Total estimated costs</b>
Completed runway projects	\$0.0			\$0.0
Ongoing runway projects	\$0.0	\$0.0		\$0.0
Planned runway projects			\$15,832.0	\$15,832.0
<b>Total runway projects</b>				<b>\$15,832.0</b>
Completed taxiway projects	\$0.0			\$0.0
Ongoing taxiway projects	\$0.0	\$6,700.0		\$6,700.0
Planned taxiway projects			\$40,600.0	\$40,600.0
<b>Total taxiway projects</b>				<b>\$47,300.0</b>
Completed gate projects	\$0.0			\$0.0
Ongoing gate projects	\$0.0	\$0.0		\$0.0
Planned gate projects			\$3,000.0	\$3,000.0
<b>Total gate projects</b>				<b>\$3,000.0</b>
Completed terminal projects	\$0.0			\$0.0
Ongoing terminal projects	\$0.0	\$0.0		\$0.0
Planned terminal projects			\$0.0	\$0.0
<b>Total terminal projects</b>				<b>\$0.0</b>
Completed support projects	\$0.0			\$0.0
Ongoing support projects	\$0.0	\$0.0		\$0.0
Planned support projects			\$0.0	\$0.0
<b>Total support projects</b>				<b>\$0.0</b>
<b>Total airport</b>	<b>\$0.0</b>	<b>\$6,700.0</b>	<b>\$59,432.0</b>	<b>\$66,132.0</b>

Source: GAO analysis of costs reported by the airport.

Orlando airport officials provided the following information regarding A380-related infrastructure projects:

- Virgin Atlantic Airlines has indicated they plan to introduce service at Orlando in 2009; however, no firm date has been set. Airport officials plan to be ready to accommodate the A380 by completing work that will accommodate the A380 on the West Airfield by 2008. They noted that because the airport is the fourth busiest origin and destination hub in the U.S.—and one of only four airports on the East Coast designated to receive the A380—it is an attractive destination for international A380 traffic.

- Orlando's total estimate is based on long-term facilities needed to accommodate the A380. However, only first-phase work will be done to the West Airfield because runways and some taxiways already meet FAA Design Group VI standards. The cost of phase one development is about \$35.3 million. Phase Two work to the East Airfield will be developed as demand increases and after FAA makes a final decision on interim standards included in Engineering Briefs 63 and 65. The estimated cost of Phase Two is \$30.6 million. West Airfield development includes widening runway and taxiway shoulders; adding fillets; and modifying lighting, signage, and markers. The cost estimate also included A380 parking at two terminal gates. They estimated that Phase One would be completed in the 2007 time period, and the Phase Two projects are expected to be underway by 2015.
- FAA has approved the two Modifications of Standards requested by the Orlando airport.
- Airport officials did not provide specific funding sources for construction projects but these would include Airport Improvement Program grants, passenger facility charges, and state grants.



**Appendix III: Summary Costs Reported by  
Airports to Accommodate the A380**

**Table 15: Philadelphia International Airport's Estimated A380-Related Costs as of March 1, 2006**

(Dollars in thousands)

<b>Project type</b>	<b>Cost of completed projects</b>	<b>Cost of ongoing projects</b>	<b>Cost of planned projects</b>	<b>Total estimated costs</b>
Completed runway projects	\$0.0			\$0.0
Ongoing runway projects	\$0.0	\$0.0		\$0.0
Planned runway projects			\$2,991.2	\$2,991.2
<b>Total runway projects</b>				<b>\$2,991.2</b>
Completed taxiway projects	\$0.0			\$0.0
Ongoing taxiway projects	\$0.0	\$0.0		\$0.0
Planned taxiway projects			\$4,859.9	\$4,859.9
<b>Total taxiway projects</b>				<b>\$4,859.9</b>
Completed gate projects	\$0.0			\$0.0
Ongoing gate projects	\$0.0	\$0.0		\$0.0
Planned gate projects			\$770.5	\$770.5
<b>Total gate projects</b>				<b>\$770.5</b>
Completed terminal projects	\$0.0			\$0.0
Ongoing terminal projects	\$0.0	\$0.0		\$0.0
Planned terminal projects			\$3,529.4	\$3,529.4
<b>Total terminal projects</b>				<b>\$3,529.4</b>
Completed support projects	\$0.0			\$0.0
Ongoing support projects	\$0.0	\$0.0		\$0.0
Planned support projects			\$0.0	\$0.0
<b>Total support projects</b>				<b>\$0.0</b>
<b>Total airport</b>	<b>\$0.0</b>	<b>\$0.0</b>	<b>\$12,150.9</b>	<b>\$12,150.9</b>

Source: GAO analysis of costs reported by the airport.

Philadelphia airport officials provided the following information regarding A380-related infrastructure project costs:

- As of March 1, 2006, no air carriers had identified Philadelphia International Airport for A380 service. However, airport officials are planning for potential future cargo demand. In addition, the airport may serve as an alternate airport for A380 passenger aircraft and could have the potential to serve international passenger traffic.
- The estimate assumes that the airport would widen shoulders and blast pads on one existing 200-foot-wide runway to comply with Design Group VI standards. In addition, the estimate provides for construction to

taxiways that the A380 would use to comply with Design Group VI requirements. Airport officials also assumed that they would improve two existing gates and add boarding bridges to service the A380's upper deck and improve passenger hold areas, baggage processing, and ticketing to handle two A380s at once. Airport officials noted that the timing of these projects is currently uncertain. The airport is now focused on expanding airfield capacity for smaller planes. The A380 projects would not begin until the current building program is complete. For example, the planned taxiway projects are estimated to begin in 2011.

- Philadelphia has not requested a Modification of Standards for its A380 plans, as of March 1, 2006.
- Airport officials said that construction would be funded by a combination of Airport Improvement Program funds (48.5 percent), passenger facility charges (35.4 percent), bonds (8.1 percent), and other grants (8.1 percent).

**Appendix III: Summary Costs Reported by  
Airports to Accommodate the A380**

**Table 16: San Francisco International Airport's Estimated A380-Related Costs as of March 1, 2006**

(Dollars in thousands)

<b>Project type</b>	<b>Cost of completed projects</b>	<b>Cost of ongoing projects</b>	<b>Cost of planned projects</b>	<b>Total estimated costs</b>
Completed runway projects	\$3,500.0			\$3,500.0
Ongoing runway projects	\$0.0	\$0.0		\$0.0
Planned runway projects			\$2,000.0	\$2,000.0
<b>Total runway projects</b>				<b>\$5,500.0</b>
Completed taxiway projects	\$850.0			\$850.0
Ongoing taxiway projects	\$0.0	\$3,200.0		\$3,200.0
Planned taxiway projects			\$4,000.0	\$4,000.0
<b>Total taxiway projects</b>				<b>\$8,050.0</b>
Completed gate projects	\$0.0			\$0.0
Ongoing gate projects	\$0.0	\$6,250.0		\$6,250.0
Planned gate projects			\$1,100.0	\$1,100.0
<b>Total gate projects</b>				<b>\$7,350.0</b>
Completed terminal projects	\$0.0			\$0.0
Ongoing terminal projects	\$0.0	\$0.0		\$0.0
Planned terminal projects			\$0.0	\$0.0
<b>Total terminal projects</b>				<b>\$0.0</b>
Completed support projects	\$0.0			\$0.0
Ongoing support projects		\$500.00		\$500.00
Planned support projects			\$0.0	\$0.0
<b>Total support projects</b>				<b>\$500.0</b>
<b>Total airport</b>	<b>\$4,350.0</b>	<b>\$9,950.0</b>	<b>\$7,100.0</b>	<b>\$21,400.0</b>

Source: GAO analysis of costs reported by the airport.

San Francisco airport officials provided the following information regarding A380-related infrastructure project costs:

- San Francisco airport officials expect A380 service in early 2007. As of March 1, 2006, airport officials had identified six air carriers that might operate A380 aircraft at this airport. The airport has four runways that are 200 feet wide but only two can be used for A380 departures. The third can be used for landings. Airport officials said they had to make changes to accept the A380 or they would have lost traffic to other airports.
- The airport assumed A380 service would begin soon after the aircraft was certified and has modified the shoulders, lighting, and markings on two of

its four 200-foot-wide runways to Design Group VI for A380 service, completing construction on the first runway in 2003 and the second in 2004. Changes in shoulders, lighting, and markings are also planned for a third Design Group VI runway, which is planned to be completed in 2008. Taxiway construction, consisting of widening shoulders and moving lights, was completed in 2004 and 2005 in compliance with Engineering Brief 63. Ongoing taxiway projects will be completed in 2006 and 2007. Two gates will be modified in 2006 to provide one upper and one lower jet bridge. A third jet bridge for one of the gates could be added.

