



## **Master Plan Update Studies** **Executive Summary**

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City and County of Denver Department of Aviation  
Published March 2012

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**The purpose of this executive summary is to provide an overview of the findings and recommendations from the Master Plan Update Studies for Denver International Airport. The Master Plan Update Studies report should be consulted for additional information on the technical analyses, assumptions, and methodologies supporting the findings and recommendations.**

All photographs provided courtesy of Denver International Airport.

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## Introduction

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The original master plan for the planned Denver International Airport (DEN), completed in the late 1980s when Airport construction was initiated, established the capacity of the new facility at approximately 50 million annual passengers. In 2006, as the Airport was accommodating nearly that number of passengers, the City and County of Denver, Department of Aviation, began the process of updating the original 20-year-old master plan. In October 2006, the Department of Aviation authorized a team led by Ricondo & Associates, Inc. to initiate the Master Plan Update Studies for the Airport.

A master plan is a critical planning document from an airport management and operations perspective, as it guides future airport growth and development within a strategic framework that reflects airport management's priorities, airport operational characteristics, and other relevant factors. An airport master plan provides a road map for efficiently accommodating aviation demand through the foreseeable future while preserving the flexibility necessary to respond to evolving industry conditions, the regulatory environment, and the characteristics of airport activity. Aviation has changed tremendously over the 20 years since DEN's original master plan was prepared. These changes include enhanced security measures and processes, technological advancement of the airline check-in process, improved baggage screening technology and more-stringent regulations, evolution of the airline aircraft fleets, and changes in airline and aviation industry economics. Additionally, the Airport was designed to accommodate a significantly higher number of connecting passengers than have materialized. The proportional increase in origin and destination (O&D) passengers has placed greater demand on Airport facilities than the same increase in the number of connecting passengers would have, because "local" O&D passengers utilize roadways, parking facilities, airline ticketing and baggage facilities, security checkpoints, and other facilities that connecting passengers do not. These changes have resulted in different and typically more intensive demands on Airport facilities, systems, and equipment. These factors were considered in the Master Plan Update to define a future development plan that accommodates forecast demand, both in magnitude and characteristics, while providing flexibility for the Department of Aviation to respond to future changes.

Visit Denver International Airport's Web site at [www.flydenver.com](http://www.flydenver.com) to view the latest information on the Master Plan Update, the airport layout plan, and other Airport development plans and programs.



A view towards Longs Peak beyond the Airport, looking west.

## History

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Stapleton International Airport (formerly Denver Municipal Airport until 1944) was the primary airport serving the Denver region until 1995. Stapleton had been expanded several times to accommodate increasing airline traffic. In the mid-1970s, local planners agreed that Stapleton would again need to be expanded to meet future demand.

Several studies completed in the late 1970s and early 1980s determined that expansion of the existing airport onto the adjacent Rocky Mountain Arsenal was the least expensive alternative. Several problems were encountered with potential expansion onto the arsenal, including opposition by neighboring Adams County, concerns regarding increased noise exposure, inefficiencies associated with the layout of an expanded Stapleton, and the high cost of remediating the heavily polluted arsenal site. These conditions gave momentum to a plan to construct a new airport away from the city.

After several years of analysis and debate on whether or not to construct a new airport, an intergovernmental agreement was reached between the City and County of Denver and Adams County that allowed annexation of 53 square miles of land by the City for developing a new airport. The voters of Adams County approved the annexation of land for a new airport in May 1988. In May 1989, in a similar referendum, the citizens of Denver voted to go forward with construction of a new airport, to be located approximately 23 miles northeast of the downtown Denver business district. Groundbreaking for the new Denver International Airport occurred on September 28, 1989. The Airport opened for commercial service on February 28, 1995.

## Master Plan Objectives

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The goal of the master plan is to provide a framework and strategy to support future Airport development to meet forecast demand in a safe, cost effective, operationally efficient, and flexible manner, while also considering potential environmental and socioeconomic impacts. Although the master plan ultimately defines and documents a long-range concept for Airport facilities, specific facility planning and design decisions are made closer to the time when development is warranted or imminent.

The purpose of the Master Plan Update is to guide long-term facility development, policy decisions, and operational changes at the Airport by providing a framework for decision-making. This framework is crucial given changing conditions in the local and national aviation industry and community concerns regarding Airport growth. The plan's long-term concept supports logical and purposeful development to efficiently and safely meet Airport needs, minimizing the likelihood of incompatible or conflicting development. Preserving future development areas, both in size and functional/operational location, allows the Department of Aviation to make prudent development decisions as demand or other conditions dictate or opportunities are presented. The Master Plan Update includes a development plan for the Airport that is consistent with the Adams County-City and County of Denver intergovernmental agreement and accommodates changes in airfield design standards, demand characteristics, and the aviation industry.

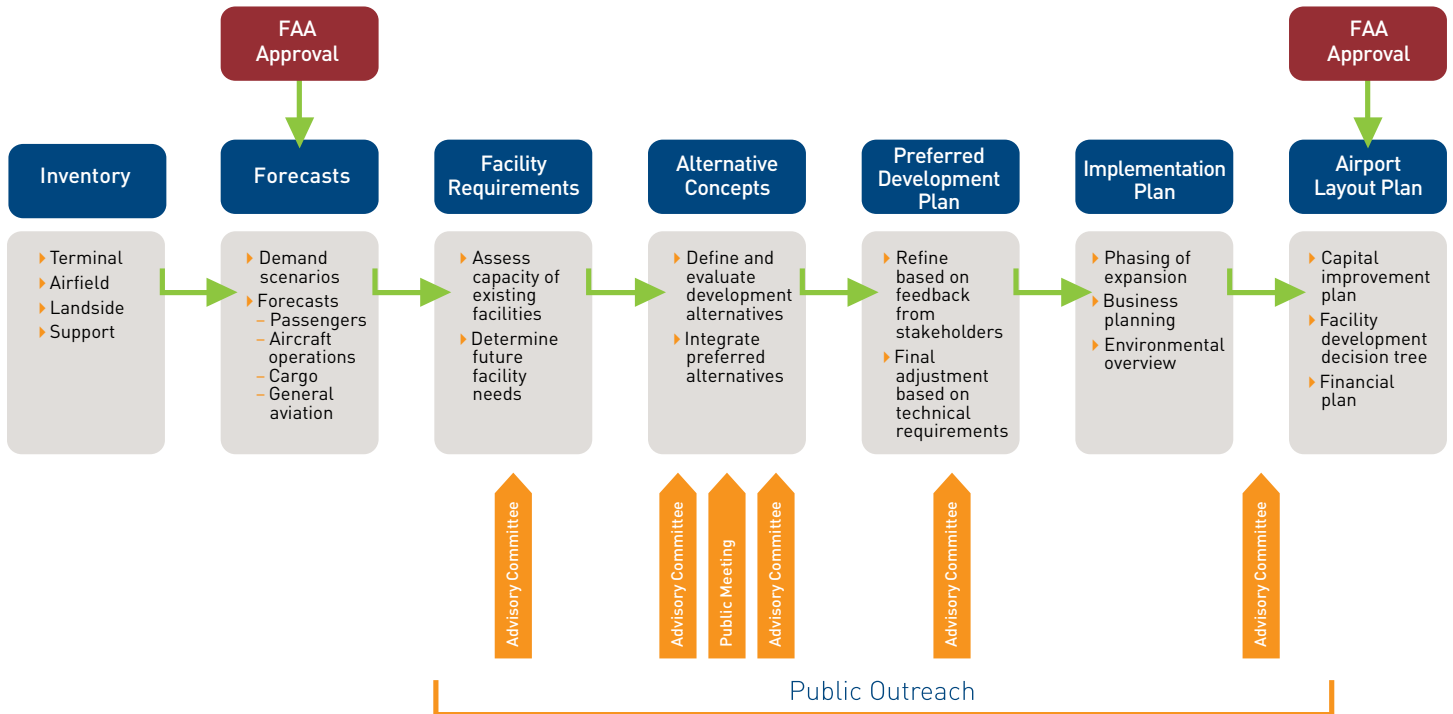


An aerial view of Denver International Airport.

The Master Plan Update encompassed many considerations and key objectives. As it developed, the plan sought to:

- Prioritize and protect safety and security
- Keep costs practical and affordable
- Maintain consistency with the Department of Aviation's vision, mission, and goals for the Airport
- Align and coordinate Airport development with city and regional development plans
- Minimize impacts on current operations
- Optimize operational efficiencies and flexibility
- Emphasize customer service and satisfaction
- Provide the Department of Aviation the flexibility to effectively respond to the changing needs of the dynamic aviation industry
- Continue to support the role of the Airport as a critical economic engine for the region and the state
- Meet sustainability goals and environmental requirements and continue the Airport's leadership in environmental stewardship
- Reserve and maintain land uses on-airport to permit logical, phased development that is both flexible and responsive to Airport tenant and community needs
- Respect the architecturally iconic nature of the terminal
- Create opportunities to enhance nonairline revenues

## Study Process



The master planning process began with an inventory of the physical, operational, and functional characteristics of the Airport and its immediate environs. A base forecast was developed for a 25-year planning horizon, from 2006 through 2030, and approved by the Federal Aviation Administration (FAA). Four forecast scenarios were developed to reflect reasonable conditions that could develop at the Airport over the 2030 planning horizon. These forecast scenarios were used to establish future requirements for airfield, terminal, landside (access and parking), and support facilities. The future requirements for these airport components were used to define alternatives. The alternatives for each component

were evaluated, and the preferred alternative for each was integrated into an overall preferred development plan for the Airport, with environmental conditions and potential impacts considered throughout the process. An implementation plan, based on demand-driven triggers, was also created for the preferred development plan. The preferred development plan was then depicted on the airport layout plan, which was approved by the FAA in May 2011. During the master planning process, input was received through stakeholder group meetings, public meetings, and a Master Plan Advisory Committee that included representatives from government agencies, airlines, local businesses, and community organizations.

## Aviation Activity Forecasts

To assess the ability of Airport facilities and evaluate the potential need for new or expanded facilities, aviation activity forecasts were developed for airline passengers, scheduled and other aircraft operations, and cargo. The forecasts included a base forecast and four alternate forecast scenarios that were both higher and lower than the base forecast.

The forecasts were prepared in 2007 using 2006 data as the source for the base forecast. The FAA approved this forecast in August 2007, supporting its subsequent use in the Master Plan Update analyses. These forecasts provided the basis for determining facility requirements, implementation planning, and other analyses as part of the Master Plan Update.

The forecasts were developed using several methodologies, including a market share approach (a share of the U.S. market/growth rate) and a socioeconomic regression approach (defining relationships between various socioeconomic factors and originating passengers). Two short-range forecasts were developed for annual passengers and aircraft operations at the Airport in 2015. The 2015 Base Forecast was developed along with a high-growth forecast, named the 2015 ALT Forecast, to provide flexibility for short-range facility planning.

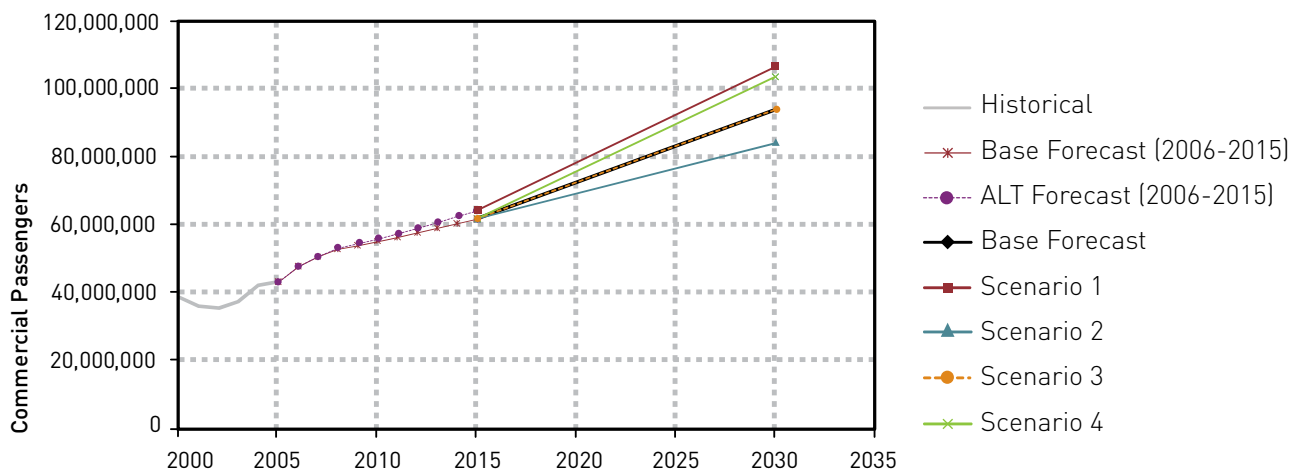
The 2030 Base Forecast was developed by extending the 2015 Base Forecast to 2030, using similar techniques and methodologies as those used in developing the 2015 Base Forecast. The 2030 Base Forecast was based on historical trends at DEN and expected growth in aviation activity nationwide. The four forecast scenarios were defined to reflect reasonable conditions that alter the historical and socioeconomic indicator relationships, and could reasonably be expected at the Airport over 25 years (2006 to 2030).

The four alternate forecast scenarios are as follows:

- **Scenario 1:** High growth with continued hubbing operations (based on the 2015 ALT Forecast).
- **Scenario 2:** Base O&D growth with a pronounced decrease in hubbing operations resulting from airline business changes (based on the 2015 Base Forecast).
- **Scenario 3:** Evolution in the aircraft fleet mix serving the Airport, reflecting increased activity by widebody aircraft and, on average, larger narrowbody aircraft through the 2030 planning horizon, resulting in reduced airfield demand while maintaining base forecast terminal/passenger activity (based on the 2015 Base Forecast).
- **Scenario 4:** High growth in international flights and passengers, reflecting the overflow of activity from other major international gateway airports as those facilities operate at maximum capacity. The Airport would function as an expanded international gateway for passenger access to airline route networks, in addition to continuing to serve robust international O&D growth at the Airport (based on the 2015 Base Forecast).

