

GAO

Testimony

Before the Subcommittee on Aviation,
Committee on Transportation and Infrastructure,
House of Representatives

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DENVER
INTERNATIONAL
AIRPORT

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063538/154219

Mr. Chairman and Members of the Subcommittee:

We appreciate this opportunity to testify on Denver International Airport (DIA). Since 1991, we have issued three reports on various aspects of the airport's financing, construction, and automated baggage handling system.¹ Our testimony today, drawn from this body of work and our ongoing work for Senators John McCain and Hank Brown, focuses on DIA's (1) development, including that of the automated baggage system, (2) cost, and (3) airfield construction. We would like to summarize our findings in these areas and then turn to a more detailed explanation of them.

- First, DIA was designed and built in just over 5 years and opened on February 28, 1995. This accomplishment is often obscured by issues and problems associated with its state-of-the-art baggage system. The airport, one of the largest ever constructed in the nation, has 33 miles of runways and taxiways. Site preparation and construction began in September 1989; the scheduled opening date was October 1993. Because of changes in the scope and design of the airport, the opening was delayed from October 1993 to December 1993 and then to March 1994. The airport's opening was further postponed as a result of mechanical and software problems with the automated baggage handling system. Parts of the automated baggage system were functional when the airport opened, but a back-up conventional baggage handling system--using conveyor belts, tugs, and carts--will be used as a permanent adjunct or until the automated system is operating on all concourses.
- Second, DIA's total cost is over \$4.8 billion. The total cost includes \$3 billion in construction costs, \$1 billion more than the first firm estimate in May 1990. Most of the cost increases were due to changes in the scope of the airport, such as the addition of an automated baggage system and widening and lengthening a concourse. Cost increases for financing during construction also contributed to the rise in the airport's total cost. The Federal Aviation Administration (FAA) plans to spend \$655 million in federal funds toward the cost of the airport.
- Third, there were construction problems with some of the 135,000 concrete panels that make up DIA's runway systems. For example, we found that faulty construction practices and poor workmanship on three runway systems affected about 14,400 panels. The majority of the problems identified,

¹See New Denver Airport: Safety, Construction, Capacity, and Financing Considerations (GAO/RCED-91-240, Sept. 17, 1991); New Denver Airport Followup (GAO/RCED-92-285R, Sept. 14, 1992); and New Denver Airport: Impact of Delayed Baggage System (GAO/RCED-95-35BR, Oct. 14, 1994).

which included impurities in the concrete mixture and missing steel bars in the pavement, were corrected before the airport's opening. However, we found that some of these problems had not been corrected. As a result, the City and County of Denver have scheduled additional work to remediate remaining problems beginning in June of this year. Additionally, while limited testing on another runway and taxiway system found problems, no additional tests have been done. As a result, questions remain about whether additional problems exist. If such problems exist and are not corrected, the pavement could deteriorate prematurely.

- Fourth, FAA determined that its newly constructed \$19 million Terminal Radar Approach Control (TRACON) facility had some cracks in the internal walls and water damage resulting from inadequate rain gutters. Repairs on the building are under way. In response to allegations that the air traffic control tower was leaning, FAA conducted tests that showed that the tower is straight as designed.

We will now turn to a more detailed discussion of our findings.

DIA'S DEVELOPMENT AND CONSTRUCTION

Denver International Airport (DIA) opened for business on February 28, 1995. With the exception of the automated baggage system, the airport had been ready to open for almost a year. DIA was conceived as a necessary replacement for Denver's existing airport--Stapleton International Airport. Stapleton was a major airline hub, was close to downtown, and had recently undergone \$100 million in improvements. However, its capacity was reduced in bad weather, and nearby residents opposed expansion because of airport noise. In 1988, the City and County of Denver (both hereafter referred to as the City) made a preliminary agreement to acquire a 53-square-mile site in Adams County, northeast of Denver, for a new airport. In May 1988, voters in Adams County approved annexation of the land for the airport. In November 1988, the City developed a "conceptual estimate" of \$1.34 billion for the proposed airport. In May 1989, voters in Denver approved the airport plan. Following this approval, site preparation and construction began in September 1989.² Appendix I provides a graphic representation of DIA's development.

The design and construction process at DIA was organized under a Program Manager System. In this system, the City joined with a

²The Denver Airport System is headed by the Director of the Department of Aviation, who reports directly to the Mayor of the City of Denver.

joint-venture engineering, architecture, and airport-design firm. Together, they acted as a Project Management Team to coordinate and ensure the quality of some 61 design contracts, 134 construction contractors, and over 2,000 subcontractors. These contractors and subcontractors would be responsible for building terminals, concourses, roadways, parking lots, and more than 33 miles of runways and taxiways.