- FAA approved a Modification of Standards for the A380 to operate on taxiways that comply with Engineering Brief 63 requirements.
- Runway, taxiway, and gate construction has been—and is planned to be—paid for from Airport Improvement Program funds with airport revenue used for the matching share.

**Appendix III: Summary Costs Reported by  
Airports to Accommodate the A380**

**Table 17: Tampa International Airport's Estimated A380-Related Costs as of March 1, 2006**

(Dollars in thousands)

<b>Project type</b>	<b>Cost of completed projects</b>	<b>Cost of ongoing projects</b>	<b>Cost of planned projects</b>	<b>Total estimated costs</b>
Completed runway projects	\$0.0			\$0.0
Ongoing runway projects	\$0.0	\$0.0		\$0.0
Planned runway projects			\$0.0	\$0.0
<b>Total runway projects</b>				<b>\$0.0</b>
Completed taxiway projects	\$0.0			\$0.0
Ongoing taxiway projects	\$0.0	\$0.0		\$0.0
Planned taxiway projects			\$0.0	\$0.0
<b>Total taxiway projects</b>				<b>\$0.0</b>
Completed gate projects	\$100.0			\$100.0
Ongoing gate projects	\$0.0	\$0.0		\$0.0
Planned gate projects			\$2,200.0	\$2,200.0
<b>Total gate projects</b>				<b>\$2,300.0</b>
Completed terminal projects	\$0.0			\$0.0
Ongoing terminal projects	\$0.0	\$0.0		\$0.0
Planned terminal projects			\$0.0	\$0.0
<b>Total terminal projects</b>				<b>\$0.0</b>
Completed support projects	\$0.0			\$0.0
Ongoing support projects	\$0.0	\$0.0		\$0.0
Planned support projects			\$0.0	\$0.0
<b>Total support projects</b>				<b>\$0.0</b>
<b>Total airport</b>	<b>\$100.0</b>	<b>\$0.0</b>	<b>\$2,200.0</b>	<b>\$2,300.0</b>

Source: GAO analysis of costs reported by the airport.

Tampa airport officials provided the following information regarding A380-related infrastructure project costs:

- Airport officials do not expect scheduled A380 service in the near term at Tampa, but expect their airport will serve as an alternate airport for A380s flying to Miami and Orlando.
- Tampa's estimate assumed that construction will not be necessary on the existing 150-foot-wide runways or 75-foot-wide taxiways. The cost for serving A380s consists of special fuel pits required for the aircraft and two upper-deck boarding bridges planned for a potential future North Terminal. In addition, at the current terminal, the airport plans to use three

existing gates that can now serve A380s with dual lower-deck boarding bridges.

- Airport officials expect to apply for a Modification of Standards to serve as an alternate A380 airport.
- Airport officials said the recently-built A380 fuel pit at Airside C Terminal was funded by passenger facility charges. Airport officials did not provide data on how A380 projects would be funded at the potential future North Terminal.

**Appendix III: Summary Costs Reported by  
Airports to Accommodate the A380**

**Table 18: Washington Dulles International Airport's Estimated A380-Related Costs as of March 1, 2006**

(Dollars in thousands)

<b>Project type</b>	<b>Cost of completed projects</b>	<b>Cost of ongoing projects</b>	<b>Cost of planned projects</b>	<b>Total estimated costs</b>
Completed runway projects	\$500.0			\$500.0
Ongoing runway projects	\$0.0	\$0.0		\$0.0
Planned runway projects			\$1,595.0	\$1,595.0
<b>Total runway projects</b>				<b>\$2,095.0</b>
Completed taxiway projects	\$0.0			\$0.0
Ongoing taxiway projects	\$0.0	\$0.0		\$0.0
Planned taxiway projects			\$3,206.0	\$3,206.0
<b>Total taxiway projects</b>				<b>\$3,206.0</b>
Completed gate projects	\$0.0			\$0.0
Ongoing gate projects	\$0.0	\$5,600.0		\$5,600.0
Planned gate projects			\$0.0	\$0.0
<b>Total gate projects</b>				<b>\$5,600.0</b>
Completed terminal projects	\$0.0			\$0.0
Ongoing terminal projects	\$0.0	\$0.0		\$0.0
Planned terminal projects			\$0.0	\$0.0
<b>Total terminal projects</b>				<b>\$0.0</b>
Completed support projects	\$0.0			\$0.0
Ongoing support projects	\$0.0	\$0.0		\$0.0
Planned support projects			\$0.0	\$0.0
<b>Total support projects</b>				<b>\$0.0</b>
<b>Total airport</b>	<b>\$500.0</b>	<b>\$5,600.0</b>	<b>\$4,801.0</b>	<b>\$10,901.0</b>

Source: GAO analysis of costs reported by the airport.

Washington Dulles airport officials provided the following information regarding A380-related infrastructure project costs:

- Washington Dulles airport officials expect to receive A380 passenger flights initially from three air carriers from 2007 through 2009. They identified a possible fourth passenger airline and potential cargo flights that could also service the airport in the future.
- After contracting an airfield study for the A380, airport officials have elected to use one of three scenarios that would involve making some changes in runways, taxiways, and gates. The airport's estimate assumed that it would need to modify lighting and signage on one runway. The

estimates do not include all costs necessary to bring the runways to Engineering Brief 65 or Design Group VI standards. Airport officials noted that if FAA does not approve their approach and requires them to meet the standards of Engineering Brief 65, costs could rise. The estimate also assumed that the airport would need to make minor modifications to taxiways' shoulders and lighting, which are expected to be completed in 2006. Further, the estimate assumed that they would make changes for A380 parking at two terminal gates.

- Washington Dulles airport has not submitted any requests for Modification of Standards for A380 operations as of March 1, 2006. However, airport officials plan to submit a request for Modification of Standards to FAA in the near future.
- All construction would be funded through airport bonds.



# Appendix IV: Status of Modifications of Standards Requested by Airports to Accommodate the A380

**Table 19: Status of A380-Related Modifications of Standards Requests (as of March 1, 2006)**

Airports	Request description	FAA decision
<b>Anchorage</b>	1. Requested approval to operate an A380 on Taxiway R. The taxiway does not meet Design Group VI taxiway object-free area of 193 feet between taxiway connectors Q and T. The current separation equals 174 feet.	Approved based on the following conditions: <ul style="list-style-type: none"> <li>• FAA recommended future investigation of relocating the vehicle service road located in the 174-foot section to a 193-foot distance.</li> <li>• A reconstructed Taxiway R must be built to Design Group VI standards.</li> <li>• Imposed a maximum height restriction of 14 feet on vehicles using the vehicle service road along Taxiway R.</li> </ul>
	2. Requested approval for an A380 runway operating plan regarding Runway 14/32 centerline to Parallel Taxiway Y centerline separation for A380 taxiing when any aircraft is on approach.	Approved based on the following conditions: <ul style="list-style-type: none"> <li>• Must post taxiway signage to indicate restricted taxiing section.</li> <li>• The runway and taxiway bridges and culverts on the designated A380 route must support A380 weight loads.</li> <li>• Construction of new runway or parallel taxiways must be built to Design Group VI standards.</li> </ul> Imposed taxiing restrictions.
<b>Dallas/Fort Worth</b>	1. Requested approval to operate an A380 on 200-foot-wide Runway 18L/36R. The runway does not meet Design Group VI shoulder widths of 40 feet on each side. Proposed using the existing 25-foot shoulders.	Disapproved: FAA Design Group VI standards require 40-foot shoulders on each side of the runway.
	2. Requested approval to operate an A380 on 100-foot-wide Taxiway F. The taxiway does not meet Design Group VI shoulder widths of 40 feet on each side. Proposed using existing 25-foot shoulders.	Disapproved: FAA Design Group VI standards require 40-foot shoulders on each side of the taxiway.
	3. Requested approval to operate an A380 on Runway 18L/36R using the existing runway blast pads on the runway ends.	Disapproved: FAA Design Group VI standards require a 400-foot length and a 280-foot width.
<b>Denver</b>	1. Requested approval to operate an A380 on existing 75-foot-wide Taxiways AN, B4, and F. The taxiways do not meet Design Group VI overall taxiway pavement width of 180 feet. Proposed modifying tangent sections of the 35-foot-wide shoulders according to Engineering Brief 63.	Pending
	2. Requested approval to operate an A380 on Taxiway AN. The taxiway does not meet Design Group VI taxiway centerline to fixed or moveable object separation distance of 193 feet. Proposed using the taxiway with a 167-foot separation.	Pending