## Passenger Activity

Activity Forecast Scenarios – Commercial Passengers



Under the base forecast, total cargo volume at DEN is forecast to increase from approximately 310,800 tons in 2006 to approximately 713,700 tons in 2030. The number of all-cargo aircraft operations is forecast to increase from 20,614 in 2006 to 39,600 in 2030, at a compounded annual growth rate of 3.5 percent. General aviation activity at the Airport is forecast to increase from 11,415 operations in 2006 to 19,400 in 2030. Other air taxi operations, including for-hire charters transporting passengers, medical flights, fixed-base operations, and transportation of property by aircraft, are forecast to increase from 12,361 operations in 2006 to 14,800 in 2030. Military activity at DEN is forecast to remain constant at approximately 1,100 operations per year during the forecast period.

Actual activity may vary from the forecasts as the result of unforeseen events or changes in the operational characteristics of Denver International Airport, airline business changes, or economic uncertainties in the region or nation.

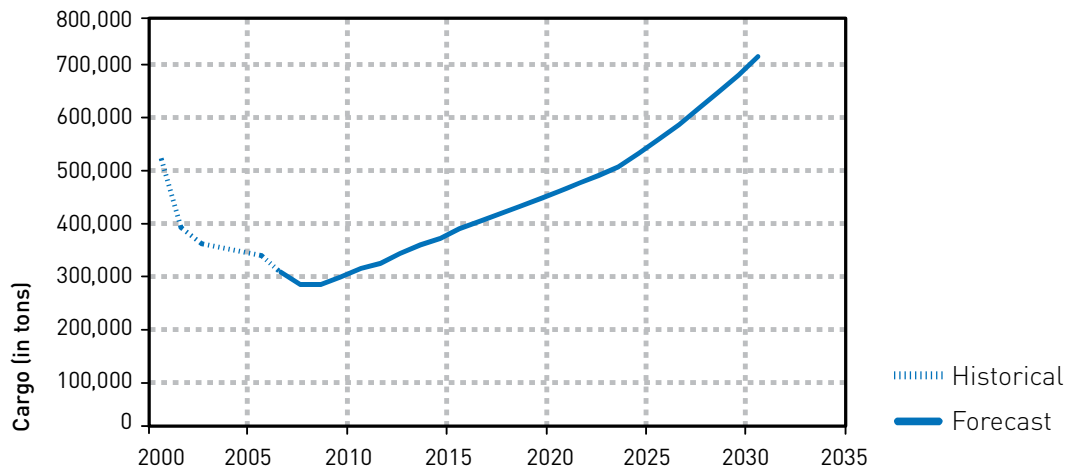


Passengers travel on one of many moving walkways at Denver International Airport's Concourse B, which help them get quickly to and from their gates. (Top)

At sunset with the Rocky Mountains as backdrop, an aircraft lands at Denver International Airport. (Bottom)



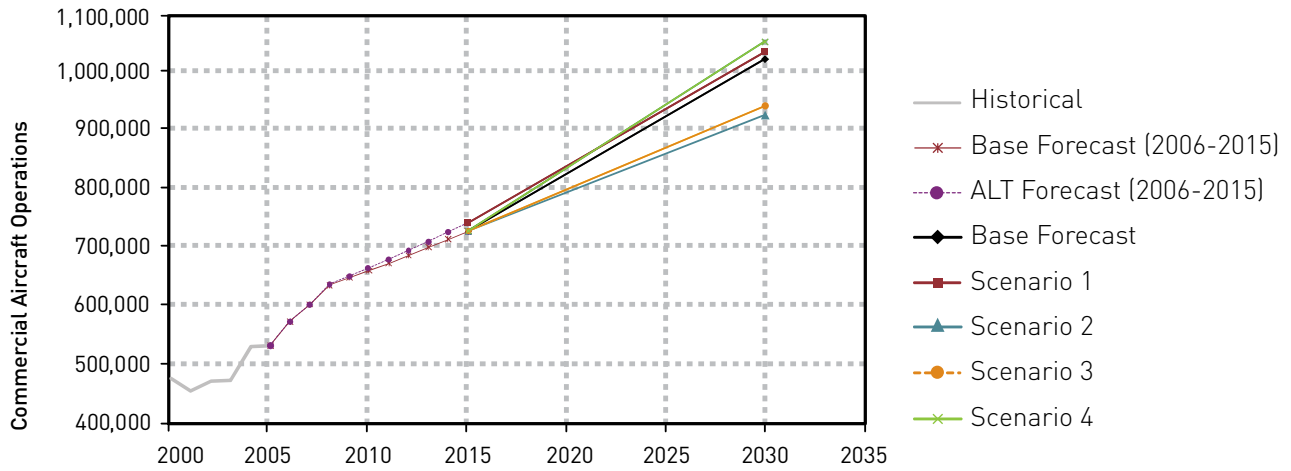
## Cargo Volume



## Aviation Activity Forecasts continued

### Aircraft Activity

Activity Forecast Scenarios – Commercial Aircraft Operations (Takeoffs and Landings)

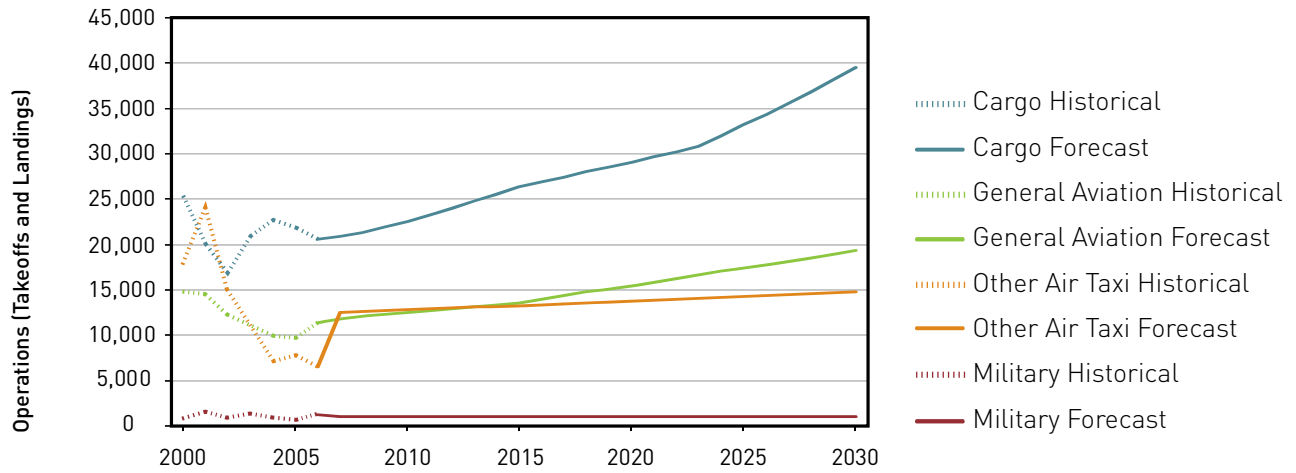


### Forecast Summary

Forecast	Passenger Forecast			
	2030 Million Annual Passengers (Rounded)	O&D / Connecting Percentage	2030 Peak Month Average Day Passengers	Average Annual Growth Rate (2006-2030)
Base Forecast	94.1	63% / 37%	302,378	2.9%
Scenario 1: High Growth	106.7	62% / 38%	343,374	3.4%
Scenario 2: Decrease in hubbing/connecting activity	84.3	67% / 33%	268,869	2.4%
Scenario 3: Evolution to larger aircraft fleet	94.1	62% / 38%	302,714	2.9%
Scenario 4: Robust international growth as Denver evolves into an international gateway	104.0	63% / 37%	331,141	3.3%

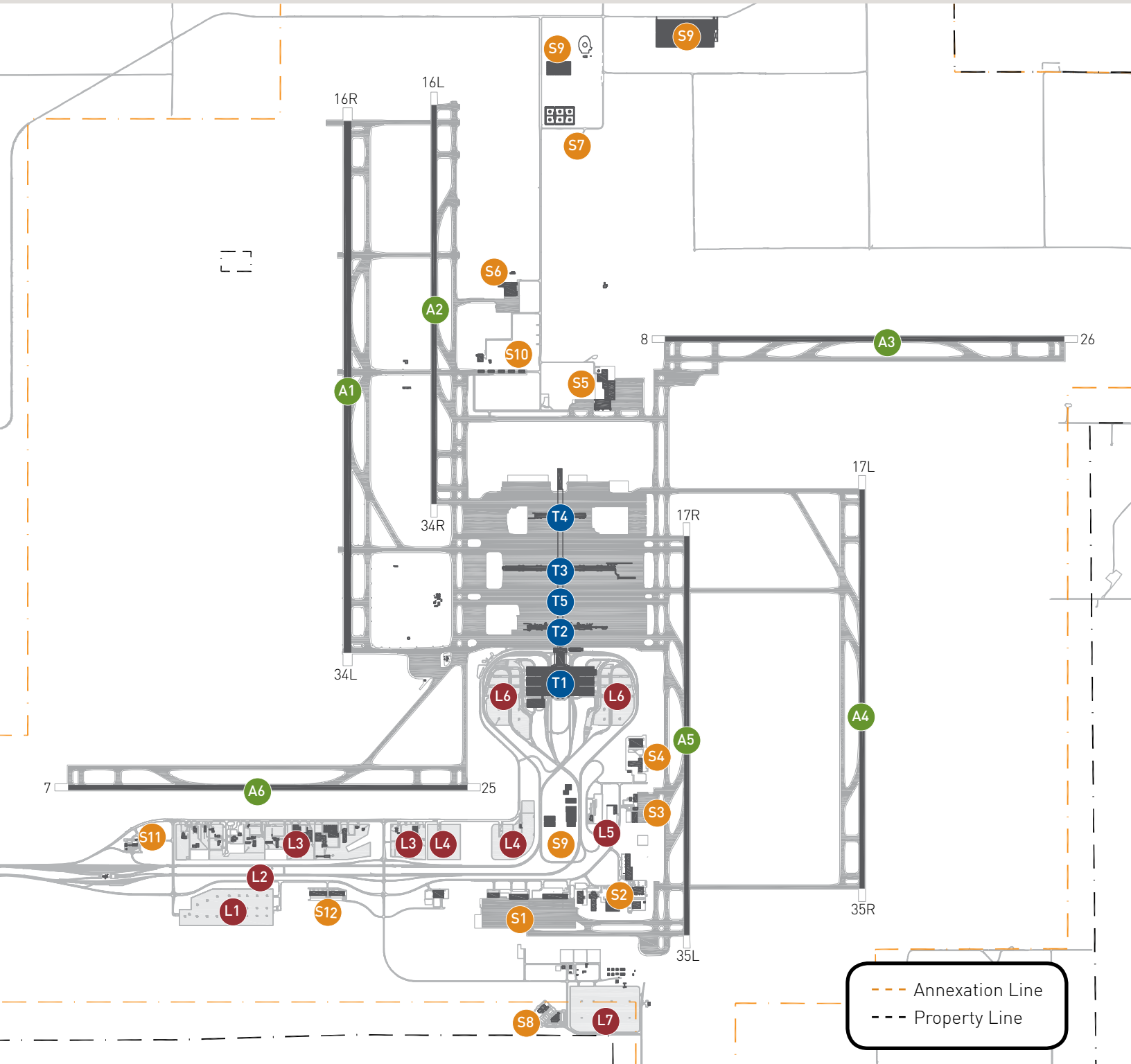


## Other Aircraft Activity



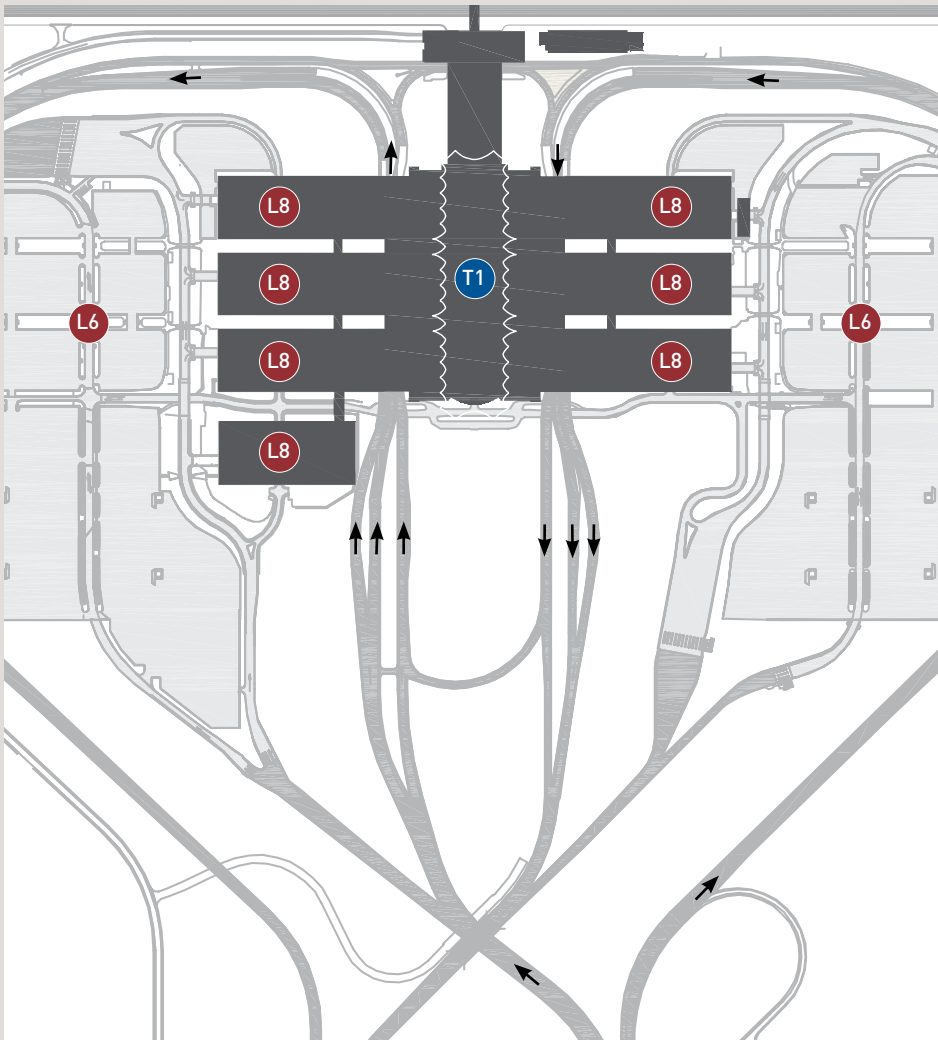
Aircraft Activity Forecast			Facility and Activity Implications
2030 Annual Operations (Takeoffs and Landings)	2030 Peak Month Average Day Operations	Average Annual Growth Rate (2006-2030)	
1,109,300	3,311	2.6%	
1,241,500	3,709	3.1%	Increased demand for all facilities
998,900	2,963	2.1%	More landside facilities (car rental, hotel, parking) More terminal facilities (security checkpoints, ticketing) Reduced airfield operations Reduced demand for gates
1,025,900	3,061	2.2%	Requires fewer gates but more concourse frontage Fewer aircraft operations Airfield enhancements needed
1,187,900	3,545	2.9%	Larger aircraft Expansion of international arrival facilities Higher connecting passenger percentage

# Existing Facilities Map



These graphics depict the existing airfield, terminal, landside, and support facilities at DEN.