In 1989, the City began to solicit bids for construction without obtaining formal input on the airport's design from the ultimate users of the facility--the airlines. In negotiating with these major tenants to sign gate leases, the City agreed to some very large and significant design changes. These decisions triggered far-reaching changes to the design and construction of DIA's buildings and systems, many of them in mechanical, electrical, and telecommunications systems that are complex and difficult to coordinate. For example, at Continental Airlines' suggestion, the City moved the international gates away from the north side of the main terminal to its Concourse A and built a passenger bridge from Concourse A to the main terminal, duplicating the function of a below-ground "people-mover" system.

United Airlines also requested substantial modifications when it negotiated an agreement with the City. Most significantly, United requested an automated baggage handling system for Concourse B to ensure that nearly all of its transferring passengers' bags reached flights very quickly. At that time, the City planned to allow each airline to develop its own baggage system as long as this system did not interfere with any airportwide automated baggage system that the City might wish to install in the future.

The City had already explored the feasibility of installing an airportwide automated baggage system. In August 1990, a study commissioned by the City indicated that the highly complex and technically difficult state-of-the-art automated baggage system necessary for an airport of that size could probably not be built and tested in time to meet the scheduled opening date of October 1993. Specifically, the consultant's report discussed the risks involved with five baggage system options.³ Following the consultant's report, the City decided to open the airport using a conventional tug-and-cart baggage system. However, after United agreed to sign a 30-year lease in June 1991, the City decided to develop an automated system for the entire airport. According to the consultant's report, the automated system selected was the one option that posed the greatest risk for not meeting the airport's scheduled October 1993 opening date. Appendix II provides a timeline of the development of the automated baggage system.

³The five airportwide baggage system options discussed by the contractor were a conventional tug-and-cart system and four types of automated systems.

The opening of the airport was postponed at first because of construction delays and later because of problems with the automated baggage system. The first delays--from October 1993 to December 19, 1993, and again to March 9, 1994, resulted because the construction of the airport was not complete. The airport's opening was delayed again from March 1994 to May 1994 and then postponed indefinitely, solely as a result of problems in getting the baggage system to work properly. Recognizing that the contractor for the baggage system could not predict when the automated baggage system would be operating, the City decided in July 1994 to build an alternative baggage system. February 28, 1995, was established as the airport's new opening date.

DIA opened with the conventional baggage system providing service to all concourses, while a partially functioning automated baggage system served Concourse B. Specifically, the automated system was only operating for the luggage of United passengers on Concourse B--and only for normal size bags on outbound flights and large size bags, such as skis on inbound flights. The City expects the automated system to be fully operational for Concourse B in July 1995 and for Concourse A in August 1995. A decision on whether to extend the automated system to Concourse C--the most distant concourse from the terminal--will be made later. According to City officials, the carriers operating from Concourse C are satisfied with the alternative baggage system. The total construction cost of the baggage handling system--both the automated and conventional systems--is about \$300 million to date.

THE COST OF DIA

The total cost of DIA is over \$4.8 billion, including pledges of \$655 million in federal funds.⁴ The total cost covers planning, land acquisition, program management, engineering and architectural design, construction, interest and finance charges incurred prior to opening day, air traffic control facilities, and airline and car rental facilities. Appendix III provides a summary of DIA's costs.⁵

Construction and Other Costs

In November 1988, before selecting a site for the airport, the City developed a "conceptual estimate" of \$1.3 billion for

⁴While FAA has conditionally agreed to provide funds to DIA for fiscal years 1996-2002, the availability of these moneys depends on congressional authorization and appropriation.

⁵We have reported all cost figures in nominal dollars--not adjusted for inflation. Inflation has been relatively low during the past few years, and these dollar amounts would not be substantially different if expressed in inflation-adjusted 1995 dollars.

constructing a new airport. The earliest firm estimate for the cost of design and construction of the airport was contained in the May 1990A bond series prospectus prepared by the City. At that point, the City estimated that construction costs would be about \$2.08 billion, excluding planning, land, interest, and finance charges. This estimate was revised in February 1992 to \$2.7 billion. The principal reason for the growth in the cost was the airlines' additional requirements, such as tenant finishes in facilities, increasing apron sizes in the aircraft parking areas, widening and lengthening a concourse, expanding the parking structure, and adding the automated baggage system.

In February 1994, the City revised the estimated cost of construction to \$2.92 billion. Two factors made up this increase: (1) \$30 million, mainly for the terminal, electronic systems, and tenant improvements in concourses A and B, and (2) \$194 million for additional facilities requested by the airlines. In September 1994, the project's estimated cost was increased to include \$51 million for a back-up baggage handling system and about \$24 million for additional capital projects. As shown in table 1, the updated costs for the baggage systems brought the final construction cost at the airport's opening to about \$3 billion.