**Appendix IV: Status of Modifications of Standards Requested by Airports to Accommodate the A380**

Airports	Request description	FAA decision
	3. Requested approval to operate an A380 on Taxiway B4. The taxiway does not meet Design Group VI taxiway centerline to fixed or moveable object separation distance of 193 feet. Proposed using the taxiway with a 165-foot separation.	Pending
	4. Requested approval to operate an A380 on Taxiway BS. The taxiway does not meet Design Group VI taxiway centerline to taxiway centerline separation of 324 feet. Proposed using the taxiway with a 267-foot separation while under temporary operating restrictions.	Pending
<b>Indianapolis</b>		
	1. Requested approval to operate an A380 on 150-foot-wide Runways 5L/23R and 5R/23L that do not meet Design Group VI overall runway and shoulder width of 280 feet.	Pending
<b>John F. Kennedy (NY)</b>		
	1. Requested approval to operate an A380 on a 75-foot-wide taxiway. The taxiway does not meet Design Group VI overall taxiway pavement width of 180 feet. Proposed using the taxiway with expanded shoulders.	Approved on interim basis under the condition that modifications are made to adhere to guidance of Engineering Brief 63.
	2. Requested approval to operate an A380 on Parallel Taxiways A and B, and P and Q. The taxiways do not meet Design Group VI taxiway centerline to taxiway centerline separation of 324 feet. Proposed using the parallel taxiways with 284-foot separations.	Approved based on the following conditions: <ul style="list-style-type: none"> <li>• FAA required Taxiway A to be moved 16 feet towards parallel Taxiway B.</li> <li>• Taxiway edge delineators reduced to 75 feet.</li> <li>• Must meet taxiway centerline lighting spacing requirement.</li> <li>• Must post signage for hold position for A380 bridge crossing and for possible jet blast from A380 on bridges.</li> <li>• Construction of new taxiways must be built to Design Group VI standards.</li> <li>• A380 taxiing prohibited on Taxiways B and Q.</li> <li>• Simultaneous taxiing operations restricted on parallel taxiways with A380 and other aircraft and must maintain a 47-foot wingtip separation.</li> <li>• No simultaneous aircraft operations on bridges when an A380 crosses either bridge.</li> <li>• A380 taxiing speed restricted to a maximum of 15 miles per hour.</li> </ul>

**Appendix IV: Status of Modifications of Standards Requested by Airports to Accommodate the A380**

<b>Airports</b>	<b>Request description</b>	<b>FAA decision</b>
	3. Requested approval to operate an A380 on Taxiway A. The taxiway does not meet Design Group VI taxiway centerline to fixed or moveable object separation distance of 193 feet. Proposed using taxiways with 146-foot separations.	<p>Approved based on the following conditions:</p> <ul style="list-style-type: none"> <li>• FAA recommended investigating the possibility of relocating the restricted vehicle service road away from Taxiway A.</li> <li>• FAA required Taxiway A to be moved 16 feet towards parallel Taxiway B.</li> <li>• Must meet taxiway centerline lighting spacing requirement.</li> <li>• Taxiway edge delineators reduced to 75 feet.</li> <li>• Must post signage of possible jet blast from an A380 on bridges.</li> <li>• Construction of new taxiways must be built to Design Group VI standards.</li> <li>• Taxiway Q closed for all A380 operations.</li> <li>• A380 taxiing speed restricted to a maximum of 15 miles per hour.</li> <li>• Imposed a maximum height restriction of 14 feet on vehicles using the restricted vehicle service road.</li> </ul>
	4. Requested approval for an A380 runway operating plan regarding the runway centerline to parallel taxiway centerline separation for A380 taxiing when any aircraft is on approach.	<p>Approved based on the following conditions:</p> <ul style="list-style-type: none"> <li>• Must post taxiway signage to indicate restricted taxiing section.</li> <li>• Construction of new taxiways must be built to Design Group VI standards.</li> <li>• Imposed taxiing restrictions.</li> </ul>
	5. Requested approval to operate an A380 on 150-foot-wide Runway 4L/22R that does not meet Design Group VI overall runway and shoulder width of 280 feet.	Pending

**Appendix IV: Status of Modifications of Standards Requested by Airports to Accommodate the A380**

Airports	Request description	FAA decision
<b>Los Angeles</b>	1. Requested approval to operate an A380 on a taxiway that does not meet Design Group VI taxiway centerline to fixed or moveable object separation distance of 193 feet. Proposed using the taxiway with a 146.5-foot separation.	<p>Approved based on the following conditions:</p> <ul style="list-style-type: none"> <li>• FAA recommended future investigation of relocating or narrowing vehicle service road.</li> <li>• Required modification of several taxiways.</li> <li>• Construction of new taxiways must be built to Design Group VI standards.</li> <li>• Allowed 146.5-foot separation from vehicle service road.</li> <li>• Required a 167-foot minimum separation from buildings on A380 taxiing routes.</li> <li>• Imposed a maximum height restriction of 14 feet on vehicles using the vehicle service road.</li> <li>• A380 operations prohibited on Taxiway Q and highly restricted on Taxiway L.</li> <li>• A380 taxiing speed restricted to a maximum of 15 miles per hour.</li> <li>• Recommended change in proposed A380 taxiing routes that cross active runways to reduce runway incursions.</li> <li>• Must ensure hold lines to designated arrival and departure runways in place.</li> </ul>
	2. Requested approval for an A380 operating plan regarding the parallel taxiway centerline to taxiway centerline separation.	<p>Approved based on the following conditions:</p> <ul style="list-style-type: none"> <li>• Construction of new taxiways must be built to Design Group VI standards.</li> <li>• A380 taxiing speed restricted to a maximum of 15 miles per hour.</li> <li>• Imposed taxiing restrictions with taxiing A380 and other aircraft.</li> <li>• A380 taxiing prohibited on Taxiway Q.</li> </ul>
	3. Requested approval to operate an A380 on a 75-foot-wide taxiway that does not meet Design Group VI overall taxiway pavement width of 180 feet.	<p>Approved on interim basis under the condition that modifications adhere to guidance of Engineering Brief 63.</p>
	4. Requested approval for an A380 runway operating plan regarding the runway centerline to parallel taxiway centerline separation for A380 taxiing when any aircraft is on approach.	<p>Approved based on the following conditions:</p> <ul style="list-style-type: none"> <li>• Runways 7L/25R and 6R/24L would not be used for A380 operations.</li> <li>• Must post taxiway signage to indicate restricted taxiing section.</li> <li>• Runway and taxiway bridges and culverts on designated A380 route must support A380 weight loads.</li> <li>• Construction of new runway/parallel taxiways must be built to Design Group VI standards.</li> <li>• Imposed taxiing restrictions.</li> </ul>
	5. Requested approval to operate an A380 on a 150-foot-wide runway that does not meet Design Group VI runway width of 200 feet.	<p>Approved on interim basis under the condition that modifications adhere to guidance of Engineering Brief 65.</p>