## Terminal Area



### Airfield

- A1. Runway 16R-34L
- A2. Runway 16L-34R
- A3. Runway 8-26
- A4. Runway 17L-35R
- A5. Runway 17R-35L
- A6. Runway 7-25

### Terminal

- T1. Jeppesen Terminal
- T2. Concourse A
- T3. Concourse B
- T4. Concourse C
- T5. Automated Guideway Transit System (AGTS)

### Landside

- L1. Pikes Peak Shuttle Parking Lot
- L2. Peña Boulevard Corridor
- L3. Rental Car Facilities
- L4. Employee Parking
- L5. Commercial Vehicle Staging Area
- L6. Economy Parking Lots
- L7. Mount Elbert Shuttle Parking Lot
- L8. Garage Parking

### Support

- S1. Cargo Facilities
- S2. Flight Kitchens, Belly Freight, and Airline Maintenance Facilities
- S3. General Aviation
- S4. Airport Maintenance Facilities
- S5. United Airlines Maintenance Hangar
- S6. Continental Airlines Maintenance Hangar
- S7. Fuel Farm
- S8. FAA TRACON and Technical Operations Center
- S9. Solar Facilities
- S10. Snow Equipment Storage
- S11. Gateway Service Station
- S12. World Port Buildings

## Airfield

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The airfield at Denver International Airport consists of runways, taxiways, apron areas, deice pads, navigational aids, vehicle service roads, and other supporting facilities. The airfield has six runways configured as two sets of parallel runways oriented in a north-south direction (Runways 16L-34R, 16R-34L, 17L-35R, and 17R-35L) and two crosswind runways oriented in an east-west direction (Runways 7-25 and 8-26). Five of these runways are 12,000 feet long and, with the exception of runway shoulders that are programmed to be upgraded, are designed to accommodate aircraft up to Airplane Design Group (ADG) V (e.g., Boeing 747, Boeing 787, Boeing 777, Airbus A340, and Airbus A350). Runway 16R-34L was commissioned in September 2003 and is the longest commercial runway in the United States at 16,000 feet; this runway can accommodate up to ADG VI aircraft (e.g., Airbus A380) and provides the ability for aircraft destined for long-range markets to depart at maximum takeoff weight. DEN was designed with a flow-through airfield that generally operates in a north-south flow, with arrivals occurring on one side of the central terminal area and departures on the other side. The east-west runways provide crosswind capability and additional flexibility for accommodating arrivals and departures when winds permit.

In the original master plan for the new Airport, 12 runways were envisioned at full development. Airfield requirements developed as part of the Master Plan Update indicate the need for three additional runways for the base forecast or two to four additional runways (depending upon the forecast scenario) through 2030. This results in a total of eight to 10 runways required within the 2030 planning horizon.

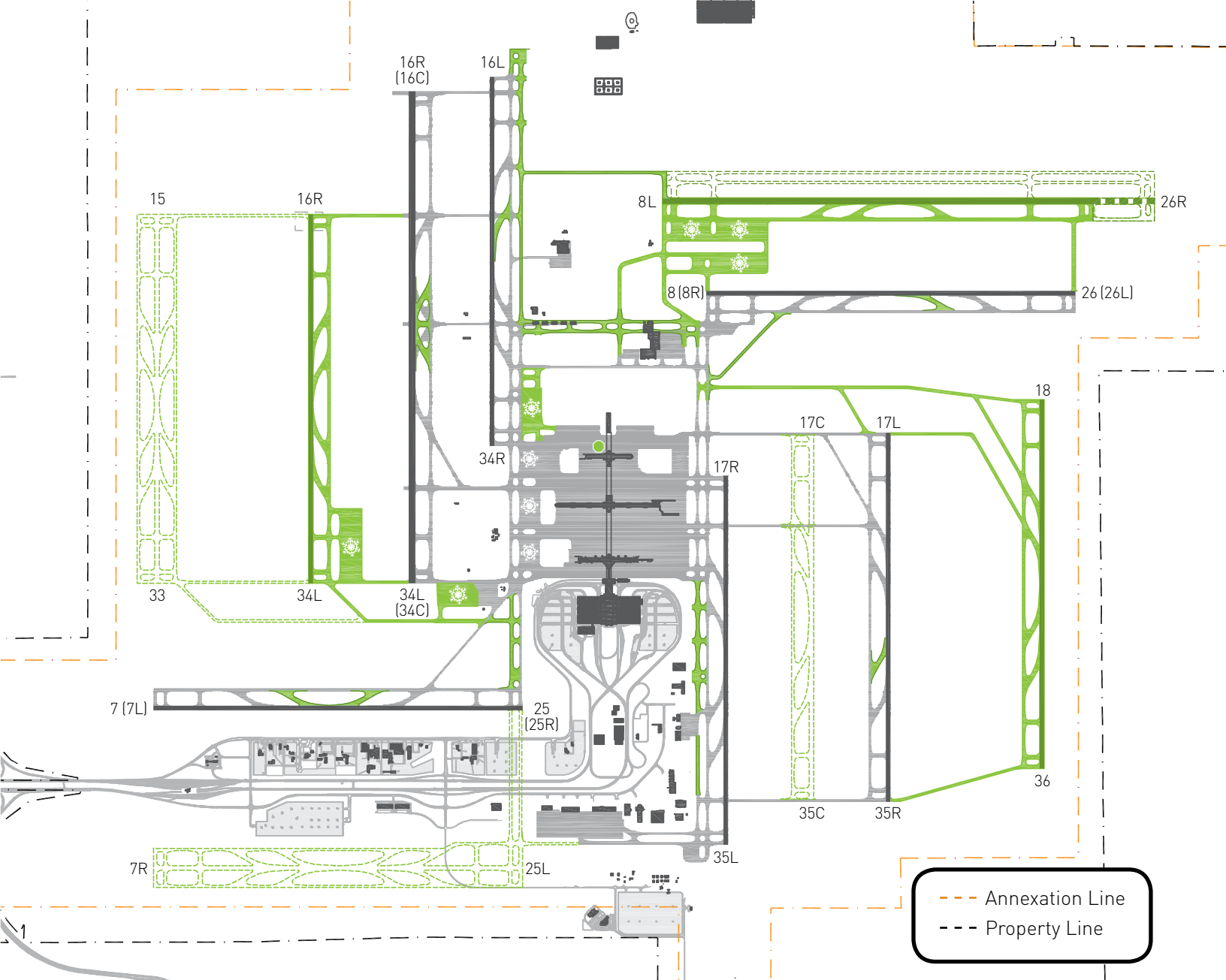
A total of 12 runways remains in the ultimate development plan. Preserving the ability to develop these runways protects against the possibility of future incompatible land uses and ensures that the Airport can meet post-2030 demand. As part of the Master Plan Update, it was determined that Runways 8L-26R, 18-36, 16R-34L, and 7R-25L would be the first to be constructed to meet forecast demand through the 2030 planning horizon.<sup>1</sup> All future runways are planned to a length of 12,000 feet with the exception of future Runway 8L-26R, which is planned for an initial length of 14,000 feet and an ultimate length of 16,000 feet. The additional runway length will allow the Airport to accommodate current and new generation aircraft in wind conditions that mandate an east-west runway orientation and to provide operational redundancy for the 16,000-foot-long Runway 16R-34L.

To maintain the flow-through operation of the airfield, the locations of future runways as included in the Master Plan Update, are generally consistent with their locations in the original master plan. As part of the Master Plan Update, the locations of runways have been refined to account for changes in FAA criteria and advisory circulars, existing air traffic control operations, as well as to accommodate projected airfield requirements. The current runway separation criteria could ultimately be reduced if the FAA's Next Generation (NextGen) Air Transportation System is implemented. Planning standards that may allow a reduction in runway separation have not been developed to date, and the FAA has mandated that current runway separation criteria be maintained for airfield planning in this Master Plan Update.

The preferred airfield development plan incorporates end-around bypass taxiways that allow aircraft on outboard runways to taxi independently of operations on inboard runways. End-around taxiways reduce taxiing delays by minimizing queuing bottlenecks at inboard runways and providing a safe means of taxiing around the end of an operational runway.

The preferred airfield development plan includes four deice pads located west of existing Concourses A, B, and C, and a fifth near the end of Runway 34L. The pads are used to collect and recycle used deicing fluid. Deicing facilities are critical to airfield performance when deicing conditions occur. Future aircraft-deicing requirements were derived from the number of available departure runways (considering airfield operating configurations, snow clearing activities, weather conditions, and adequate staffing of deicing pads). Deicing pad requirements are dependent on effective management of the pads. In the requirements developed for the Master Plan Update, 20-minute processing times per position were assumed, as well as 32 departures per hour. These assumptions result in a need for approximately 11 deicing positions per active departure runway end. Given predominant winds from the north during deicing conditions, a future deice pad has been planned near future Runway 34L, along with expansion of the existing deice pad near existing Runway 34L, which is used for northerly departures. In addition, deice pads are to be located near existing Runway 8 (to be renamed Runway 8R) and future Runway 8L.

1. Existing Runway 16R-34L is to be renamed Runway 16C-34C after future Runway 16R-34L is constructed. Similarly, existing Runway 8-26 will be renamed Runway 8R-26L when future Runway 8L-26R is constructed, and existing Runway 7-25 will be renamed Runway 7L-25R after construction of future Runway 7R-25L. The future designations are shown in brackets (e.g., Runway 34L [34C]) throughout this document.



## Preferred Airfield Development Plan

- Existing
- Planned
- Ultimate Development
- Replacement Airport Traffic Control Tower
- ❄ Deice Pad

The Airport has one of the tallest airport traffic control towers in the United States. The 327-foot tower is located adjacent to Concourse C and air traffic controllers are able to view all runways and all taxiway movement areas from this tower. A replacement for the existing tower is shown on the preferred development plan. Given staffing and space demands associated with new technology and equipment to support

future runways as they are commissioned, cab space in the existing tower will not be sufficient to accommodate activity associated with an eighth or ninth runway. After several options for replacement were explored, it was determined that a taller tower located near the existing tower would provide views of the ultimate airfield and provide sufficient cab space to serve all 12 future runways.

## Terminal

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The terminal complex is located in the center of the airfield and consists of a landside terminal building (the Elrey B. Jeppesen Terminal) and three linear satellite concourses (A, B, and C) located north of the terminal and oriented in an east-west direction. The terminal building consists of six levels open to passengers, encompassing a total building area of approximately 2 million square feet.

The three concourses are linked to the terminal by an underground automated guideway transit system (AGTS). Passengers can also walk between Concourse A and the terminal via a two-level pedestrian bridge. As of November 2011, Concourses A, B, and C encompass a total of 149 aircraft parking positions, including 60 narrowbody gates (Boeing 737 or Airbus A320), 25 widebody gates (Boeing 767 or Airbus A340), and 19 regional jet gates — all with aircraft loading bridges. The remaining 45 positions are apron loaded for smaller regional jet and propeller aircraft. All aircraft arrivals requiring international passenger processing are accommodated at the eight international gates located near the center of Concourse A. These gates connect to a sterile corridor that uses the upper level of the pedestrian bridge to connect to the U.S. Customs and Border Protection facilities located on Level 5 of Jeppesen Terminal.