Table 1: History of Growth of Budgeted Construction Cost at DIA

Date	Budget	Scope
Nov. 1988	\$1.339 billion	Conceptual estimate, includes four runways, two concourses, 78 gates and two-module terminal
May 1990	\$2.079 billion	Five runways, expanded aprons, three concourses with basements, 94 gates, three-module terminal, basic tenant finishes for airlines, conventional baggage system
Feb. 1992	\$2.700 billion	Five runways, three concourses, 94 gates, three-module terminal, upgraded tenant finishes for United Airlines' facilities, expanded cargo facility, automated baggage system for Concourse B, expanded parking lots, commuter building, expanded basement, 41 positions added to accommodate commuter flights, and airportwide automated baggage system
Feb. 1994	\$2.924 billion	Same scope as above plus costs of moving cargo area, additional tenant finishes for United Airlines' facilities, and additional equipment and services
Sept. 1994	\$2.953 billion	Additional \$75 million for an alternative back-up baggage system and modifications to automated baggage system, minus a \$45.6 million reimbursement from United Airlines for a change in scope regarding its parts distribution facility, for a net increase of \$29.4 million
Mar. 1995	\$3.000 billion	Same scope as above except for updated costs on baggage systems and miscellaneous costs incurred for the airport's opening

Financing costs were another major expense. These costs included about \$958 million for capitalized interest and bond financing incurred before the airport's opening. These expenses brought DIA's estimated total cost to about \$4.2 billion. When

other costs, including those for air traffic control facilities, special airline facilities, and rental car facilities, are taken into account, DIA's total cost is estimated to be over \$4.8 billion.

The Federal Investment in DIA

FAA has pledged about \$655 million in federal funds from the Airport and Airway Trust Fund for DIA. This amount represents about 14 percent of DIA's total cost.⁶ Over two-thirds of the total federal funds for DIA will be provided from FAA's Airport Improvement Program account, and the remainder will come from FAA's Facilities and Equipment account. To date, DIA has received about \$477 million in federal funds, and the remainder is planned to be distributed by 2002. Appendix IV provides a breakdown of federal funding for DIA by fiscal year.

About half of the total federal funds for the project--\$327 million--have been or will be spent on the construction of airfield pavement. Federal funds are also used for the construction of some airport buildings, land purchases, air traffic control facilities, and support and engineering. Appendix V provides a breakdown of federal funding for DIA by various categories of projects.

QUALITY ASSURANCE SYSTEM IS LATE TO IDENTIFY SOME AIRFIELD CONSTRUCTION PROBLEMS

The City's quality assurance program, while generally effective in detecting airfield construction problems and effecting remedial action, had some notable lapses.

Scope of Problems With Pavement

DIA's total airfield pavement, which consists of approximately 135,000 concrete panels, required placing approximately 5.3 million square yards of concrete.⁷ Construction work was performed simultaneously on three to five runways and airport structures, and quality assurance inspectors were responsible for many different aspects of the airfield's construction. The City found problems with the pavement at DIA in three areas: (1) the concrete was of

⁶In fiscal year 1993, FAA obligated \$10 million to complete rough grading for a sixth DIA runway. Although the City has not used this funding, it plans to request an additional \$65 million from FAA to complete the runway. Also, the City may ask FAA to provide \$30 million for airport access roads by the year 2000.

⁷Most panels are approximately 20 feet by 19 feet.

poor quality,⁸ (2) the steel tie bars were improperly installed,⁹ and (3) the steel dowel bars were improperly aligned and attached.¹⁰

We reviewed the City's construction reports and project records for three of the five runway systems. These three systems comprised about 32,000, or 24 percent, of DIA's 135,000 panels.¹¹ These records showed that about 14,400, or 45 percent, of the 32,000 panels inspected did not conform to the contracts' specifications when the concrete was initially placed by the contractors. Table 2 shows the type and extent of problems that occurred on the 14,400 panels.

Table 2: Problems With Pavement on Three DIA Runway Systems

Type of pavement problem	Number of panels affected
Clay contamination and cracking	3,009
Tie bars improperly installed	10,374
Dowel bars improperly aligned and attached	1,000 ^a
Total	14,383

^aAccording to DIA, additional problems with the dowel bars were repaired during construction.

Source: GAO's analysis of FAA and DIA documents.

In most cases, the City required contractors to repair or replace panels that had problems. As specified by the contracts, the contractors had to pay to repair or replace the problem panels they were responsible for.¹²

⁸The problems with the quality of the concrete included contamination of the concrete with clay and cracking.

⁹Tie bars are inserted into the concrete panels to promote aggregate interlock--a mechanism for transferring weight.