**Appendix IV: Status of Modifications of  
Standards Requested by Airports to  
Accommodate the A380**

Airports	Request description	FAA decision
<b>Memphis</b>	1. Requested approval to operate an A380 on a 75-foot-wide taxiway. The taxiway does not meet Design Group VI overall taxiway pavement width of 180 feet. Proposed expanding the shoulders.	Approved on interim basis under the condition that modifications adhere to guidance of Engineering Brief 63.
	2. Requested approval to operate an A380 on Taxiway A. The taxiway does not meet Design Group VI taxiway object free area of 193 feet due to the adjacent vehicle service road located 163 feet from it.	Approved based on the following conditions: <ul style="list-style-type: none"> <li>• FAA recommended future investigation of relocating or narrowing vehicle service road.</li> <li>• Construction of new taxiways must be built to Design Group VI standards.</li> <li>• Allowed 163-foot separation from vehicle service road.</li> <li>• Required a 167-foot minimum separation from buildings on A380 taxiing routes.</li> <li>• All other A380 taxiing routes must maintain Design Group VI separation.</li> <li>• Imposed a maximum height restriction of 14 feet on vehicles using the vehicle service road.</li> <li>• A380 taxiing speed restricted to a maximum of 15 miles per hour.</li> </ul>
	3. Requested approval to operate an A380 on taxiway sections that do not meet Design Group VI taxiway edge safety margin.	Approved based on the following conditions: <ul style="list-style-type: none"> <li>• FAA required implementation of A380 Inspection and Maintenance Plan for those taxiway sections.</li> <li>• Use of dual taxiway centerline markings not approved.</li> <li>• Construction of new taxiways for Design Group VI aircraft operations must be built to Design Group VI standards.</li> </ul>
	4. Requested approval for A380 runway operating plan regarding the runway centerline to parallel taxiway centerline separation for A380 taxiing when any aircraft is on approach.	Approved based on the following conditions: <ul style="list-style-type: none"> <li>• Parallel Runway 18R/36L would not be used for A380 operations.</li> <li>• Must post taxiway signage to indicate restricted taxiing section.</li> <li>• Runway and taxiway bridges and culverts on designated A380 route must support A380F weight loads.</li> <li>• Construction of new runway and parallel taxiways must be built to Design Group VI standards.</li> <li>• Imposed taxiing restrictions.</li> </ul>
	5. Requested approval to operate an A380 on a 150-foot-wide runway. The runway does not meet Design Group VI runway width of 200 feet. Proposed using the runway with adaptations.	Disapproved: FAA Design Group VI standards require 40-foot shoulders on each side of the runway and a 280-foot width. <ul style="list-style-type: none"> <li>• Modifications must adhere to guidance under Engineering Brief 65.</li> </ul>

**Appendix IV: Status of Modifications of Standards Requested by Airports to Accommodate the A380**

Airports	Request description	FAA decision
<b>Miami</b>	1. Requested approval to operate an A380 on 150-foot-wide Runway 9/27 that does not meet Design Group VI runway width of 200 feet.	Disapproved: FAA Design Group VI standards require 40-foot shoulders on each side of the runway. <ul style="list-style-type: none"> <li>• Modifications must adhere to guidance under Engineering Brief 65.</li> </ul>
	2. Requested approval to operate an A380 on 200-foot-wide Runway 9/27. The runway does not meet Design Group VI shoulder width of 40 feet on each side. Proposed using the existing 25-foot shoulders.	Disapproved: FAA Design Group VI standards require 40-foot shoulders on each side of the runway. <ul style="list-style-type: none"> <li>• Modifications must adhere to guidance under Engineering Brief 65.</li> </ul>
	3. Requested approval to operate an A380 on 200-foot-wide Runway 8R/26L. The runway does not meet Design Group VI shoulder width of 40 feet on each side. Proposed using the existing 35-foot shoulders.	Disapproved: FAA Design Group VI standards require 40-foot shoulders on each side of the runway. <ul style="list-style-type: none"> <li>• Modifications must adhere to guidance under Engineering Brief 65.</li> </ul>
	4. Requested approval to operate an A380 using existing 250-foot-wide Runway 9/27 blast pads on one of the runway ends.	Disapproved: FAA Design Group VI standards require a 400-foot length and a 280-foot width.
	5. Requested approval to operate an A380 using existing 270-foot-wide Runway 8R/26L blast pads on one of the runway ends.	Disapproved: FAA Design Group VI standards require a 400-foot length and a 280-foot width.
	6. Requested approval to operate an A380 on 75-foot-wide Taxiway S that does not meet Design Group VI overall taxiway pavement width of 180 feet.	Approved on interim basis under the condition to adhere to guidance of Engineering Brief 63. <ul style="list-style-type: none"> <li>• Any underground structures and utilities, taxiway culverts, and taxiway bridges must support A380 weight loads.</li> </ul>
	7. Requested approval to operate an A380 on 75-foot-wide Taxiway P that does not meet Design Group VI overall taxiway pavement width of 180 feet.	Approved on interim basis under the condition to adhere to guidance of Engineering Brief 63. <ul style="list-style-type: none"> <li>• Any underground structures and utilities, taxiway culverts, and taxiway bridges must support A380 weight loads.</li> <li>• The service road tunnel under the taxiway must also support A380 weight loads or be rerouted to other taxiways.</li> </ul>
	8. Requested approval to operate an A380 on 75-foot-wide Taxiway N that does not meet Design Group VI overall taxiway pavement width of 180 feet.	Approved on interim basis under the condition to adhere to guidance of Engineering Brief 63. <ul style="list-style-type: none"> <li>• Any underground structures and utilities, taxiway culverts, and taxiway bridges must support A380 weight loads.</li> </ul>
	9. Requested approval to operate an A380 on 75-foot-wide Taxiway Z that does not meet Design Group VI overall taxiway pavement width of 180 feet.	Approved on interim basis under the condition to adhere to guidance of Engineering Brief 63. <ul style="list-style-type: none"> <li>• Any underground structures and utilities, taxiway culverts, and taxiway bridges must support A380 weight loads.</li> </ul>
	10. Requested approval to operate an A380 on 75-foot-wide Taxiway JJ that does not meet Design Group VI overall taxiway pavement width of 180 feet.	Approved on interim basis under the condition to adhere to guidance of Engineering Brief 63. <ul style="list-style-type: none"> <li>• Any underground structures and utilities, taxiway culverts, and taxiway bridges must support A380 weight loads.</li> </ul>

**Appendix IV: Status of Modifications of  
Standards Requested by Airports to  
Accommodate the A380**

Airports	Request description	FAA decision
	11. Requested approval to operate an A380 on 75-foot-wide Taxiway K that does not meet Design Group VI overall taxiway pavement width of 180 feet.	Approved on interim basis under the condition to adhere to guidance of Engineering Brief 63. <ul style="list-style-type: none"> <li>Any underground structures and utilities, taxiway culverts, and taxiway bridges must support A380 weight loads.</li> </ul>
	12. Requested approval to operate an A380 on existing taxiway connectors and fillets on Taxiway S that do not meet Design Group VI safety margin of 20 feet.	Approved based on the following conditions: <ul style="list-style-type: none"> <li>If repeated excursions occur on existing fillets, fillets must be retrofitted to Design Group VI standards and any damaged taxiway shoulders corrected after each excursion.</li> <li>Reconstruction of new taxiway connectors must be built to Design Group VI standards.</li> <li>Must inform air traffic control of substandard connectors and A380 pilots to apply oversteer.</li> <li>A380 taxiing speed restricted to a maximum of 15 miles per hour.</li> </ul>
	13. Requested approval to operate an A380 on existing taxiway connectors and fillets on Taxiways S and T that do not meet Design Group VI safety margin of 20 feet.	Approved based on the following conditions: <ul style="list-style-type: none"> <li>If repeated excursions occur on existing fillets, fillets must be retrofitted to Design Group VI standards and any damaged taxiway shoulders corrected.</li> <li>Taxiway safety edge margins must be increased.</li> <li>Reconstruction of new taxiway connectors must be built to Design Group VI standards.</li> <li>Must inform air traffic control of substandard connectors and A380 pilots to apply oversteer.</li> <li>A380 taxiing speed restricted to a maximum of 15 miles per hour.</li> </ul>
	14. Requested approval to operate an A380 on existing taxiway connectors and fillets on Taxiway N that do not meet Design Group VI safety margin of 20 feet.	Approved based on the following conditions: <ul style="list-style-type: none"> <li>If repeated excursions occur on existing fillets, fillets must be retrofitted to Design Group VI standards and any damaged taxiway shoulders corrected.</li> <li>Reconstruction of new taxiway connectors must be built to Design Group VI standards.</li> <li>Must inform air traffic control of substandard connectors and A380 pilots to apply oversteer.</li> <li>A380 taxiing speed restricted to a maximum of 15 miles per hour.</li> <li>Taxiway safety edge margins must be increased.</li> </ul>
	15. Requested approval to operate an A380 on existing taxiway connectors and fillets on Taxiways Y and Z that do not meet Design Group VI safety margin of 20 feet.	Approved based on the following conditions: <ul style="list-style-type: none"> <li>If repeated excursions occur on existing fillets, fillets must be retrofitted to Design Group VI standards and any damaged taxiway shoulders corrected.</li> <li>Reconstruction of new taxiway connectors must be built to Design Group VI standards.</li> <li>Must inform air traffic control of substandard connectors and A380 pilots to apply oversteer.</li> <li>A380 taxiing speed restricted to a maximum of 15 miles per hour.</li> </ul>