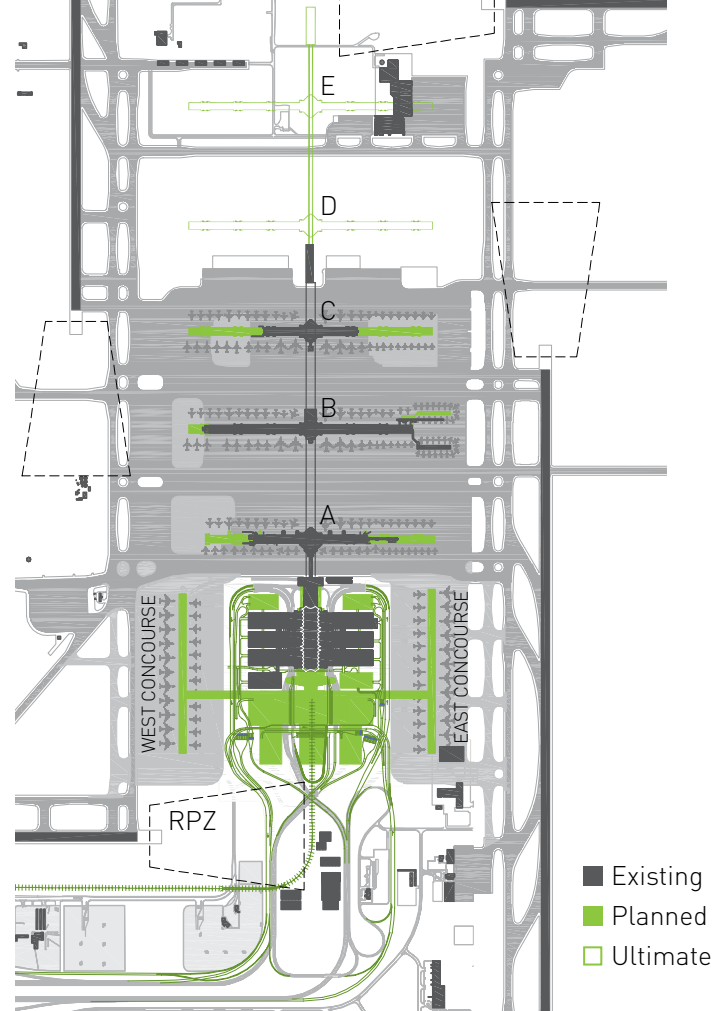
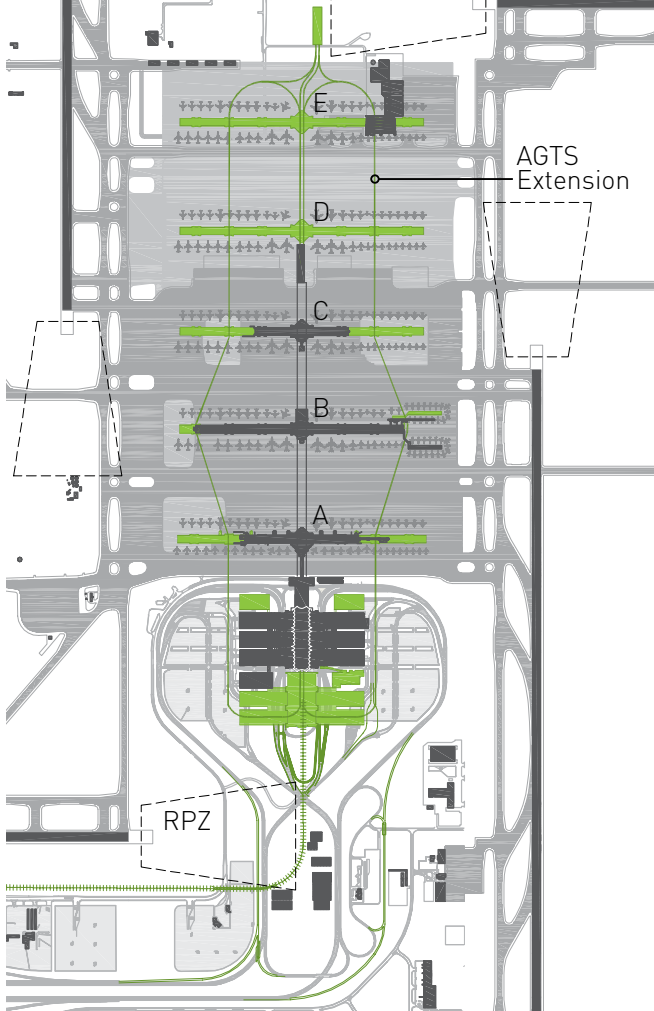
The AGTS provides the only passenger access between Jeppesen Terminal and Concourses B and C, and provides alternative access to Concourse A. With incremental improvements to train headways, achievable through changes to the train control system, the addition of a track crossover south of the existing terminal station, and the purchase of additional train vehicles, peak-period system capacity is expected to be approximately 7,600 passengers per hour in each direction. This capacity equates approximately to the demand associated with the ultimate expansion of Concourses A, B, and C, depending on the volume of inter-concourse connecting passengers and passengers using the Concourse A pedestrian bridge to access the terminal building.

The functional areas of the terminal (e.g., ticketing/check-in, baggage makeup, baggage sortation, baggage claim, security screening, etc.) will reach capacity in different time frames, reflecting the changes in industry standards, airline operations, regulations, and other defining criteria since the terminal was designed. Specifically, the terminal requirements analysis demonstrated that the following improvements would be required to provide adequate capacity to accommodate forecast demand through the 2030 planning horizon:

- Up to approximately 90 additional gates could be required under the base forecast, with approximately 66 to 117 additional gates required, depending on the forecast scenario.
- Up to approximately 7,500 linear feet of additional gate and apron frontage could be required under the base forecast, with approximately 4,500 to 11,700 additional linear feet required, depending on the forecast scenario.
- Up to two additional equivalent terminal modules (a module equals approximately one-third of the existing terminal) could be required under the base forecast, with one to three additional modules required, depending on the forecast scenario.
- Additional capacity in terminal functional components will be necessary, including: security checkpoints, check-in positions, baggage operations, airline space, concessions, and international passenger processing.
- Additional AGTS capacity will be needed to efficiently support future gates.

In the original terminal expansion plan, incremental and modular expansion was planned to the south, increasing the number of terminal modules from three to an ultimate of six, approximately doubling the size of the terminal. The existing linear satellite concourses have the capability to be expanded to accommodate a total of approximately 200 gates or aircraft parking positions. In addition to these existing concourses, future Concourses D and E were planned to accommodate an additional 120 to 140 total gates, providing the ultimate capability for a total of over 300 gates or aircraft parking positions in the original plan.

To accommodate demand associated with future Concourses D and E, original AGTS planning suggested expanding the existing “out and back” shuttle configuration to two independent loops passing back toward the terminal via the outer subcores of the concourses and then onto the existing “spine” at the south end of the expanded terminal. This reconfiguration would provide a capacity of approximately 18,000 passengers per hour in each direction, sufficient to accommodate the additional demand associated with future Concourses D and E and beyond. Furthermore, the operation of two independent loops would provide redundant AGTS capability during periods when the train malfunctions or is otherwise out of service.



## Original Terminal and Concourse Expansion Plan

Given the implementation costs and terminal area operational disruption and effects associated with construction of a looped train system, alternatives to the development of Concourses D and E were explored. Upon exploration and refinement of more than two dozen alternatives, a concept with concourses located directly east and west of the existing terminal building was defined. The benefits of this alternative terminal and concourse concept are outlined below. This concept:

- Reduces passenger and baggage travel times and better accommodates higher-than-originally-forecast O&D passenger demands
- Provides capabilities to accommodate long-term flexibility and growth
- Does not preclude ultimate development of Concourses D and E if AGTS capacity can be increased beyond that which is currently technically feasible and practical
- Eases reliance on AGTS and addresses existing AGTS capacity limitations (prior to making a decision on the preferred concourse development plan, further detailed analysis is needed to evaluate the capacity of the AGTS in light of any technological advancements)

## Preferred Terminal and Concourse Development Plan

A new layout for a new terminal south of Jeppesen Terminal orients the building in an east-west direction. This layout was modified from that in the original master plan to address the following terminal planning challenges:

- Accommodate evolution of passenger demand characteristics
- Meet vehicle circulation and curbside demand
- Resolve vertical and horizontal terminal roadway geometry issues
- Provide long-term flexibility and post-2030 growth capabilities beyond the originally planned, mirrored expansion of the terminal to the south
- Design an east-west oriented terminal as either two unit terminals or a single consolidated facility and accommodate international passenger demand
- Optimize the use of existing infrastructure
- Integrate the FasTracks rail station, hotel, and plaza
- Limit development of new terminal roadways within the Runway Protection Zone (RPZ) to those improvements in the original terminal expansion plan (per the FAA)

## Landside

Landside facilities at the Airport include access roads, parking, and rental car facilities. Peña Boulevard provides the main roadway access into Denver International Airport. This limited-access highway provides a connection between DEN and Interstate 70, the E-470 toll road, and several arterial roadways. On-airport public roadways (e.g., Jackson Gap Street, Gun Club Road, 75<sup>th</sup> Avenue, 78<sup>th</sup> Avenue, Valley Head Road) provide landside access to the terminal, public and employee parking lots, rental car facilities, and support facilities. Access to facilities located in the north airfield is provided by either 120<sup>th</sup> Avenue or 96<sup>th</sup> Avenue to Quency Way, which turns into 114<sup>th</sup> Avenue.

The terminal curbside roadway is functionally divided into two sides, serving the east and west sides of the terminal building, commonly identified as Terminal East and Terminal West. Access is provided to both sides of the terminal via a three-level linear curbside roadway system. The lowest-level curbsides is located at Level 4 of the garage and operates as a pickup area for arriving passengers by private vehicles only. The Level 5 curbsides operate as drop-off and pickup areas for commercial vehicles. The Level 6 curbsides are used by private vehicles dropping off departing passengers.

Public parking is provided in seven garages and four surface parking lots. Seven five-story garages are adjacent to each side of the terminal (four on the west side, three on the east side), providing a total of approximately 15,000 parking spaces. Economy surface parking lots are located on the east and west sides of the parking garages and comprise approximately 8,300 parking spaces. Two shuttle parking lots accommodate long-term parking, with transportation provided by shuttle buses between the lots and the terminal. The Pikes Peak Shuttle Parking Lot, located south of 75<sup>th</sup> Avenue between Gun Club Road and Elk Street, provides approximately 9,000 parking spaces. The Mt. Elbert Shuttle Parking Lot, located south of 71<sup>st</sup> Avenue, provides approximately 8,600 parking spaces. A privately operated parking lot in the rental car area has approximately 2,100 spaces.

Employee parking for airport tenants is accommodated in two parking lots. The airside employee parking lot is used by employees who have access to the secured areas of the airport and consists of approximately 3,700 parking spaces. The landside employee parking lot consists of 2,800 parking spaces, and shuttle bus service is provided for employees working in Jeppesen Terminal or the concourses. Additional employee parking lots for Department of Aviation employees



Inbound vehicles drive to the east side of Denver International Airport's Jeppesen Terminal.

are available near Jeppesen Terminal and the airport maintenance buildings, as well as at cargo buildings and other tenant facilities located away from the terminal.

A parking area where patrons are allowed to park free and wait for 45 minutes, known as a cell phone lot, consists of 107 parking spaces and is located off Peña Boulevard and 75<sup>th</sup> Avenue, east of the E-470 interchange. Other parking areas include a commercial vehicle staging area that provides 314 spaces for the temporary staging of limousines, buses, hotel vans and shuttles, and taxicabs.

Twelve rental car companies have facilities along Peña Boulevard on airport property, totaling approximately 96 acres. Eleven of the rental car companies operate facilities in the rental car area located southwest of the Jeppesen Terminal on 78<sup>th</sup> Avenue. Shuttle buses operated by each company provide transportation to and from Jeppesen Terminal for their customers.

The existing landside facilities will be operating at capacity as forecast demand is realized. The various landside components will reach capacity in different time frames, reflecting the changes in industry standards, use of public transportation, regulations, and other defining criteria since the original design of the terminal and landside infrastructure. Specifically, the landside requirements analysis demonstrated that the following improvements would be required to provide sufficient capacity to accommodate forecast demand over the 2030 planning horizon:



- Additional curbside length is projected to be required on all three terminal roadside levels, specifically the departures and arrivals curbs for private vehicles and the commercial vehicle dropoff curb. Additional curbside lengths are planned in future terminal and roadway expansion concepts.
- Additional lanes could be required on Peña Boulevard (eastbound and westbound) east of Gun Club Road by approximately 2025 to 2030 under the base forecast.
- Additional capacity on the segments of roadway providing access to and egress from the east and west sides of the terminal is projected to be required by approximately 2020 (east terminal access roadway and west terminal exit roadway) under the base forecast.
- Improvements could be required as early as 2015 (approximately) at several intersections along Peña Boulevard, with additional intersection improvements required over the 2030 planning horizon for the intersections to operate at an acceptable level of service under the base forecast.
- Additional on-airport public parking supply could be required as early as 2015 to accommodate base forecast demand, unless demand-management measures are implemented (e.g., pricing changes, management of access to the commercial curb, or other techniques), subject to the Airport's policy on public parking development. Approximately 41,500 additional spaces are projected to be required by 2030 if demand management measures are not taken or alternative transportation modes are not provided.
- Employee parking demand is projected to reach facility capacity in approximately 2015, requiring additional parking spaces thereafter. An estimated 3,900 additional spaces are forecast to be required by 2030.
- Rental car facilities are projected to require expansion on their existing sites prior to 2020 or by consolidating ready-and-return operations in a single facility. Further expansion beyond existing sites, a consolidated facility, or both will be required to meet 2030 demand.
- The commercial vehicle staging area will need to be expanded to meet 2030 demand, including more than 180 additional taxicab spaces and at least 30 additional spaces for couriers, limousines, and special vehicles.

It is envisioned that Peña Boulevard will remain the primary access route into the terminal complex, cargo, parking, and rental car facilities. This road is currently three lanes in each direction and can be widened.

Given the east-west orientation of the future terminal, a separate access roadway is planned, delinked from roadways serving the Jeppesen Terminal, which would allow for adequate decision distances, optimal roadway grades, and acceptable roadway geometry approaching and departing the terminal curbsides. The terminal curbs for the east-west terminal would be at least 1,400 feet long, which would accommodate curbside demand beyond 2030. The new roadway alignment could be constructed with limited operational impact on the existing access roadway.

Adequate space to meet rental car facility expansion until approximately 2020 is available within the existing rental car area along 78<sup>th</sup> Avenue by consolidating brands owned and operated by the same rental car companies into one facility. Beyond 2020, it is projected that the rental car company needs will exceed the available space in the existing rental car area and construction of a consolidated rental car facility served by a consolidated busing operation or landside automated people mover would be explored, as well as the option for parking structures and remote vehicle storage and staging. A consolidated rental car facility location has not been identified on the preferred development plan, although large areas are available along Peña Boulevard and designated for the development of parking, rental car, and other uses. The future consolidated facility is the subject of further study.

A route alignment is planned for the construction of the FasTracks electrified commuter rail connection between the Airport and downtown Denver, scheduled for operation by early 2016. Once entering Airport property at Peña Boulevard and Interstate 70, the rail corridor will run along the east and south sides of Peña Boulevard. In the vicinity of Picadilly Road, the rail will cross over Peña Boulevard and follow the north side of 78<sup>th</sup> Avenue past the rental car facilities and into a station located at the south end of Jeppesen Terminal.

Plans call for public parking to be expanded in six new parking structures adjacent to Jeppesen Terminal and the future east-west terminal. Additional parking capacity can also be provided by constructing surface lots or parking structures, as needed, in areas away from the terminal complex, similar to the existing Pikes Peak and Mt. Elbert shuttle lots. On-airport public parking demand may decrease with the initiation of FasTracks rail service, an increase in off-airport parking facilities, or both. The development of on-Airport surface parking lots may be influenced by potential opportunities for developing airport-related parking facilities at stations along the FasTracks rail line, particularly those in proximity to the Airport.