¹⁰Dowel bars are inserted into the sides of the concrete panels to help transfer the aircraft's weight from one panel to another.

¹¹These include runway systems 17R/35L, 17L/35R, and 8R/26L.

¹²Runways at DIA were covered by warranties contained in specific clauses in the contract. According to these clauses, observable defects noted during construction are to be remedied during the construction process at no additional costs to the City. Latent defects--defects in material or workmanship that are not apparent

On one runway, concrete was contaminated with clay. This occurred because inspectors did not inspect the batch plant where the contractor was mixing concrete and the contractor failed to notice that a critical screen was missing. As a result, clay went into the mix for 10 days while paving continued. The contamination was discovered when clay was found on the pavement's surface approximately 3 weeks later. The contractor repaired or replaced the affected panels at no additional cost to the City.

According to the City, the problems with the tie bars occurred because it was not always evident to contractors or inspectors that the machines installing the tie bars had not spaced them properly or that workers were not operating the machine properly. In July 1993, the City tested two runways and sections of other pavements on the airfields where it suspected that the contractors had improperly installed the tie bars.¹³ The tests, using special ground-penetrating radar (GPR) instruments, showed that the contractor had not installed tie bars in thousands of panels according to specifications, had installed too few or too many tie bars or had installed tie bars at the incorrect depth. The City allowed the contractor to make repairs by inserting additional tie bars. The City told us that all repairs related to the tie bars had been completed.

Quality Assurance Process Missed Some Problems

We found some instances in which the City--through its quality assurance program--did not ensure that the contractor corrected the 10,374 identified problems with the pavement as required. To verify that the contractor had completed repairs related to the tie bars, we examined portions of two runways and taxiways on February 24, 1995. Many of the nonconforming panels we inspected had not been repaired.¹⁴ According to the design engineer for the taxiway, if tie bars are not properly installed, the joint between the panels could widen enough to cause settlement, faulting, and failure of the concrete on each side of a joint.

As a result of our examination, the City performed a 100-percent visual inspection of both runway systems on February 26, 1995, less than 48 hours before the airport opened. After determining that the 762 panels with too few tie bars had not been repaired, the City will require the contractor to begin repairs in

during construction, such as missing tie bars--have been remedied when discovered at no cost to the City.

¹³The tests were performed by a consultant under contract to the City.

¹⁴Repairs were evident because of small patches on the pavement surface.

June 1995. However, the City is not going to repair about 400 panels we identified as having too many tie bars. The City is not requiring the contractor to repair these panels because the City's design engineers concluded that the performance or life of the runways will not be affected by the presence of too many tie bars. However, an FAA pavement expert with whom we discussed the issue told us that the presence of too many tie bars could cause panels to break and crack.

In addition to these unresolved problems, questions remain about whether problems exist on another runway and taxiway system. For example, GPR tests conducted at seven locations on the runway system identified a shortage of tie bars in each location. Specifically, 63 percent (210 of 334) of the panels tested did not conform with the contract's specifications. The City told us that the panels had been repaired by the responsible contractor. While the City plans no additional tests, it does plan to visually inspect all the pavement.

In May 1995, FAA requested that the City provide its inspection records so the agency could ascertain how extensive DIA's pavement problems are and whether the City's GPR tests included an adequate sample of panels. FAA plans to use this information to determine if additional testing should be conducted.

FAA IS CORRECTING CONSTRUCTION PROBLEMS FOUND AT AIR TRAFFIC CONTROL FACILITIES

DIA's principal air traffic control facilities--the TRACON building and the 300-foot air traffic control tower--have been subject to allegations of poor design and workmanship or substandard construction. Except for some problems with cracks and water damage at the TRACON facility that FAA is addressing, we have not found support for these allegations.

The \$19 million TRACON building was completed in September 1992. By December 1992, FAA's project engineers found several cracks along non-weight-bearing walls. According to FAA officials who have since reviewed the construction plans for the facility, a slip joint--a critical design element necessary to compensate for expected expansion and contraction of the soil underneath the building--was overlooked during design and construction. The soil has expanded beyond the 2-inch limit that the building's foundation was designed to accommodate. FAA's engineers assume that this movement is causing the building's walls to crack. According to FAA, the floor's movement has not affected the operations or safety of the facility. Repairs, to be paid for by FAA, are under way and are estimated to cost between \$150,000 and \$175,000; \$150,000 had already been obligated as of March 1995.

FAA's project engineers also found water damage on some of the TRACON facility's walls where cracks had appeared because the

contractor installed rain gutters that were too small. As a result, water backed up and seeped into several non-weight-bearing walls. The contractor's 1-year warranty on the work had expired. Action is being taken to install exterior gutters at an estimated cost of between \$90,000 to \$100,000. FAA will pay for these repairs.