**Appendix IV: Status of Modifications of  
Standards Requested by Airports to  
Accommodate the A380**

Airports	Request description	FAA decision
	16. Requested approval to operate an A380 on existing taxiway connectors and fillets on Taxiway K7 that do not meet Design Group VI safety margin of 20 feet.	<p>Approved based on the following conditions:</p> <ul style="list-style-type: none"> <li>• If repeated excursions occur on existing fillets, fillets must be retrofitted to Design Group VI standards and any damaged taxiway shoulders corrected.</li> <li>• Taxiway safety edge margins must be increased.</li> <li>• Reconstruction of new taxiway connectors must be built to Design Group VI standards.</li> <li>• Must inform air traffic control of substandard connectors and A380 pilots to apply oversteer.</li> <li>• A380 taxiing speed restricted to a maximum of 15 miles per hour.</li> </ul>
	17. Requested approval for an A380 runway operating plan regarding Runway 9/27 centerline to parallel Taxiway Q centerline separation for A380 taxiing when any aircraft is on approach.	<p>Approved based on the following conditions:</p> <ul style="list-style-type: none"> <li>• Must post taxiway signage to indicate restricted taxiing section.</li> <li>• Runway and taxiway bridges and culverts on designated A380 route must support A380 weight loads.</li> <li>• Construction of new runway and parallel taxiways must be built to Design Group VI standards.</li> <li>• Imposed taxiing restrictions.</li> </ul>
	18. Requested approval for an A380 runway operating plan regarding Runway 9/27 centerline to parallel Taxiway T centerline separation for A380 taxiing when any aircraft is on approach.	<p>Approved based on the following conditions:</p> <ul style="list-style-type: none"> <li>• Must post taxiway signage to indicate restricted taxiing section.</li> <li>• Runway and taxiway bridges and culverts on designated A380 route must support A380 weight loads.</li> <li>• Construction of new runway and parallel taxiways must be built to Design Group VI standards.</li> <li>• Imposed taxiing restrictions.</li> <li>• Must implement special hold line procedure for A380.</li> <li>• Restricted use on Taxiway T for Design Group V aircraft while A380 uses Runway 9/27.</li> </ul>
	19. Requested approval for an A380 runway operating plan regarding Runway 8R/26L centerline to parallel Taxiway M centerline separation for A380 taxiing when any aircraft is on approach.	<p>Approved based on the following conditions:</p> <ul style="list-style-type: none"> <li>• Must post taxiway signage to indicate restricted taxiing section.</li> <li>• Runway and taxiway bridges and culverts on designated A380 route must support A380 weight loads.</li> <li>• Construction of new runway and parallel taxiways must be built to Design Group VI standards.</li> <li>• Imposed taxiing restrictions.</li> </ul>



**Appendix IV: Status of Modifications of  
Standards Requested by Airports to  
Accommodate the A380**

<b>Airports</b>	<b>Request description</b>	<b>FAA decision</b>
	20. Requested approval for A380 runway operating plan regarding Runway 8R/26L centerline to parallel Taxiway L centerline separation for A380 taxiing when any aircraft is on approach.	Approved based on the following conditions: <ul style="list-style-type: none"> <li>• Must post taxiway signage to indicate restricted taxiing section.</li> <li>• Runway and taxiway bridges and culverts on designated A380 route must support A380 weight loads.</li> <li>• Construction of new runway/parallel taxiways must be built to Design Group VI standards.</li> <li>• Imposed taxiing restrictions.</li> </ul>
	21. Requested approval for A380 runway operating plan regarding Runway 8L/26R centerline to parallel Taxiway K centerline separation for A380 taxiing when any aircraft is on approach.	Approved based on the following conditions: <ul style="list-style-type: none"> <li>• Must post taxiway signage to indicate restricted taxiing section.</li> <li>• Runway and taxiway bridges and culverts on designated A380 route must support A380 weight loads.</li> <li>• Construction of new runway/parallel taxiways must be built to Design Group VI standards.</li> <li>• Imposed taxiing restrictions.</li> <li>• Must implement special hold line procedure for A380.</li> </ul>
	22. Requested approval for an A380 operating plan regarding parallel Taxiway Q centerline to Taxiway P centerline separation.	Approved based on the following conditions: <ul style="list-style-type: none"> <li>• Construction of new taxiways must be built to Design Group VI standards.</li> <li>• Imposed taxiing restrictions with taxiing A380 and other aircraft to maintain existing 237-foot separation.</li> <li>• A380 taxiing limited to Taxiway P and prohibited on Taxiway Q.</li> <li>• A380 taxiing speed restricted to a maximum of 15 miles per hour.</li> </ul>
	23. Requested approval for A380 operating plan regarding parallel Taxiway S centerline to Taxiway T centerline separation.	Approved based on the following conditions: <ul style="list-style-type: none"> <li>• Construction of new taxiways must be built to Design Group VI standards.</li> <li>• Imposed taxiing restrictions with taxiing A380 and other aircraft to maintain existing 300-foot separation.</li> <li>• A380 taxiing limited to Taxiway S and prohibited on Taxiway T.</li> <li>• A380 taxiing speed restricted to a maximum of 15 miles per hour.</li> </ul>
	24. Requested approval for an A380 operating plan regarding parallel Taxiway Q centerline to Taxiway P centerline separation.	Approved based on the following conditions: <ul style="list-style-type: none"> <li>• Construction of new taxiways must be built to Design Group VI standards.</li> <li>• Imposed taxiing restrictions with taxiing A380 and other aircraft to maintain existing 300-foot separation.</li> <li>• A380 taxiing limited to Taxiway P and prohibited on Taxiway Q.</li> <li>• A380 taxiing speed restricted to a maximum of 15 miles per hour.</li> </ul>

**Appendix IV: Status of Modifications of Standards Requested by Airports to Accommodate the A380**

<b>Airports</b>	<b>Request description</b>	<b>FAA decision</b>
	25. Requested approval for an A380 operating plan regarding parallel Taxiway M centerline to Taxiway N centerline separation.	Approved based on the following conditions: <ul style="list-style-type: none"> <li>• Construction of new taxiways must be built to Design Group VI standards.</li> <li>• Imposed taxiing restrictions with taxiing A380 and other aircraft to maintain existing 300-foot separation.</li> <li>• A380 taxiing limited to Taxiway N and prohibited on Taxiway M.</li> <li>• A380 taxiing speed restricted to a maximum of 15 miles per hour.</li> </ul>
	26. Requested approval for an A380 operating plan regarding parallel Taxiway N centerline to Taxilane MD11 centerline separation.	Approved based on the following conditions: <ul style="list-style-type: none"> <li>• Construction of new taxiways must be built to Design Group VI standards.</li> <li>• Imposed taxiing restrictions with taxiing A380 and other aircraft to maintain existing 245-foot separation.</li> <li>• A380 taxiing limited to Taxiway N and prohibited on Taxiway MD11.</li> <li>• A380 taxiing speed restricted to a maximum of 15 miles per hour.</li> </ul>
	27. Requested approval for an A380 operating plan regarding parallel Taxiway Y centerline to Taxiway HH centerline separation.	Approved based on the following conditions: <ul style="list-style-type: none"> <li>• Construction of new taxiways must be built to Design Group VI standards.</li> <li>• Imposed taxiing restrictions with taxiing A380 and other aircraft to maintain existing 300-foot separation.</li> <li>• A380 taxiing limited to Taxiway Y and prohibited on Taxiway HH.</li> <li>• A380 taxiing speed restricted to a maximum of 15 miles per hour.</li> </ul>
	28. Requested approval for an A380 operating plan regarding parallel Taxiway Y centerline to Taxiway W centerline separation.	Approved based on the following conditions: <ul style="list-style-type: none"> <li>• Construction of new taxiways must be built to Design Group VI standards.</li> <li>• Imposed taxiing restrictions with taxiing A380 and other aircraft to maintain existing 300-foot separation.</li> <li>• A380 taxiing limited to Taxiway Y and prohibited on Taxiway W.</li> <li>• A380 taxiing speed restricted to a maximum of 15 miles per hour.</li> </ul>