## Support

Airport support facilities include general aviation, airline maintenance, airport administration and management, airport maintenance, belly freight and cargo facilities, flight kitchens, fuel farm, aircraft rescue and firefighting (ARFF) facilities, and ground support equipment (GSE) maintenance, storage, and staging. A majority of the existing support facilities are located south of the terminal and south and east of Peña Boulevard. This area contains general aviation, cargo, flight kitchens, and airline GSE maintenance facilities. The general aviation facilities consist of hangar storage, an executive terminal, and a maintenance facility. The all-cargo complex consists of three buildings used by the all-cargo carriers serving the Airport (i.e., FedEx, UPS, and DHL). Belly cargo is processed in two buildings located to the east of the all-cargo carrier complex, accessible from 75<sup>th</sup> Avenue. United Airlines occupies a single building and all other airlines use the Joint Use Cargo Building. Also located in the south support facilities area are two flight kitchen buildings, two airline GSE maintenance buildings, and DEN's maintenance complex.

Located north of the concourses are two aircraft maintenance hangars: a multiple-bay facility leased to United Airlines and a single-bay facility leased to Continental Airlines (now merged with United Airlines). Four ARFF facilities are located throughout the airfield to respond to aircraft emergencies, while also serving all terminal and landside facilities. The Airport Office Building houses the Department of Aviation administration offices and is attached to Jeppesen Terminal. Additional airport administration space is provided at various locations in Jeppesen Terminal, concourses, and airport maintenance facilities throughout the airfield.



At dusk, a FedEx jet is loaded with cargo.

Support facilities, such as cargo, general aviation, and the fuel farm, require expansion to meet 2030 Base Forecast demand, as follows:

- Small incremental additional all-cargo building capacity would be required by 2020 based on the base forecast, with an approximate doubling of all-cargo building space, a 25 percent increase in aircraft apron, and 60 percent increase in landside facilities required by 2030.
- Pre-security truck staging is anticipated to be needed, as well as areas reserved to support the processing of cargo and to accommodate potential and changing security requirements.
- The general aviation apron may need to be expanded by approximately 80 percent expansion; the associated existing fixed base operator terminal and landside and parking areas are projected to meet demand through 2030.
- Airline maintenance facilities, the need for which is largely driven by airline business decisions, were determined to be sufficient through 2030.
- Airline GSE facilities are projected to be expanded by 80 percent to meet demand associated with the 2030 Base Forecast.
- Flight kitchens were determined to be sufficient through 2030.
- Two additional aircraft fuel storage tanks and improvements to the system's pumping operations and its pipelines would be required within the 2030 planning horizon.
- A total area of approximately 62 acres may be necessary for airport maintenance facilities by 2030. The decision to expand will largely be driven by demand for vehicle storage (including snow equipment and buses) and housing for repair equipment to support new runways.
- Additional ARFF facilities will be needed as new runways, terminal/concourses, and other landside facilities are constructed.

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At the time the original master plan was prepared, air cargo facilities were planned for the north side of the Airport, accessible via 114<sup>th</sup> Avenue or 120<sup>th</sup> Avenue. However, the proximity of DEN's south side to regional cargo handling and distribution infrastructure along the Interstate 70 corridor caused a relocation of the future air cargo facilities to the area south of the terminal when the airport was built. The capability for expansion of the cargo area to accommodate additional facilities is limited because of the land reserved for the development of future Runway 7R-25L and future Taxiways A, F and G, and the related airspace and sight line issues. The originally planned cargo area on the north side of the Airport remains available for expansion. Most rough grading and major utility lines already are completed. This space is identified on the airport layout plan for continued preservation for future cargo facility development. Other areas throughout the airfield are also available for future cargo expansion.

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General aviation facilities are planned to be expanded adjacent to the existing facilities. A portion of the existing airport maintenance facilities will eventually be displaced to accommodate construction of the future east concourse. Airport maintenance facilities are planned to be expanded near the intersection of 75<sup>th</sup> Avenue and Jackson Gap Street and also in the north airfield, along Queensburg Street.

The relocation of an existing ARFF station and the construction of up to four additional ARFF stations are planned to accommodate the eventual full buildout of the airfield to 12 runways. The ARFF stations are sited to comply with Denver Fire Department policies that prohibit primary responding ARFF equipment from crossing runways. Additional landside and structure fire and rescue protection may be required to supplement existing stations because of the expansion of the terminal, concourses, South Terminal Redevelopment Program (hotel, plaza, FasTracks train station), and other landside facilities.



Airfield snow equipment work together to clear snow from a taxiway.

## Development Plan

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A development schedule was created that identifies short-range (approximate 0- to 10-year time frame) and long-range (approximate 11- to 20-year time frame) projects based on the 2030 Base Forecast. The division between short- and long-range development plans was established to characterize development that has a higher likelihood of justification and implementation within 10 years; however, it is important to recognize that the division is approximate and dynamic. The short-range projects are those that may be needed before activity levels of approximately 71 million annual passengers or 880,000 annual aircraft operations, or both, are reached at the Airport. Long-range projects are those that are expected to be necessary after the short-range projects are implemented and before activity level of approximately 94 million annual passengers or 1.1 million annual aircraft operations, or both, are reached. Additional projects beyond the 2030 planning horizon are preserved on the airport layout plan for the ultimate development of the Airport.

The facility requirements that are the foundation for phased development over the 2030 planning horizon were determined based on the aviation activity forecasts (base forecasts and alternate forecast scenarios). Given the current uncertainty in the aviation industry, the economic downturn, and airline optimization of system capacity, actual activity is currently tracking lower than the forecasts. Consequently, projects characterized in the following sections as needed in the short- or long-range may be shifted between the time frames as actual activity triggers implementation. Alternatively, facility improvements may still be undertaken within the noted time frames, but at a reduced scale if demand does not materialize as forecast.

## Short-range Development Plan (0- to 10-Year Time Frame)

The following capacity-related projects are currently anticipated to be justified within the next 10 years (through approximately 2020). These facilities and projects are shown on the short-range development plan on pages 24 and 25.

### Airfield

- 1. Runway 8L-26R and Associated Projects** – These projects entail the construction of Runway 8L-26R and associated taxiways. This runway, which would be DEN's seventh, would allow air traffic control to increase the use of the operationally desirable, high-capacity runway configurations and reduce both ground delays and airspace travel times. In addition, Runway 8L-26R would reduce capacity impacts during periods of strong crosswinds when air traffic control is forced into a west-only runway use configuration. This seventh runway would also provide redundancy for Runway 16R-34L [16C-34C], which is the only runway at the Airport capable of accommodating Airplane Design Group VI aircraft. With an initial length of 14,000 feet, the new runway would also provide redundancy for long-haul international flights. In addition to the runway and associated taxiway system, a new ARFF station may be built to support aircraft activity on the runway, and an electrical vault to house airfield wiring and lighting controls likely will be necessary.
- 2. Acute-Angled Exit Taxiways B5 and F8** – This project consists of the construction of acute-angled exit taxiways to support reduced runway occupancy times by providing earlier runway turnoffs.
- 3. Relocation of Acute-Angled Exit Taxiways D6 and D8** – This project is intended to increase safety by reducing the number of missed approaches to Runway 16R [16C] and to decrease runway occupancy times by locating the taxiways where they can be used by more aircraft exiting Runway 16R-34L [16C-34C].

### Terminal

#### 4. South Terminal Plaza/Hotel/Train Station

- Plaza/Hotel** – This project entails construction of a 500-room business-class hotel, connected to the south end of the existing terminal building by a public plaza. The hotel will be a full-service facility and include conference rooms and ballrooms, a pool, and exercise areas.

- **FasTracks Train Station** – This project calls for construction of a rail station connected to the south end of Jeppesen Terminal as a terminus for the FasTracks East Corridor commuter rail line (see description of 12. FasTracks Rail Alignment). This project also incorporates a new security screening checkpoint.
  - **AGTS Improvements** - The existing AGTS track and control system will be extended, with a new track crossover, to increase the capacity of the AGTS to accommodate up to eight trains that can handle the demand resulting from the full extensions of Concourses A, B, and C.
- 5. Extension of Concourses A, B, and C** – This project entails phased expansion of the three existing concourses to provide a maximum of approximately 50 additional gates or aircraft parking positions. The need for and eventual development of these gates will be affected by management decisions, operational policies, airline gate use and operations, and any delay reaching forecast activity. Given that actual activity is not materializing as quickly as forecast at the initiation of the Master Plan Update – the result of economic uncertainties – industry changes, fuel prices, and other relevant factors, a demand for approximately 25 gates is projected by 2020. Should conditions and demand change, the flexibility exists to implement more than 25 additional gates in this time frame; however, such implementation should not occur without a clearly demonstrated need.



- 6. Terminal Improvements** – This project consists of expansion of elements and functional components of the terminal.
- **U.S. Customs and Border Protection (CBP) Facility Expansion** – An expansion is planned of the primary international passenger arrivals processing and baggage claim facilities. The project also includes three additional international aircraft parking nodes on Concourse A and connection of those nodes to an extended sterile corridor linking the gates to the CBP facilities.
  - **Security Screening Checkpoint Expansion** – This project provides for the provision for up to 10 additional security screening checkpoint lanes, some of which can be constructed as part of the South Terminal/FasTracks Train Station. This project may also be combined with Jeppesen Terminal Reconfiguration project listed below.
  - **Baggage System Expansion** – To accommodate forecast growth in passenger activity, capacity increases are needed for both outbound baggage sortation and make-up and inbound baggage claim facilities. Baggage sortation improvements will be necessary to handle common-use check-in operations and offsite baggage check-in, as well as to provide additional capacity for baggage checked at the exclusively leased ticket counter positions. Baggage claim capacity may be increased by a reconfiguration of the existing claim area to provide for more claim units, or by expanding Jeppesen Terminal north or south.
  - **Jeppesen Terminal Reconfiguration** – Jeppesen Terminal may be reconfigured, specifically check-in counters and security screening checkpoints, to provide additional capacity and changes in these passenger processing functions.

Denver International Airport's 16,000-foot runway, Runway 16R-34L, is the longest commercial runway in the United States.

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## Landside

- 7. Reallocation and Balancing of Rental Car Facilities** – Facility expansion and renovations and some form of rental car company relocation and consolidation to accommodate increased rental car demand will be undertaken.
- 8. Public Parking Expansion** – Approximately 10,500 new on-airport public parking spaces in surface parking lots, or garages, or both, adjacent to the terminal would be built. Further analysis will be required to determine (a) the types of parking products needed, (b) management of parking demand through rate adjustments and other techniques, (c) impacts of rail/transit on parking demand, and (d) on-site development options. Off-site private facilities will also be considered.
- 9. Employee Parking Expansion** – An addition of 1,400 employee parking spaces will be provided.
- 10. Level 6 Roadway Covered Median and Shelter** – This project encompasses construction of a concrete median at Level 6 to provide additional curbside capacity. Reallocation of the existing curbside space at Levels 5 and 6 would be necessary to most effectively use the capacity provided by the expanded median.
- 11. Commercial Vehicle Staging** – An expansion to the existing commercial vehicle staging area, specifically an increase in the number of spaces for taxicab staging may be needed.
- 12. FasTracks Rail Alignment** – Denver's Regional Transportation District (RTD) will build the FasTracks East Corridor commuter rail line on Airport property adjacent to the Peña Boulevard corridor from Interstate 70 to Jeppesen Terminal. The rail line will extend from a central transit hub at the downtown Denver Union Station to the Airport with multiple stops along the route. The rail line will terminate at the FasTracks train station located south of Jeppesen Terminal.

## Support

- 13. Cargo Expansion** – A small expansion of the cargo apron and processing facilities may be needed. The existing cargo aircraft apron would be extended approximately 325 feet to the west to accommodate increases in cargo operations and aircraft activity. Expansion can also be accommodated on the north side of the Airport, east of Runway 16L-34R or in other areas throughout the airfield.

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## 14. General Aviation/Fixed Base Operator Expansion

A small expansion of the existing general aviation facilities, including additional aircraft apron parking, hangar, and terminal facilities may be needed.

## 15. Multi-Tenant GSE Support

Construction of a maintenance facility for airline ground support equipment will be undertaken.

## 16. U.S. Customs and Border Protection Dog Kennel

This project consists of building a dog kennel facility for U.S. Customs and Border Protection.

## 17. Bus Maintenance Facility

A new maintenance facility for Airport buses used as public and employee parking shuttles would be built.

## Long-range Development Plan (11- to 20-Year Time Frame)

To accommodate forecast demand, the following long-range projects are envisioned for the approximate 11- to 20-year time frame (2021 to 2030). The buildout of facilities/development areas is planned to be completed incrementally as demand warrants. With time, some of these projects may be accelerated to the short-range time frame, some may be deferred, some may be deemed unnecessary as a result of material changes, and new projects may be added. These facilities and projects are shown on the long-range development plan on pages 26 and 27.

## Airfield

- 18. Runway 18-36 and Associated Projects** – Building Runway 18-36 would increase airfield capacity and allow for triple simultaneous instrument arrivals in the east airfield and provisionally would allow for quadruple simultaneous arrivals using the east airfield and Runway 34R in the west airfield. This project would also reduce the impact of runway snow removal and routine closures for runway maintenance and pavement rehabilitation. Enabling projects are also included, such as an east airfield end-around bypass Taxiway EE, which would increase safety by limiting the number of runway crossings. Aircraft movement efficiency would be enhanced by the resulting reduction in aircraft queuing. Construction of an ARFF station would be necessary to support future Runway 18-36, meeting FAA safety and response requirements, as well as those of the Denver Fire Department. Construction of an airfield electrical vault to house the wiring and lighting controls for the future runway will also be necessary.

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### **19. Runway 16R-34L and Associated Projects –**

Construction of future Runway 16R-34L would increase overall airfield capacity and provide additional capacity in the west airfield. Enabling projects such as acquisition and remediation of the Koch Third Creek Gas Plan and construction of a west airfield end-around bypass Taxiway W, which would enhance safety by limiting the number of runway crossings are also included in this package. The project would increase aircraft movement efficiency by reducing aircraft queuing. An airfield electrical vault to house the wiring and lighting controls for future Runway 16R-34L and supporting taxiways will be needed.