FAA examined the air traffic control tower after allegations were made that it was leaning. In March 1993, FAA surveyed the tower shaft and verified that it was standing straight as designed. In January 1995, FAA again surveyed the tower shaft and found that it was straight.

OBSERVATIONS

Our work at DIA revealed several insights that could be useful to future construction projects of this type:

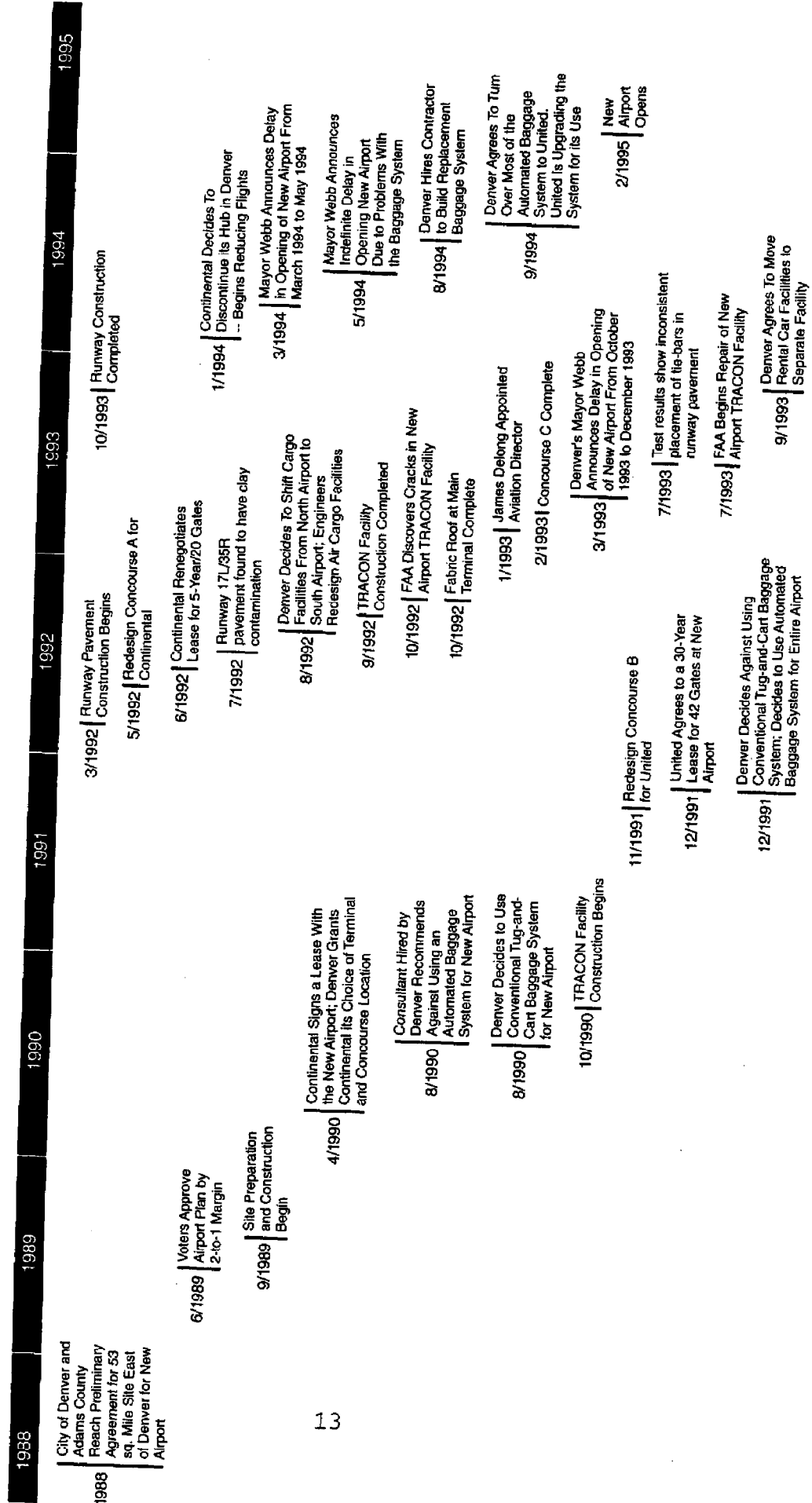
- Get the users (the airlines) involved early to minimize changes in design at the airport. DIA's design underwent numerous changes as the City negotiated with the airlines over their space and leases. These changes added over \$1 billion dollars to the overall cost of the airport and often resulted in reconstruction and delays.
- Provide for alternative or back-up systems when dealing with new and untested technology. The automated baggage system, which will cost about \$234 million, was to be one of the largest and most sophisticated systems of its kind in the world. The significant mechanical and software problems that occurred on the system were the sole reason that the airport opened almost 1 year late. The system is still not totally operational. The City was advised early on by several consultants that building the automated system was a high-risk proposition, especially within the time frames allowed. The City disregarded these opinions and has paid a high price for this decision. In DIA's case, it would have been cheaper to plan for and build an alternative system from the start rather than deciding to install one after major problems surfaced.
- Provide for a vigorous quality control and quality assurance program. The City's quality assurance program was generally effective in detecting and correcting most of the contractor's nonconforming work on the airfield. The City stressed the importance of quality control with its contractors. As a result of this emphasis, most of the construction projects at the airport were finished on time and according to specifications. However, some notable lapses occurred, especially regarding airfield construction. At DIA, we found instances in which problems went undetected and effective measures were not always