**Appendix IV: Status of Modifications of Standards Requested by Airports to Accommodate the A380**

Airports	Request description	FAA decision
	29. Requested approval for an A380 operating plan regarding parallel Taxiway JJ centerline to Taxiway HH centerline separation.	<p>Approved based on the following conditions:</p> <ul style="list-style-type: none"> <li>• Construction of new taxiways must be built to Design Group VI standards.</li> <li>• Imposed taxiing restrictions with taxiing A380 and other aircraft to maintain existing 300-foot separation.</li> <li>• A380 taxiing limited to Taxiway JJ and prohibited on Taxiway HH.</li> <li>• A380 taxiing speed restricted to a maximum of 15 miles per hour.</li> <li>• Required a 167-foot minimum separation from building area to Taxiway JJ.</li> </ul>
	30. Requested approval to operate an A380 on Taxiway S. The taxiway does not meet Design Group VI taxiway centerline to fixed or moveable object separation distance of 193 feet. Proposed using the taxiway with a 170-foot separation.	<p>Approved based on the following conditions:</p> <ul style="list-style-type: none"> <li>• FAA recommended future investigation of relocating vehicle service road.</li> <li>• Reconstruction of Taxiway S must be built to Design Group VI standards.</li> <li>• Allowed 170-foot separation from vehicle service road.</li> <li>• A380 taxiing speed restricted to a maximum of 15 miles per hour.</li> <li>• Imposed a maximum height restriction of 14 feet on vehicles using the vehicle service road.</li> </ul>
	31. Requested approval to operate an A380 on Taxiway P. The taxiway does not meet Design Group VI taxiway centerline to fixed or moveable object separation distance of 193 feet. Proposed using the taxiway with a 137-foot separation.	Disapproved
	32. Requested approval to operate an A380 on Taxiway K. The taxiway does not meet Design Group VI taxiway centerline to fixed or moveable object separation distance of 193 feet. Proposed using the taxiway with a 160-foot separation.	<p>Approved based on the following conditions:</p> <ul style="list-style-type: none"> <li>• FAA recommended future investigation of relocating the vehicle service road.</li> <li>• Reconstruction of Taxiway K must be built to Design Group VI standards.</li> <li>• Allowed 160-foot separation from vehicle service road.</li> <li>• A380 taxiing speed restricted to a maximum of 15 miles per hour.</li> <li>• Imposed a maximum height restriction of 14 feet on vehicles using the vehicle service road.</li> </ul>
<b>Ontario</b>	1. Requested approval to operate an A380 on Taxiways N and S. The taxiways do not meet Design Group VI taxiway centerline to fixed or moveable object separation distance of 193 feet. Proposed using the taxiways with 160-foot separation.	Pending

**Appendix IV: Status of Modifications of  
Standards Requested by Airports to  
Accommodate the A380**

<b>Airports</b>	<b>Request description</b>	<b>FAA decision</b>
	2. Requested approval for an A380 runway operating plan regarding Runway 8L/26R centerline to Parallel Taxiway N centerline separation and Runway 8R/26L centerline to Parallel Taxiway S centerline separation.	Pending
	3. Requested approval to operate an A380 on 150-foot-wide Runway 8L/26R with modified 65-foot shoulders that would meet Design Group VI overall runway pavement width of 280 feet.	Pending
	4. Requested approval to operate an A380 on 150-foot-wide Runway 8R/26L with 50-foot shoulders that does not meet Design Group VI overall runway pavement width of 280 feet.	Pending
	5. Requested approval to operate an A380 on 75-foot-wide Taxiways N, S, W, B, U, R, and D with 52.5-foot shoulders that would meet Design Group VI overall taxiway pavement width of 180 feet.	Pending
<b>Orlando</b>		
	1. Requested approval to operate an A380 on Parallel Taxiways E and F. The taxiways do not meet Design Group VI taxiway centerline to taxiway centerline separation of 324 feet. Proposed using the taxiways with a 300-foot separation.	Approved based on the following conditions: <ul style="list-style-type: none"> <li>• FAA required ramp taxiways and taxilanes at Airside Terminal Four and at future South Terminal must be in accordance to Design Group VI standards.</li> <li>• Construction of new taxiways must be built to Design Group VI standards.</li> <li>• Taxiing speed restricted on A380 when any aircraft smaller than an A380 is taxiing on a parallel taxiway.</li> <li>• A380 taxiing limited to Taxiway F and not on Taxiway E.</li> <li>• Air traffic control must implement A380 operational plan to limit A380 to those runways and taxiways.</li> </ul>
	2. Requested approval to operate an A380 on 75-foot-wide Taxiways B, B1, B10, and C. The taxiways do not meet Design Group VI total taxiway pavement widths of 180 feet. Proposed expanding the shoulders on the taxiways.	Approved on interim basis under the condition to adhere to guidance of Engineering Brief 63. <ul style="list-style-type: none"> <li>• Taxiway F bridge must support A380 weight loads.</li> <li>• Taxiway fillet designs must be in accordance with Design Group VI standards.</li> <li>• Any underground structures and utilities, taxiway culverts, and taxiway bridges must support A380 weight loads.</li> <li>• Taxiways E, J, Y, and Z and shoulders must be reconstructed to Design Group VI standards.</li> </ul>
<b>San Francisco</b>		

**Appendix IV: Status of Modifications of Standards Requested by Airports to Accommodate the A380**

Airports	Request description	FAA decision
	1. Requested approval for an A380 runway operating plan regarding the runway centerline to parallel taxiway centerline separation for A380 taxiing when any aircraft is on approach.	Approved based on the following conditions: <ul style="list-style-type: none"> <li>• Runways 1L/19R and 10R/28L would not be used for A380 operations.</li> <li>• Must post taxiway signage to indicate restricted taxiing section.</li> <li>• Construction of new runway/parallel taxiways must be built to Design Group VI standards.</li> <li>• Imposed taxiing restrictions.</li> </ul>
	2. Requested approval to operate an A380 on 75-foot-wide taxiways that do not meet Design Group VI overall taxiway pavement width of 180 feet.	Approved on interim basis under the condition that modifications adhere to guidance of Engineering Brief 63.
	3. Requested approval for an A380 operating plan regarding the parallel taxiway centerline to taxiway centerline separation.	Approved based on the following conditions: <ul style="list-style-type: none"> <li>• Construction of new taxiways must be built to Design Group VI standards.</li> <li>• Required Taxiway A to be moved 13.5 feet and relocate the vehicle service road 10 feet towards the boarding area.</li> <li>• Required Taxiway M to be moved 42.5 feet and relocate the vehicle service road 54.5 feet towards the Remote Aircraft Parking area.</li> <li>• Imposed taxiing restrictions with taxiing A380 and other aircraft.</li> <li>• A380 taxiing prohibited on Taxiway A.</li> <li>• A380 taxiing speed restricted to a maximum of 15 miles per hour.</li> </ul>
	4. Requested approval to operate an A380 on taxiway that does not meet Design Group VI taxiway centerline to fixed or moveable object separation distance of 193 feet. Proposed using the taxiway with a 146.5-foot separation.	Approved based on the following conditions: <ul style="list-style-type: none"> <li>• Allowed 146.5-foot separation from vehicle service road.</li> <li>• FAA recommended future investigation of relocating vehicle service road.</li> <li>• Construction of new taxiways must be built to Design Group VI standards.</li> <li>• A380 taxiing speed restricted to a maximum of 15 miles per hour.</li> <li>• Imposed a maximum height restriction of 14 feet on vehicles using the vehicle service road.</li> <li>• Must ensure hold lines to designated arrival and departure runways are in place.</li> <li>• Required a section of the vehicle service road next to Taxiway C moved 11.5 feet to achieve 146.5-foot separation.</li> <li>• Imposed a 400-foot clearance on vehicles using vehicle service road during A380 taxiing.</li> <li>• Required vehicle service road to be realigned 60.5 feet to maintain the 146.5-foot separation.</li> </ul>

Source: GAO summary of information provided by airports and FAA.