- 20. Acute-Angled Exit Taxiways R5, B6, and P5 –** This project involves construction of acute-angled exit taxiways to support reduced runway occupancy times by providing early runway turnoffs for aircraft.
- 21. Taxiway R7 –** This would be an extension of the exit taxiway from Runway 8-26 [8R-26L] to provide a more efficient and shorter taxiing distance for aircraft arrivals on Runway 26 [26L].
- 22. Taxiway L –** Building Taxiway L would improve taxiway flows from Runway 17R-35L and provide two parallel taxiways for bidirectional taxiing capability between the existing concourses and the future east concourse, the general aviation ramp, and the cargo area. Aircraft activity (especially cargo and general aviation aircraft activity) and the construction schedule for the east concourse will determine the timing of this project.
- 23. Replacement Airport Traffic Control Tower –** This project encompasses the construction of an airport traffic control tower to accommodate air traffic control coverage of the full 12-runway buildout of the airfield. The amount of cab space in the existing airport traffic control tower is limited and may not support an eighth runway. Two options could provide sufficient coverage for the airfield. The first option includes construction of two airport traffic control towers, one in the west airfield between future Runways 15-33 and 16R-34L and a second in the east airfield between future Runways 18-36 and 17L-35R. The second option would mean building a replacement airport traffic control tower near the existing airport traffic control tower and adjacent to Concourse C, and decommissioning of the existing tower. This centralized site could accommodate a taller tower

and larger cab. All three potential tower sites are reserved on the airport layout plan to provide the flexibility to optimize ultimate siting and configuration at the time a decision is necessary; however, the single replacement tower adjacent to Concourse C is preferred based on initial coordination with the FAA. The final selection of the tower location will be determined during advanced planning and design to consider technological advances, NextGen requirements, cost implications, construction and phasing constraints, and ultimate runway locations (to the degree that any runway locations would be refined once NextGen airfield facility planning criteria are defined).

- 24. WA Deice Pad Expansion –** To provide four to five additional deicing positions for narrowbody aircraft or three positions for widebody aircraft, an expansion of the WA Deice Pad is necessary to accommodate forecast activity. The phasing of this project may be deferred if the management, operation, and balancing of deicing operations among available deicing facilities at the Airport change. The project may be accelerated if concourse expansion is determined to interfere with aircraft queuing and taxiway flows during deicing operations, or if Runway 25 is utilized more frequently during deicing conditions.
- 25. Runway 34L Deice Pad –** Construction of the Runway 34L Deice Pad will provide up to 11 deicing positions for narrowbody aircraft, necessary to accommodate forecast activity.
- 26. Runway 8R Deice Pad –** Up to 11 narrowbody deicing positions adjacent to Runway 8 [8R] for use by aircraft departing from Runway 8 [8R] are needed, which would also entail construction of a new deicing fluid recovery facility near the Runway 8-26 complex for the collection of spent deicing fluids from adjacent deicing pads.
- 27. Runway 8L Deice Pad –** Construction of up to 11 narrowbody aircraft deicing positions adjacent to future Runway 8L for use by aircraft departing from Runway 8L or 8R (could be constructed at the time of runway construction or at a future time).
- 28. D Deice Pad –** The new D Deice Pad, northwest of Concourse C, would replace the J Deice Pad to accommodate the ultimate west expansion of Concourse C and provide six deicing positions for narrowbody aircraft, necessary to accommodate forecast activity. The phasing

of this project may be deferred if the management, operation, or balancing of deicing operations among available deicing facilities at the Airport change. The project may be accelerated if concourse expansion interferes with aircraft queuing and taxiway flows during deicing operations.

## Terminal

**29. East-West Terminal** – A new terminal passenger processing building or buildings located immediately south of the future hotel and plaza would be a major undertaking. This project would include a separate terminal roadway system to serve the future east-west terminal building, parking, and related facilities. The roadway system would be integrated with Peña Boulevard. The project would maintain the existing FAA “grandfathered” roadway system within the Runway 25 Runway Protection Zone.

**30. Terminal Improvements** – Improvements to expand elements and functional components of the terminal would be needed to meet demand.

- **Baggage System Expansion** – Expansion of the baggage system capacity, necessary to accommodate forecast growth in passenger activity, including expansion of outbound baggage sortation facilities, will be needed.
- **U.S. Customs and Border Protection Expansion** – This project calls for expanding facilities to accommodate additional primary inspection counters and baggage claim units. This project would also extend the sterile corridor to connect gates on Concourse A with passenger processing facilities on Jeppesen Terminal Level 5.

**31. Extension of Concourses A, B, or C** – If the full expansion of the three existing concourses (providing up to 50 additional gates) is not completed in the short range, this project will proceed in the long term, encompassing extensions to the concourses. As noted in the earlier description of this project, under the short-range development plan, the need for and timing of gates and aircraft parking positions will be influenced by management decisions, operational policies, airline gate use and operations, and any delay in the realization of forecast activity. This project would be completed before building the east and west concourses.

**32. East and West Concourses and Associated Projects** – A total of approximately 60 mainline equivalent gates at the future east and west concourses, adjacent to the

future east-west terminal building would be phased in. A new people mover system linking the future concourses to the east-west terminal, and extension of the existing AGTS to link the east-west terminal with Jeppesen Terminal to accommodate connecting passengers would be needed. This project would also include realignment of the roadways serving Jeppesen Terminal and relocation of surface public parking facilities (approximately 8,000 spaces) in the terminal area. Satellite Concourses D and E could be constructed in lieu of the east and west concourses if sufficient AGTS capacity is available. Construction of the east and west concourses would include:

- **Partial Relocation of Airport Maintenance Facilities** – A relocation of a portion of the Airport maintenance facilities would be required to accommodate construction of the future east concourse (see below).
- **Relocation of ARFF Station #1** – Relocation would accommodate construction of the future west concourse. This project may be accelerated to supplement existing fire protection since expansion of the terminal, concourses, South Terminal Redevelopment Program (consisting of a hotel, plaza, and FasTracks train station), and other landside facilities will require additional structural firefighting and rescue support.
- **Construction of New ARFF Station (serving future Runways 15-33, 16R-34L and existing Runway 7-25)** – A new ARFF station would serve existing Runway 7-25 [7L-25R] following the relocation of ARFF Station #1 and would also serve future Runways 15-33 and 16R-34L.
- **Relocation of Terminal Surface Parking Facilities** – This project consists of the relocation of terminal surface parking facilities, consistent with phased implementation of the east and west concourses to accommodate the expanding terminal/concourse facilities. It is anticipated that the two future concourses will be constructed in different time frames, as necessitated by activity/demand. Public parking relocation would occur only as warranted by concourse construction.
- **Taxiway F** – Construction of Taxiway F would provide bidirectional taxiing capability between the existing concourses, the future west concourse, and Runway 7-25 [7L-25R]. As with Taxiway L, aircraft activity and/or the timing of construction of the west concourse will determine the timing of this project.



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## Landside

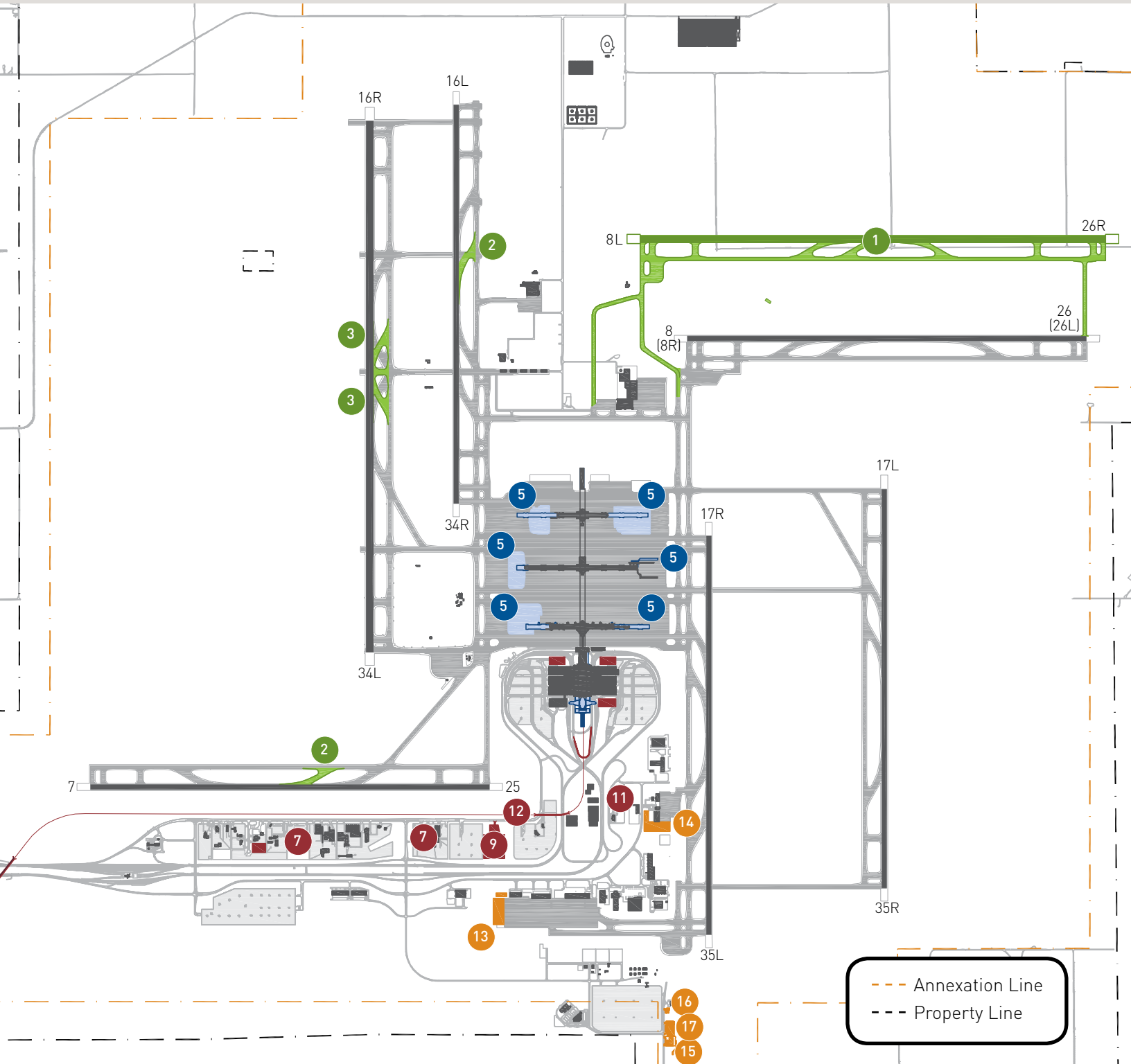
- 33. Peña Boulevard Expansion** – One lane in each direction (for a total of four in each direction) would be added on Peña Boulevard between Gun Club Road and the terminal east and west roadway split. An on-ramp from Gun Club Road to eastbound Peña Boulevard would be built, and this project also may include additional lanes in each direction on Peña Boulevard between Tower Road and Interstate 70. This 6-mile project would also encompass bridge widening and drainage structure modifications as needed. The project would require coordination with the Colorado Department of Transportation and other agencies to be compatible with planned upgrades to the Interstate 70 corridor.
- 34. Employee Parking** – The addition of 2,500 employee parking spaces would be constructed.
- 35. Public Parking Expansion** – An approximate aggregate 29,400-space expansion of on-Airport public parking facilities is identified as a possible project. Areas have been designated in the preferred development plan for additional close-in parking structures. Further analysis will be required regarding the types of parking products/needs, the management of parking demand through rate adjustments, impacts of rail/transit on parking demand, on-site development options, and off-site private facilities.
- 36. Picadilly Road/74<sup>th</sup> Avenue** – This project involves the construction of 74<sup>th</sup> Avenue immediately south of the existing Pike’s Peak lot and a portion of Picadilly Road on airport property to provide for the development of the property. Conceptual planning for Picadilly Road by the Denver Regional Council of Governments (DRCOG) calls for up to a six-lane roadway through airport property. This roadway would be within the cities of Aurora, Commerce City, and Denver.
- 37. Harvest Road** – This project, the construction of Harvest Road on airport property and within the City of Aurora, is dependent on off-airport development and may occur sooner or later than anticipated.
- 38. Consolidated Rental Car Facility** – The expansion of rental car facilities, including construction of a consolidated rental car facility would be undertaken.

- 39. Commercial Vehicle Staging** – The existing commercial vehicle staging area would be expanded.
- 40. Landside Automated People Mover** – A landside automated people mover connecting the terminal to parking, rental car, and other landside facilities would be built. The placement and timing of landside facilities may defer or accelerate construction of this project.