taken to ensure that the contractor corrected the problems that had been identified. The City's experience highlights the importance of building in quality rather than achieving quality through remediation in any major construction project.

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Mr. Chairman, this concludes our prepared statement. We would be happy to answer any questions you or the members of the Subcommittee may have.

GAO Denver International Airport: Development Timeline



GAO Denver International Airport: Baggage Timeline

1990	1991	1992	1993	1994	1995
<p>4/1/890 First Consultant Hired by the City Concerned That Travelers To Design, Install, and Test an Airport-Wide Destination Cooled Vehicle (DCV) Automated Baggage Handling System at DIA by the October 1993 Opening Date for the Airport</p> <p>8/1/890 Several Consultant Hired by the City Expressed Strong Reservations About Changing an Airport-Wide Baggage System and Recommended a Different System for Each Concourse</p> <p>8/1/890 The City Decides to Use Conventional Top-and-Cart Baggage System for All Concourses at the New Airport</p> <p>10/1/890 The City Indicates It Would Consider Airlines' Request to Build Their Own Baggage Systems As Long As These Systems Do Not Jeopardize the City's Plans for Any Automated Baggage System</p> <p>Later/1990 Conventional and United Airlines Began Designing Their Own Baggage Systems for Concourses A and B Respectively. Plans for a Top-and-Cart System for Concourse C Remained Unchanged</p>	<p>5/1/892 The City Awarded BAE a Fixed-Price Contract for Design, Build, and Test an Integrated Automated Baggage System</p> <p>8/1/892 The City Enclosed a \$23 Million Design Change Order to Relocate Baggage Carousels and Lifts in the Terminal</p> <p>9/1/892 The City Enclosed a Second Change Order for \$5.5 Million Covering Relocations in System Design and a Subsystem for Concourse B</p> <p>1/1/893 The City Enclosed a Third Change Order for \$1.9 Million for Relocations in the Terminal Building</p> <p>1/1/893 The City Sent a Letter to BAE Saying That the Lack of a Usable BAE Schedule Had Created a Serious Planning and Coordination Problem</p> <p>1/1/893 BAE Sent a Letter to the City Blaming the City for Failing to Meet its Contractual Obligations and Saying That the City Contributed to Problems With the Baggage System</p> <p>3/1/893 The City Enclosed a Fourth Change Order for \$7.2 Million for Modifications to the East Side of Concourse C</p> <p>3/1/893 The City Announced a Delay in Opening DIA from October 1993 to December 1993</p> <p>5/1/893 The City Sent a Letter to BAE Saying That BAE's Schedule of a December 1993 Completion Date Was Unacceptable and Asked for an October 1993 Completion</p> <p>5/1/893 A City Evaluation of BAE's Progress Indicated That BAE Had Yet to Begin Scheduling, to Control and Report the Baggage Relocates to the Correct Destination</p> <p>6/1/893 BAE Sent a Letter to the City Saying That BAE Would Be Completed by October 1993 and Full System Testing Would Be Completed by December Opening Date (Although Certain Components Added to the In-Peak Unit After Opening DIA)</p> <p>6/1/893 The City Enclosed a Fifth Change Order for \$1.1 Million for the Addition of a Conveyor System and Guards in Concourse B</p>	<p>8/1/892 The City Issued a Request for Proposal (RFP) for an Airport-Wide Automated Baggage System</p> <p>9/1/891 United's Baggage Contractor, BAE, Submitted a Discussion Paper to the City for Building an Integrated Automated Baggage System Within the Current Airport-Wide System and Prepared a More Formal Proposal</p> <p>10/1/891 BAE Submitted a More Formal Proposal for an Integrated Automated System, Listing a System Price of \$185 Million</p> <p>11/1/891 The Denver Airlines Airport Affairs Committee Sent a Letter to the City Expressing Concerns About the Proposed Opening of the Airport by October 1993 and Also Noted That the Baggage System was not Scheduled for Completion Until May-1994</p> <p>12/1/891 The City Released the Proposals of the Firm Responding to the RFP (BAE did not Submit a Proposal)</p> <p>12/1/891 BAE Agreed to Build an Integrated Automated System and Signed a Contract for \$20 Million To Begin System Development</p> <p>2/1/892 The City Began to Receive Letters From the Airlines Expressing Concerns About the Feasibility and Cost of an Integrated Automated Baggage System at DIA</p>	<p>8/1/893 A City Engineer's Status Report Said the Completion of Mechanical and Electrical Installation Work by December 1993 Was Probable, and That Full System Testing Would Not Be Completed Until January 1994</p> <p>9/1/893 A City Engineer's Evaluation of BAE's Progress Again Noted That BAE Would Likely Not Meet its System Testing Schedule</p> <p>9/1/893 BAE Sent a Letter to the City Saying That Full System Testing Would Be Completed in December</p> <p>11/1/893 The City Enclosed a Sixth Change Order for \$3.1 Million for Maintenance Equipment and Spare Parts</p> <p>2/1/894 The First Large-Scale Test of the Baggage System (Only on Concourse B) Resulted in Major System Failures. United's Engineers Would Not Be Operational by the Scheduled Match 1994 Opening</p> <p>2/1/894 The City Announced a Further Delay in Opening DIA From March 1994 to May 1994, Citing Delays in the Completion of the Baggage System As the Reason for the Postponement</p> <p>4/1/894 United Airlines Wrote the City Expressing Concerns About the Baggage System (Not Yet Completed and Tested by the May Opening Date)</p> <p>5/1/894 The City Announced an Indefinite Postponement of DIA's Opening Date Pending Completion of the Baggage System</p> <p>5/1/894 The City Hired Logstein, a Baggage System Consulting Firm, to Evaluate Alternative System Recommendations. Logstein Recommended That the City Buy a Conventional Top-and-Cart System to Use Until the Automated System Could be Complete</p> <p>May/1994 Numerous Problems Continued to Occur As Further System Testing Proceeded</p> <p>7/1/894 The City Decided to Build an Alternative Baggage System and Notify the Automated System</p> <p>8/1/894 BAE, the City, and United Agreed to Modify the Automated System to Serve Concourse B for About \$35 Million</p> <p>9/1/894 The City Contracted With Rapistan, Inc., to Build an Alternative Baggage System With An Estimated Cost of \$63 Million</p> <p>11/1/894 The City Executed a Standstill Change Order to Stop the Construction of the Baggage Handling Capability of the Automated System From 65 Bags to 30 Bags per Minute</p>	<p>2/1/895 The Airport Checked With An Automated System for United's Outboard and Over-sized Baggage and a Top-and-Cart System for Concourses A and C. The City Plans To Have the Full Automated System Working for Concourse B by July 1995 and Extend it to Concourse A by August 1995. The City Plans to Evaluate Further Baggage System Alternatives for Concourse C</p>	