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**Appendix IV: Status of Modifications of  
Standards Requested by Airports to  
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Note: FAA decided to remove the 15-mile-per-hour taxiing speed restriction for the A380 that was imposed under the conditions of Engineering Brief 63. The decision will be effective in May 2006.

# Appendix V: Comments by Airbus



**AIRBUS**

*Dan Cohen-Nir  
Programs Director  
Safety and Technical Affairs*

**VIA EMAIL**

April 25, 2006

Mr. Gerald Dillingham, PhD  
Physical Infrastructure Issues, Director  
Government Accountability Office  
4411 G Street, N.W., Room 2T23B  
Washington, DC 20548

Cc: Mr. Glen Trochelman  
Assistant Director  
Government Accountability Office  
200 W. Adams Street, Suite 700  
Chicago, Illinois 60606

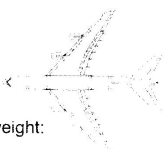

Dear Dr. Dillingham,

Airbus truly appreciates the opportunity offered by the Government Accountability Office to review, and submit comments on, the Draft Report titled 'Infrastructure Changes at U.S. Airports to Accommodate the A380'.

**General Comments**

Airbus commends the GAO for its effort in providing a comprehensive assessment of the infrastructural changes that US airports have undertaken, or may undertake, to accommodate the A380.

Since the start of the GAO study, The Boeing Company has launched an aircraft to compete with the A380 – the Boeing 747-8, which has dimensions that should require the same airfield compatibility standards as the A380. Consequently, modifications necessary for the A380 also should be deemed necessary for B747-8 service.

	<b>A380</b>	<b>B747-8</b>	
<b>Dimensions</b>			<b>Dimensions</b>
Wingspan: 261.7 ft			Wingspan: 224.75 ft
Length: 239.3 ft			Length: 243.5 ft
Height: 79.6 ft			Height: 63.5 ft
Seats: 555-853			Seats: 450-660
Maximum take-off weight: 1,235,000 pounds			Maximum take-off weight: 960,000 pounds

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Market-Driven Investments

Airbus concurs with the GAO's judgment that the infrastructure changes are not imposed on US airports but are market-driven. Airports across the United States have chosen to make those changes in order to remain competitive in the airport services marketplace. It is expected that the A380 will generate a substantial increase in airport revenues for the airports it will serve. It should be recalled that the modifications required of airports worldwide to accommodate the Boeing 747 when it was first introduced to service were done at substantial expense. The B747 was much larger in wingspan, length, weight and seating capacity compared to the next largest airplane - the Boeing 707, than is the A380 when compared to the 747-400ER. Yet, the airports chose to make those changes for competitive reasons. This proved to be a wise investment for these airports.

Airbus acknowledges the GAO's efforts to update its February 2002 report, in regard to the measurable regulatory changes that have happened since. Those changes in the form of revised FAA guidance have resulted in a dramatic decrease in the global infrastructural cost figures from 2002 to 2006.

Airbus would like to recall that, in commenting on the 2002 information, it had indicated the costs associated to the introduction of the A380 would be significantly lower than the \$2.1 billion reported in the February 2002 GAO report titled *Unresolved Issues Make It Difficult to Determine the Cost to Serve New Large Aircraft*. Airbus cost estimates were of \$520 million for those 14 airports surveyed in 2002.

Perhaps the most significant reason for the difference in expected costs was Airbus's confidence in its ability to design an aircraft compatible with existing airports. Airbus had been working with airports on the design of the to-come A380 for several years prior to the launch of the airplane in 2000, in order to minimize the impact on the airport environment. Also, we were confident in the FAA's ability to evaluate the benefits from the A380 design and develop up-to-date, safe and more cost-effective guidance. This confidence was justified as, as the GAO is reporting, the FAA has produced since two engineering briefs and, to date, approved 47 modifications to design standards in 11 airports.

The resolution of the runway width issue is underway. Airbus is confident that the US certification and operational approval of the A380 on 150-ft wide runways ultimately will allow US airports to accept A380 operations on 150-ft wide runways, at a lesser investment cost than what would have been required for full compliance to Design Group (DG)-VI standards or conformance to FAA's Engineering Brief (EB) 65.

With respect to DG-VI runway width standard, it is important to remember that these standards were first developed more than twenty years before the A380 entry into service. There have been many technological improvements during those intervening years.

It is nevertheless at this point the principal source of uncertainty in the cost evaluation of infrastructural changes by US airports. It therefore induces a very large variability in the reported runway costs depending on the airport strategy.





Contributing as well to some of the uncertainty over costs is that every airport in the study appears to have used its own and differing methodologies for estimating costs and reporting statistics.

Specific comments

The following comments are submitted for your consideration and are either based upon detailed liaison with individual airports or upon knowledge of their construction planning and schedule.

Those comments are provided after the airport names ranked in alphabetical order.

Alliance Fort Worth International Airport (AFW)

To date, no carrier has identified AFW for A380 service. Airbus assumes that most of the reported costs are associated to full compliance to DG-VI and that additional costs associated to the primary runway lengthening were dismissed, since clearly not specific to the A380.

As noted earlier in the general comments section, it is likely the runway widening costs will dramatically decrease once the FAA will develop definitive runway standards for the A380.

Airbus has no comments on the taxiway costs associated to compliance to EB63.

Ted Stevens Anchorage International Airport (ANC)

As noted earlier, the report should clearly point out that the airport's estimates are based upon the assumption that construction or reconstruction projects are planned to comply with DG-VI standards.

In particular, the runway costs estimates are based upon full compliance to DG-VI standards of one existing runway. Compliance to EB65 or final runway standards resulting from the A380 certification and operational approval should reduce significantly runway costs.

The completed taxiway projects include the construction in 2004 of taxiway Yankee, for which the accounted cost should be that of the incremental expense from DG-V to DG-VI standards. The taxiway cost estimates also include full compliance to DG-VI; conformance to EB63 would provide a less expensive solution.

The costs associated to the two remote parking positions for overnight parking seem higher than projected. Our best estimate is the costs specific to the A380 are closer to \$8 million.

Airbus has no particular comments on the costs associated to the Aircraft Fire Fighting and Rescue.



Hartsfield-Jackson Atlanta International Airport (ATL)

To date, no carrier has identified ATL for A380 service. It appears that the estimated costs for the two parallel runway and associated taxiways result from full compliance to DG-VI. Compliance to EB65 and to EB63 should reduce significantly the runway and taxiway construction costs, in the region of \$45 million. Compliance to EB63 and to the guidance resulting from the A380 certification and operational approval should further reduce infrastructural costs.

Airbus has no particular comments on the projected costs associated to the terminal gate improvements.

Dallas-Fort Worth International Airport (DFW)

The breakdown of infrastructural cost appear reasonable to us.

The report should clearly point out that the airport's construction or reconstruction projects, which are completed or planned today, will comply fully with runway and taxiway DG-VI standards.

Denver International Airport (DIA)

The report should clearly point out that the airport's runway and taxiway completed project costs correspond to the increments induced by the full compliance to DG-VI.

Planned taxiway projects may result in lesser costs if the airport is granted approval from FAA based on existing modifications of standards.

Airbus has no particular comments on the projected costs associated to the gate and terminal projects.

Washington Dulles International airport (IAD)

The best estimates for the airfield modifications to comply with EB65 are \$5.925 million. Conformance to future guidance resulting from the A380 certification and operational approval on 150-ft wide runways should further reduce infrastructural costs at a level close to \$3.8 million, if runway shoulder widening were required.

For conformance of taxiway to EB63, the costs of \$3.206 million appear reasonable to us.

Airbus has no particular comments on the \$5.6 million cost estimates for gate and concourse modifications.



Indianapolis International Airport (IND)

Airbus understands that the runway and taxiway cost estimates include compliance to EB65 and EB63. The costs reflected appear reasonable to us. Compliance to EB63 or to the runway guidance resulting from the A380 certification and operational approval should further reduce infrastructural costs.

New York John F. Kennedy International Airport (JFK)

The cost estimates are based upon the assumption that major runway reconstruction was required to accommodate the A380.

The overall figure \$47.940 million for runway costs appear much higher than Airbus estimates of \$7.6 million for several reasons.

The airport has indicated at multiple occasions that its long-term objective was to operate on four DG-VI compliant runways, not for the accommodation of the new larger aircraft but for operational purposes, more precisely for easier snow removal operations during the winter season.