## Support

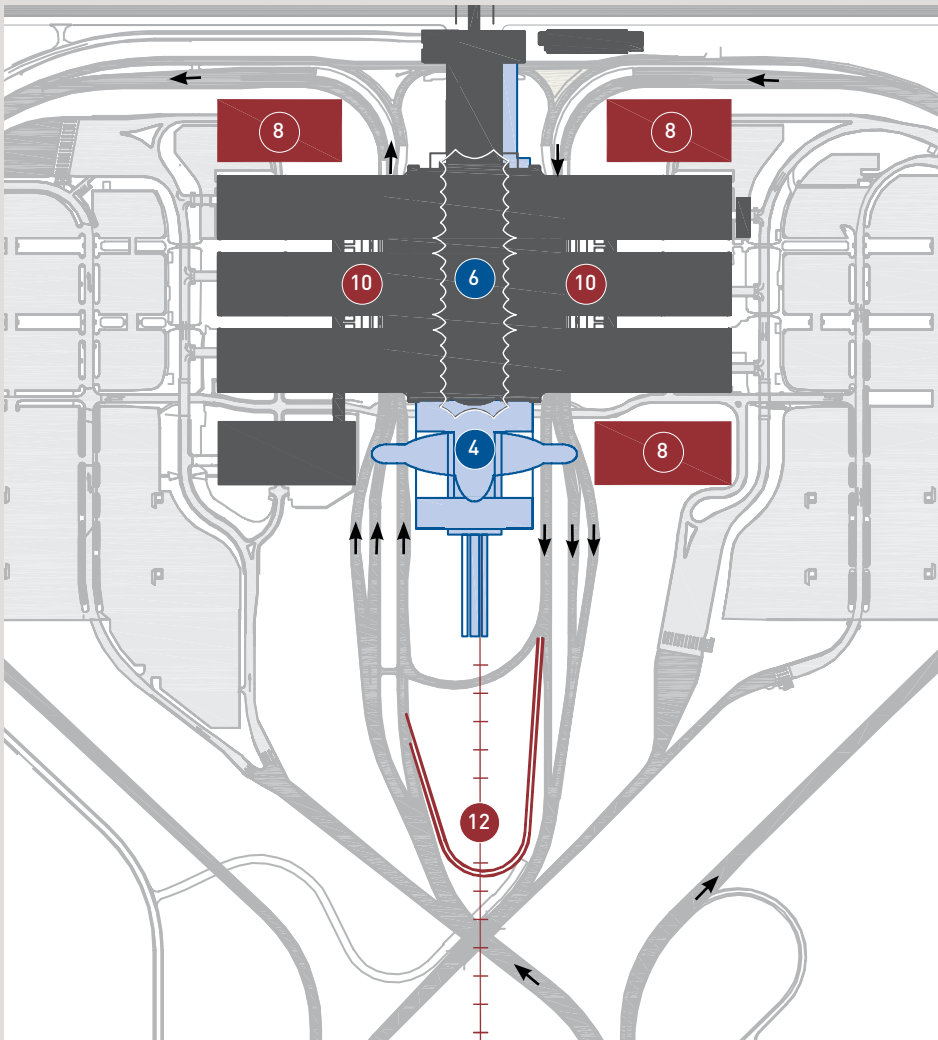
- 41. Cargo Expansion** – With no additional area available for expansion in the existing cargo area, new cargo apron and facilities will most likely be constructed on the north side of the Airport, east of Runway 16L-34R or other areas outside of the Peña Boulevard corridor. The project would include construction of the north extension of Taxiway G, which would provide dual parallel taxiway capability for improved flows for aircraft exiting Runway 16L-34R and also accommodate future development of additional aircraft maintenance and support facilities along the east side of this runway/taxiway system.
- 42. General Aviation/Fixed Base Operator Expansion** – An expansion of existing general aviation facilities, including additional aircraft apron parking, hangar, and terminal facilities would be undertaken.
- 43. Airline Maintenance** – Airline maintenance facilities would be expanded to accommodate demand. The need for the facility will be determined by airline tenants.
- 44. Fuel Farm Expansion** – Fuel storage facilities would be expanded and a second pipeline (by others) from the fuel terminal to the Airport fuel farm may be needed to accommodate forecast aircraft operations.
- 45. Airport Maintenance Facilities** – This project encompasses the expansion of facilities for the storage and maintenance of equipment, as needed. Two sites are identified on the preferred development plan for expansion of these facilities: a south site located at 75<sup>th</sup> Avenue and Jackson Gap Street to serve the terminal and Peña Boulevard corridor, and a north site located west of Queensburg Street and south of 101<sup>st</sup> Avenue that would primarily serve the airfield and north-side development.

# Short-range Development Plan (0- to 10-Year Time Frame) Map



These graphics depict short-range capacity-related projects currently anticipated to be justified within the next 10 years (through approximately 2020).

## Terminal Area



### Existing

### Airfield

1. Runway 8L-26R and Associated Projects
2. Acute-Angled Exit Taxiways B5 and F8
3. Relocation of Acute-Angled Exit Taxiways D6 and D8

### Terminal

4. South Terminal Plaza/Hotel/Train Station
5. Extension of Concourses A, B, or C
6. Terminal Improvements

### Landside

7. Reallocation and Balancing of Rental Car Facilities
8. Public Parking Expansion<sup>1</sup>
9. Employee Parking Expansion
10. Level 6 Roadway Covered Median and Shelter
11. Commercial Vehicle Staging
12. FasTracks Rail Alignment

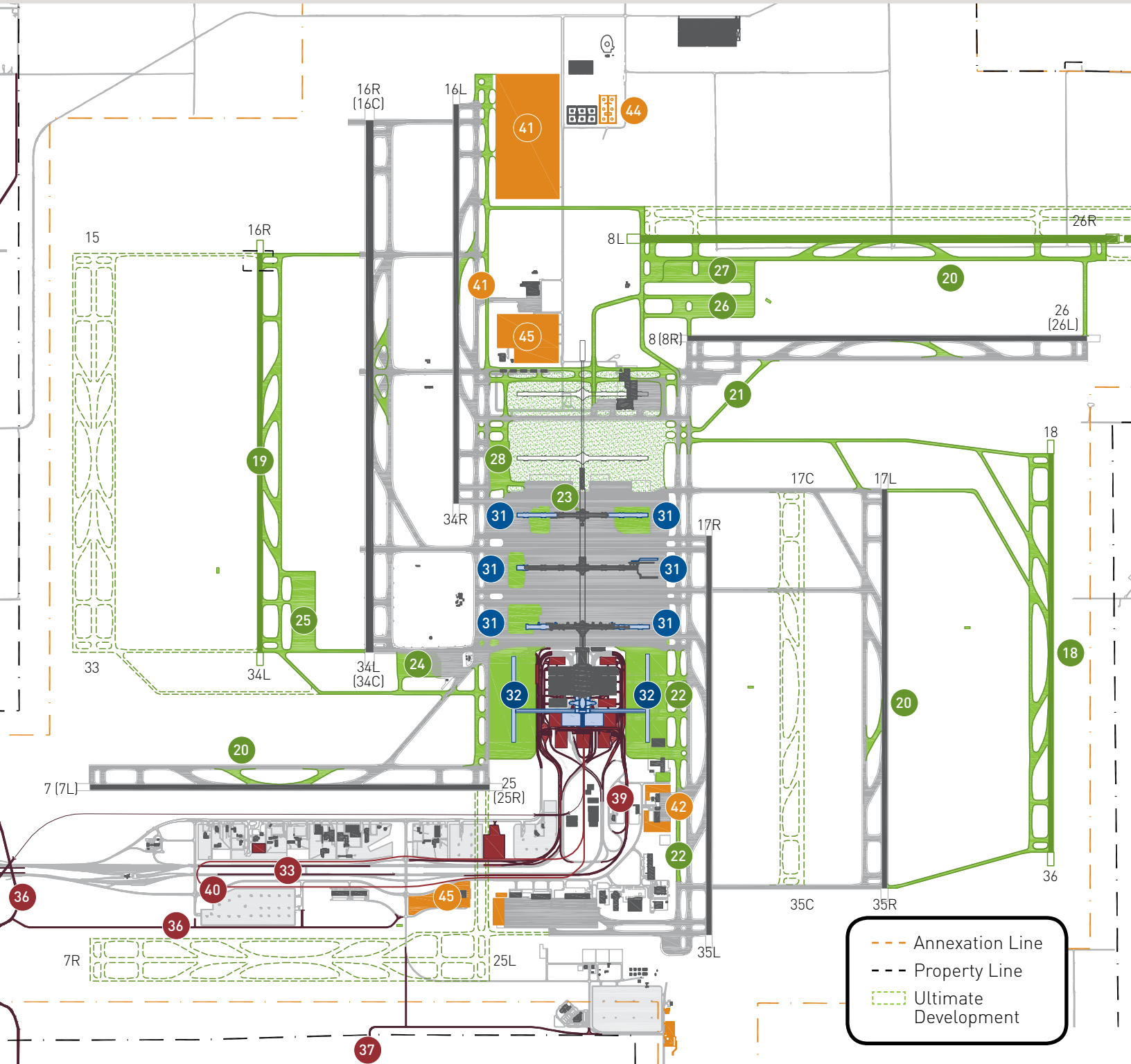
### Support

13. Cargo Expansion
14. General Aviation/Fixed Base Operator Expansion
15. Multi-Tenant GSE Support
16. U.S. Customs and Border Protection Dog Kennel
17. Bus Maintenance Facility

Note:

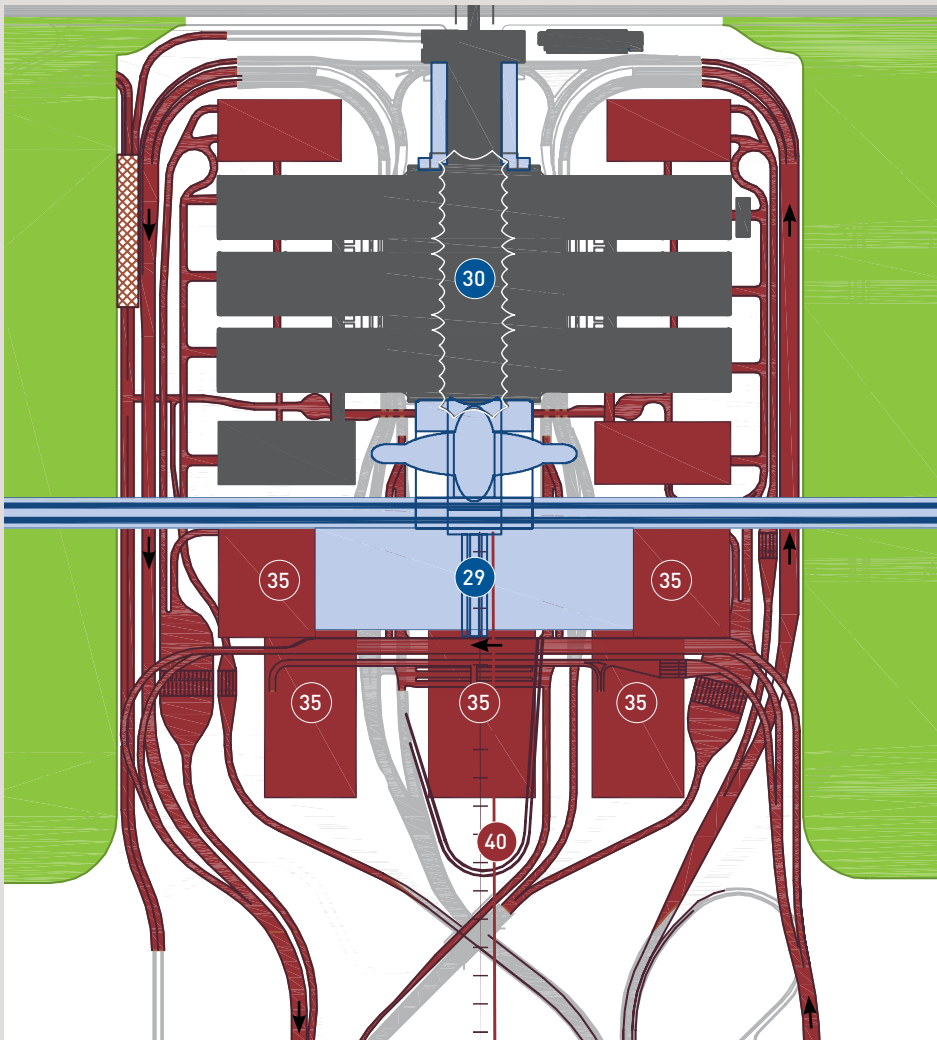
1 Additional studies will determine the future locations of non-terminal area public parking.

# Long-range Development Plan (11- to 20-Year Time Frame) Map



These graphics depict long-range capacity-related projects currently anticipated to be justified within the approximately 11- to 20-year time frame (2021 to 2030).

## Terminal Area



### Existing

#### Airfield

18. Runway 18-36 and Associated Projects
19. Runway 16R-34L and Associated Projects
20. Acute-Angled Exit Taxiways R5, B6, and P5
21. Taxiway R7
22. Taxiway L
23. Replacement Airport Traffic Control Tower
24. WA Deice Pad Expansion
25. Runway 34L Deice Pad
26. Runway 8R Deice Pad
27. Runway 8L Deice Pad
28. D Deice Pad

#### Terminal

29. East-West Terminal
30. Terminal Improvements
31. Extension of Concourses A, B, or C
32. East and West Concourses and Associated Projects

#### Landside

33. Peña Boulevard Expansion
34. Employee Parking<sup>1</sup>
35. Public Parking Expansion<sup>1</sup>
36. Picadilly Road/74th Avenue
37. Harvest Road
38. Consolidated Rental Car Facility<sup>1</sup>
39. Commercial Vehicle Staging
40. Landside Automated People Mover

#### Support

41. Cargo Expansion
42. General Aviation/Fixed Base Operator Expansion
43. Airline Maintenance<sup>1</sup>
44. Fuel Farm Expansion
45. Airport Maintenance Facilities

#### Note:

<sup>1</sup> Additional studies will determine the future locations of employee parking, non-terminal area public parking, consolidated rental car facility, and airline maintenance. Thus, the map does not depict locations for these projects.

## Implementation Planning

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The timing of facility construction greatly depends on decisions by the Department of Aviation, as well as factors such as airline decisions, technology changes, evolving regulatory requirements, and aviation demand magnitude and characteristics. Most specific improvements outlined in the preferred development plan would be triggered by activity (demand driven) levels, policy decisions, regulatory changes, or discretionary development decisions. Airport management has a process for identifying future projects as candidates for the Airport capital improvement plan (CIP)—from monitoring the need for a particular project to evaluating that project (design, scope, cost, etc.), coordinating with appropriate stakeholders (planning, engineering, and finance), and eventually integrating the project into the CIP. The process emphasizes the development of cost-benefit analyses and the definition of business cases for projects proposed for inclusion in the Department of Aviation’s CIP. Using this process, Airport management is able to make well-informed decisions regarding the CIP. The Department of Aviation also maintains a 10-year strategic business plan to promote a business-like approach for decision making and for managing and measuring financial performance of the Department of Aviation. The CIP is one of the key drivers of the Airport’s strategic business plan.



A south-looking interior photo of the Jeppesen Terminal's atrium, which includes shops and restaurants.