COST OF DENVER INTERNATIONAL AIRPORT

Dollars in millions

Category	Cost
Cost to Denver Airport System	
Construction	\$3,004
Airport planning and land	261
Capitalized interest	915
Bond discounts	43
Total cost to Denver Airport System	4,223
Cost to others	
FAA's facilities and equipment	199
United Airlines' special facilities	261
Continental Airlines' special facilities	73
Rental car facilities	66
Total cost to others	599
Total costs of Denver International Airport	\$4,823

Source: Based on information from the City and FAA.

ACTUAL AND PROPOSED FEDERAL FUNDS FOR DENVER INTERNATIONAL AIRPORT

Dollars in millions

Fiscal year	Airport Improvement Program account		Facilities and Equipment account	Total ^a
	Entitlement funds	Discretionary funds		
1988	\$0.2	\$0	\$0	\$0.2
1989	34.2	25.8	4.1	64.1
1990	31.0	59.0	38.7	128.7
1991	0	25.0	59.5	84.5
1992	2.2	42.3	39.9	84.4
1993	5.9	42.0	23.0	70.9
1994	6.0	32.0	1.2	39.2
1995	4.8	31.0	0	35.8
1996	4.9	25.0	0	29.9
1997	4.9	25.0	4.0	33.9
1998	4.9	25.0	0	29.9
1999	4.9	20.0	12.3	37.2
2000	0	0	2.0	2.0
2001	0	0	12.5	12.5
2002	0	0	1.8	1.8
Total	\$104.0	\$352.1	\$198.9	\$655.0

^aFigures may not sum to total because of rounding.

Source: Based on information from FAA.