Additionally, in the case of runway 4R-22L that was rehabilitated and widened in 2003, \$12 million were invested for an engineered materials arresting systems (EMAS), which is justified by safety concerns and is unrelated to the introduction of the A380.

The rehabilitation of three remaining runways starting in 2008 will take place after future guidance resulting from the A380 certification and operational approval on 150-ft wide runways is expected to be available. The current pavement characteristics of the three runways may result in virtually no incremental costs to accommodate the A380.

For all of the above, one can legitimately challenge any costs attached to the A380 when reviewing the incremental runway widening costs.

Airbus has no particular comments on the taxiway and gate project cost estimate provided.

Airbus best estimate for the A380 projects at JFK is around \$111 million.

Los Angeles International Airport (LAX)

Airbus has no particular comments on the planned runway and taxiway costs totaling \$ 3.7 million, associated to the Sepulveda Boulevard Tunnel bridge project. The report should point out clearly that the costs associated to the relocation of the southernmost runway are not included.

The report should more explicitly indicate that taxiway costs are in large part attributable to improvements of the taxiway intersections and fillets. Those improvements were already required for the entry into service of new generation longer airplanes such as the Airbus's A340-600 or Boeing's 777-300ER prior to the introduction of the A380. Both the A340-600 and the 777-300ER are more critical than the Boeing's 747-400 that had been used as the critical design aircraft.



The projected terminal improvements at the Tom Bradley international Terminal include improvements that are not generated by the introduction of the A380 but form part of the concomitant modernization program in the terminal interior. The report should clearly differentiate those costs from the A380 entry into service.

Airbus has no comments on the projected costs associated to the gate projects.

Orlando International Airport (MCO)

The overall cost estimate of \$66 million, which include west and east airfield projects, appears much higher than projected for the A380 operations to be considered in the 2006-2010 timeframe.

Airbus best estimate for the west airfield projects is around \$25.5 million.

Shoulders and blast pads of one of the two west airfield parallel runways will be upgraded to DG-VI standards. Airbus best estimate for the cost associated is \$3.5 million. The second runway is already compliant with DG-VI standards.

Airbus best estimate is in the region of \$22 million for conformance to EB63 or DG-VI of the existing taxiway infrastructure (bridge, intersections, shoulders) on the west airfield.

Beyond 2010, the airport may consider east airfield runway and taxiway system improvements. Airbus assumes that the \$12.3 million reported correspond to full compliance to DG-VI. Conformance to EB65 or to the runway guidance resulting from the A380 certification and operational approval should further reduce infrastructural costs, in the region of \$5 million for the less expensive option. Airbus has no particular comments on the \$18.3 million taxiway cost estimates provided.

Airbus has no particular comments on the terminal cost estimates provided.

Memphis International Airport (MEM)

The estimated costs for the two parallel runways result from conformance to EB65; for completed taxiways to DG-VI (incremental costs from DG-V) and for on-going or planned taxiways to EB63. Conformance to future guidance resulting from the A380 certification and operational approval on 150-ft wide runways should further reduce infrastructural costs.

Miami International Airport (MIA)

The overall cost estimate of \$97.466 million appears much higher than projected for the A380 operations.



First, the completed Support Project (i.e. midfield holding bay) is related to growth and airfield congestion and has limited correlation to the accommodation of the A380. Clearly, the \$34.641 million figure is not justified by the needs for the A380.

Second, it is assumed that EB65 shoulder strength requirements are applicable to an existing 200-ft wide runway. This is not according to the FAA guidance, which rather considers shoulder width requirements. This only would lower construction costs significantly.

Third, conformance to the runway guidance resulting from the A380 certification and operational approval should further reduce infrastructural costs on the existing 150-ft runway.

Airbus best estimate for the runway projects is around \$10 million.

Airbus has no particular comments on the taxiway (compliance to EB63) and gate cost estimates provided.

Airbus best estimate for all projects is around \$40 million.

Ontario International Airport (ONT)

Airbus understands that the runway cost estimates include only incremental expenses incurred for compliance with EB65. The costs reflected appear reasonable to us. Compliance to EB63 and to future guidance resulting from the A380 certification and operational approval on 150-ft wide runways should further reduce infrastructural costs.

Chicago O'Hare International Airport (ORD)

The short-term plan to accommodate the A380 may include widening the runway shoulders of runway 14R-32L to comply with DG-VI standards and taxiway improvements (EB63) as well fillet widening and signage, lighting and pavement markings improvements.

Airbus estimate for those improvements is in the region of \$20 million.

Alternatively, in view of a multi-billion O'Hare Modernization Plan (OMP) that has been recently approved and that calls for two new DG-VI runways and several DG-VI taxiways partially available in 2009-2010 and completed in 2013, the airport may elect to develop an interim operational plan with specific procedures applicable in the existing airfield configuration. This alternative will virtually incur no incremental cost.

Airbus has no particular comments on the \$44.7 million cost estimate for the incremental costs of the DG-VI runway and taxiway system devised in the OMP. Airbus would like to observe that incremental costs represent a very small fraction of the OMP estimated cost.



Philadelphia International Airport (PHL)

To date, no carrier has identified PHL for A380 service. Some A380 carriers have identified PHL as a potential alternate airport for diversion purposes. As a result, airfield modifications should be non-existent and gate improvements reduced to a minimum.

The report should clearly point out that the airport's construction or reconstruction projects cost estimates are based upon compliance with DG-VI standards. Compliance to EB63 and to the runway guidance resulting from the A380 certification and operational approval should further reduce infrastructural costs.

Airbus understands that \$4.2 million are associated to future direct upper deck access and terminal improvements of two gates at existing terminals. In all likelihood, this service will not be provided in the 2006-2010 timeframe considered in this report.

Those costs appear reasonable to us.

Louisville International airport (SDF)

The report should clearly point out that the airport's taxiway project include a \$15 million new taxiway built not only for the A380 but also for airfield expansion included in the airport's master plan. Only the incremental portion resulting from compliance with current DG-VI standards in terms of taxiway width and upcoming DG-VI standards on runway-to-parallel taxiway separation should be accounted for.

The airport estimates include an \$11 million runway improvement project to comply with DG-VI standards. Compliance to EB65 or conformance to the runway guidance resulting from the A380 certification and operational approval should further reduce infrastructural costs.

San Francisco International Airport (SFO)

The breakdown of infrastructural cost appear reasonable to us. Airbus overall cost estimate is around \$20.3 million.

The report should clearly point out that the airport's construction or reconstruction projects, which are completed or planned today, will comply with runway DG-VI standards and EB63.

Tampa International Airport (TPA)

To date, no carrier has identified TPA for A380 service. Some A380 carriers have identified TPA as a potential alternate airport for diversion purposes. As a result, airfield modifications should be non-existent and gate improvements reduced to a minimum.



Airbus understands that \$2.2 million out of the \$2.3 million reported is associated to direct upper deck access to a gate in a potential new terminal. In all likelihood, this service will not be provided in the 2006-2010 timeframe considered in this report. As a result, only the remaining \$100,000 invested in the current terminal should be accounted for.

Summary comments

The list of 18 airports considered by the GAO reflects well the likely and potential US destination airports that are expected to accommodate the A380 (as well as, presumably, the B747-8) in the next 5 years. Some airports that are only intended as alternates have been also evaluated.

After reviewing the 18 airports' cost estimate, Airbus has identified several projects that are not related to the A380 and should be dismissed, as well as some discrepancies in the interpretation of applicable FAA guidance.

As a result, Airbus believes that there are significant savings in excess of \$200 million that can be found in the cost estimates provided by ATL, MIA, MCO, and JFK notably.

When comparing against the \$927 million calculated by the GAO, Airbus estimates that a more reasonable figure is in the region of \$720 million.

We appreciate the opportunity to provide our views and to submit our comments and, as in the past, are ready to assist you at any opportunity in the important endeavor of your study.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Dan Cohen-Nir".

Dan Cohen-Nir  
Programs Director  
Airbus North America Holdings Inc.

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# Appendix VI: GAO Contact and Staff Acknowledgments

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## GAO Contact

Gerald Dillingham, Ph.D., (202) 512-2834

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## Staff Acknowledgments

In addition to the person named above, Glen Trochelman, Assistant Director; Carolyn Boyce, Richard Calhoun, Nikki Clowers, Vashun Cole, Colin Fallon, and Frank Taliaferro made key contributions to this report.



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