## Enabling Work

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Certain activities, identified as enabling work, are necessary as part of the advanced planning, design, financial, and environmental processes that precede construction or implementation of the project/facility. It is critical that allowance for these activities, on a project-specific basis, be made in the long-range schedule of improvements and included in the Department of Aviation’s CIP for the Airport. Predicting when demand triggers might initiate enabling work does not indicate that specific improvement(s) will be implemented, but rather that options will be explored for accommodating demand through completion of the enabling work. In some cases, solutions other than facility development/improvements may be viable and desirable (operational changes, facility management strategies, compromises in levels of service for limited periods of peak activity, etc.).

The duration for completing the enabling work depends greatly on the complexity of the project and can vary from approximately six years or more for runways, terminal, and new concourses to two years for roadways, parking, and concourse expansions. Construction durations and commissioning activity durations can vary substantially depending on the scope of specific projects, the construction phasing/complexity, project location (constrained/developed location versus “greenfield”), and other factors.

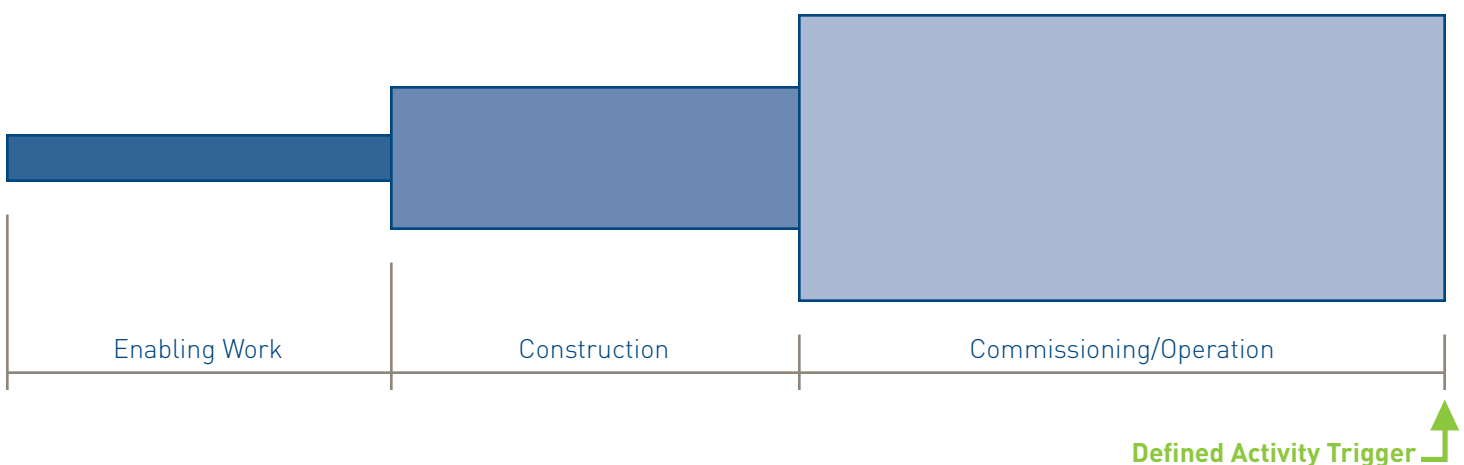
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## Flexibility

In the case of demand-driven development, the timing of project implementation is based on the characteristics and magnitude of actual and forecast demand. As actual demand may vary from that forecasted, the phased development schedule includes specific triggers that reflect the point at which specific improvements are required to be operational in order to meet demand. This approach provides the Department of Aviation the flexibility to respond effectively to actual demand as it materializes rather than making development decisions on a calendar-based schedule. Through regular monitoring and data analysis and an understanding of the impacts of various airline and industry trends, the Department of Aviation can respond strategically to meet tenant and user needs by the timely development of demand-driven facilities.

Many projects can be implemented incrementally (e.g., parking, deicing pads, concourse extensions, support facilities), with initial construction supplemented by subsequent expansions as justified by growing or changing activity. Short-range development projects should be configured with consideration of further long-range development, protecting the flexibility of future options, and minimizing the potential for future facility relocations or impacts. Projects can also be deferred through operational, policy, and management changes, which can affect the need for, timing of, or scope of a required project.

## Project Implementation



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## Decision Points

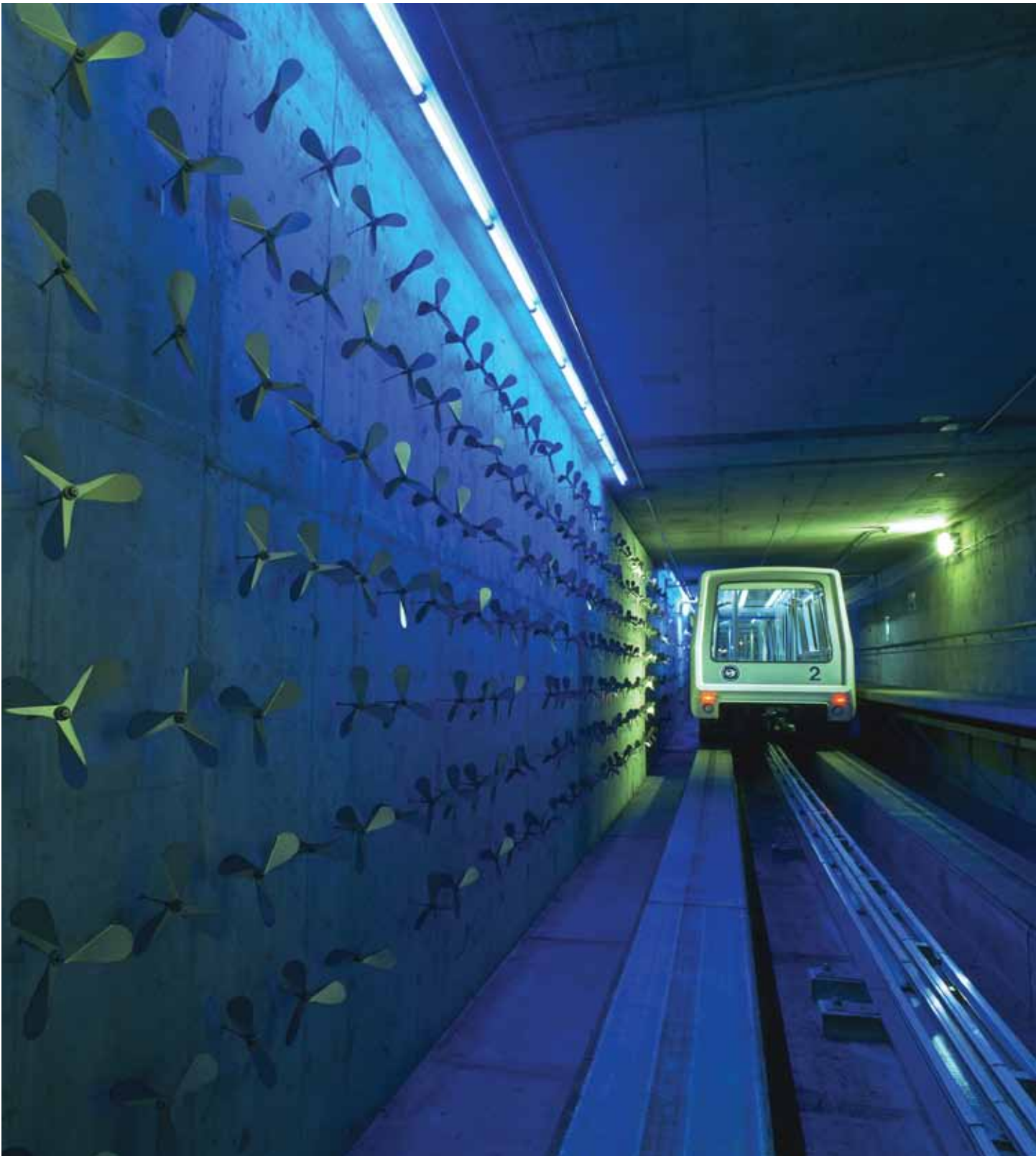
The flexibility to enable the Department of Aviation to be as responsive as possible to future changes and growth in activity can be maximized by deferring specific facility development decisions or actions as long as reasonably possible without compromising operational safety or efficiency. However, to accommodate growing demand and other needs, decisions will ultimately be necessary to allow sufficient time to complete the advanced planning, environmental processing, design, and construction of needed facilities. At these critical points, the Department of Aviation must have defined a future development path based on the conditions and characteristics occurring at the time relative to the demand triggers, including allowances for enabling work and construction. The table on the next page provides an example of the facility decisions that will be necessary.

### Decision Points

Facility Decision	Considerations
Timing of Seventh Runway	The timing of the implementation of the seventh runway requires coordination with FAA to establish how this runway will be utilized in the context of existing runway operations configurations. The operational benefits of the seventh runway based on FAA's use of it will drive the timing of its implementation.
Extension of Concourses A, B, or C	The order of implementation will be determined by the Department of Aviation based on projected airline gate requirements (including international arrivals), constructability of new gates, and project costs.
Determination of Eighth Runway	The status of the FAA's NextGen program will influence which runway will be selected as the eighth runway, based on maximum operational benefits and the ability to potentially reduce runway separations.
Expansion of Jeppesen Terminal or Construction of East-West Terminal	Jeppesen Terminal can be reconfigured and improved to accommodate greater passenger demand at an acceptable level of service, but not to projected 2030 demand levels. The relevant factors influencing this decision (operational disruption, financial implications, passenger characteristics, technological advancements, tenant preferences, etc.) must be addressed to determine whether to invest in Jeppesen Terminal or to develop new terminal facilities.
Construction of Concourses D and E or East and West Concourses	Construction of satellite Concourses D and E, which are an alternative to the east and west concourses, would require significant expansion of the AGTS, which may be more costly and disruptive than constructing the east and west concourses. Expansion alternatives for the AGTS and concourses will need additional detailed exploration and analysis to determine the preferred expansion alternative at the time that decision is warranted.
Expansion of Rental Car Facilities	As the existing rental car facilities area approaches capacity and additional facility development is warranted, the Department of Aviation will have to decide whether the facilities should be expanded in more remote locations (surface facilities), within the existing rental car area (structured facilities), or be consolidated in a rental car facility potentially closer to the terminal.
Addition of On-Airport Parking Facilities	As the demand for public parking continues to grow, and the capacity of the existing parking system is reached, the Department of Aviation will have to decide whether to continue developing public parking facilities (surface or structure) or to allow private operators to develop parking facilities (on- or off-Airport), thereby avoiding the cost of constructing, operating, and maintaining additional parking facilities.
Development of Cargo Facilities	A portion of forecast cargo demand can be accommodated in the existing cargo area. Alternatively, future cargo facilities can be developed in the north airfield or other locations on the Airport. A decision on implementing a split cargo area or consolidating all-cargo activity in the north airfield will depend, in large part, on demand for other commercial/collateral and aviation-related development in the existing cargo area in the Peña Boulevard corridor.



An automated train shuttles passengers between the Jeppesen Terminal and concourses. Pictured is the train as it moves past *Kinetic Air Light Curtain*, an Airport art installation.



## Environmental Overview

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Environmental issues were a key consideration throughout the master planning process—from identifying the Airport’s environmental resources (the environmental overview of the Airport) to incorporating consideration of effects on environmental resources in the alternatives analysis to identifying environmental considerations related to implementation of the Master Plan Update projects.

The environmental resource topics considered in the Master Plan Update align with the environmental impact categories typically considered for airport projects under the National Environmental Policy Act of 1969 (NEPA). Topics include changes in areas exposed to significant levels of aircraft noise and areas where ground disturbance associated with projects defined in the preferred development plan may impact an environmental resource, such as a wetland. The assessment of environmental impacts for the projects in the preferred development plan is a preliminary assessment, intended to identify environmental issues to indicate the type of environmental processing that may be required under NEPA to implement the recommended projects.

Based on known environmental conditions at the Airport, the potential impacts of the recommended projects on environmental resources are summarized on the next page. The environmental impacts associated with the development of components recommended in the Master Plan Update will be explored, analyzed, and documented as development decisions are made by the Department of Aviation.



A Denver International Airport-bound plane flies over one of the many sunflower fields next to or on airport property. (Top)

Farmers harvest winter wheat, one of several crops still grown on Denver International Airport property. (Center)

These 9,200 solar panels provide some power for Denver International Airport. The panels, reflecting the setting sun, are just south of Jeppesen Terminal. (Bottom)

<b>Environmental Resource</b>	<b>Potential Impact</b>
Floodplains	Development footprints and increases in impervious areas associated with projects in the preferred development plan may affect the 100-year floodplains Second Creek, Third Creek, and Box Elder Creek.
Wetlands	Development footprints of projects in the preferred development plan may affect wetland resources.
Creeks	Development footprints of projects in the preferred development plan may affect Second Creek, Third Creek, and Box Elder Creek, as well as drainage ditch tributaries to these creeks.
Water Quality	Projects in the preferred development plan could increase the amount of paved area (impervious surfaces) at the Airport, which could result in increased stormwater runoff. Potential effects to water quality from construction and stormwater runoff could result.
Hazardous Materials	Two runway projects in the preferred development plan may affect two existing hazardous materials sites at the Airport (the Box Elder Compressor Plant and the Koch Third Creek Gas Plant). Areas that previously supported fueling activities could require remediation prior to redevelopment.
Energy Supply	Development footprints of projects in the preferred development plan may affect existing oil and gas wells.
Biotic Resources	Projects in the preferred development plan located in areas not currently disturbed or paved could require consideration of potential impacts to wildlife and plant species and natural habitats.
Aircraft Noise and Compatible Land Use	An aircraft noise screening analysis indicated that noise exposure from the recommended runway projects is generally consistent with noise exposure defined previously for planned Airport runway development in the original master plan. Areas identified in the noise screening analysis where there could be noise exposure changes were primarily either on Airport property or over land already subject to controls that limit the development of incompatible land uses.
Air Quality	Construction and operation of projects in the preferred development plan may require evaluation of changes in air pollutant emissions. For example, changes in operational emissions may result from changes in facilities that support aircraft operations (e.g., runways, taxiways, deicing facilities, aircraft gates) and surface vehicles (e.g., roadways, parking areas), as well as changes in stationary sources (e.g., new buildings, new or expanded utility plant).
Surface Traffic	Some projects in the preferred development plan, such as new roadways or parking facilities, may change surface traffic patterns at the Airport and in the general environs.

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