ACTUAL AND PROPOSED FEDERAL FUNDS FOR DENVER INTERNATIONAL AIRPORT
BY PROJECT CATEGORY

Dollars in millions

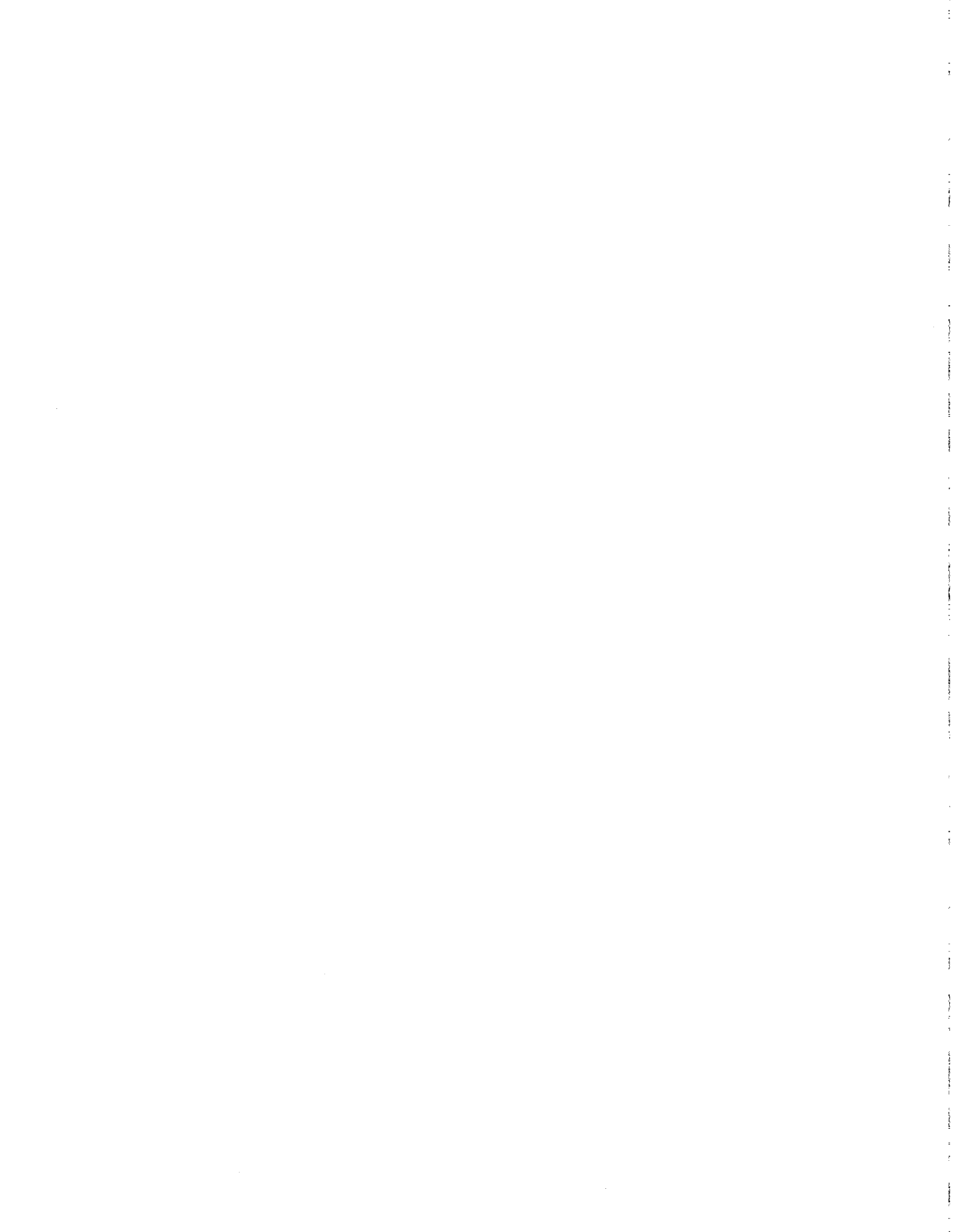
Fund/category	Total^a
Airport Improvement Program account	\$456.1
Runway/taxiway/apron construction	326.7
Train and tunnel construction	64.5
Land for development and relocation assistance	36.9
Runway/taxiway signs and lights	12.3
Utility relocation and removal	10.0
Terminal and other building construction	2.9
NAVAIDS ^b and other safety equipment	2.4
Planning	0.3
Facilities and Equipment account	\$198.9
Tower/TRACON/technical operations center construction	56.9
Communications equipment	40.6
Automation equipment	35.8
Navigation and landing equipment	25.5
Engineering and support services	21.5
Surveillance equipment	11.0
Weather equipment	6.4
Stapleton airport decommissioning	1.2
Total federal funds	\$655.0

^aFigures may not sum to total because of rounding.

^bNAVAIDS are navigational aids, such as instrument landing systems.

Source: Based on information from FAA.

(341455)



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