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1. PURPOSE. This Change 2 incorporates additional guidance on passenger convenience, ground access, and access to airport facilities, as identified in Section 131 of Public Law 112-95, “FAA Modernization and Reform Act of 2012.” Also included are limited editorial and text revisions since the release of Change 1 to this Advisory Circular (AC) in 2007. The primary revisions are contained in Chapter 8 and Appendix B of this AC. A complete update to this AC is currently in process.

2. CHANGE TEXT. Changed text is indicated by vertical bars in the margins.

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- 5) The outdated condition, arrangement, or functionality of existing facilities.
- d. At some airports, planners can use simulation models to help determine facility requirements. For large airports, simulations can model major components of an airport, including the airfield system, airspace environment, passenger and baggage flows in the terminal, and ground access networks. For smaller airports, simulations can model usage projections, passenger flows, and other support requirements including fixed base operator, maintenance, flight school, and fuel support requirements.
- e. Many of the significant improvements needed at an airport are actually driven by the demand level, not a time frame or a specific year. Therefore, planners should identify what demand levels will trigger the need for the expansion or improvement of a specific facility. In this way, the sponsor can monitor growth trends and expand the airport as demand warrants. (For a discussion of the use of Planning Activity Levels, see Section 704.e.)
- f. The findings of the capacity analyses and facility requirement determinations form the foundation for the identification of development alternatives and the selection of the alternatives that can best meet future demand. Since critical investment decisions will be based on these analyses, the planner, airport sponsor, and FAA should consider the cost of inadequate analysis in determining the level of effort and sophistication of the capacity and delay analyses. If the analyses are not sophisticated enough, development funds could be wasted on alternatives that do not meet future demand. On the other hand, planning funds can be wasted by capacity and delay analyses that are more sophisticated than they need to be. Future facility needs are to be based on these analyses and it is critical that these analyses be adequate, supportable, and defensible. Therefore, this is a critical issue to discuss during master plan scope of work development.

802. EMERGING TRENDS

- a. The aviation industry is always changing, and these changes affect the size, quantity, and type of airport facilities needed to accommodate future demand. Accommodating demand while improving safety, reducing delay, protecting the environment, and providing passengers with a better travel experience is the challenge faced by the FAA, airport management, and planning professionals as they address changes such as these:
 - 1) Airline consolidation and changes in air service patterns and aircraft fleet decisions will continue to shape airport facility needs.
 - 2) The Next Generation Air Transportation System (NextGen) is the FAA's primary means of modernizing the national air transportation system. Modern airspace and performance-based navigation are key components of NextGen.
 - 3) Enhancements in information technology are enabling more data to be transferred faster, influencing everything from airline scheduling and weather planning to advances in self-service passenger processing such as ticketing and check-in.

- 4) Sustainability considerations have and will continue to shape the industry and airport planning and design considerations. These include initiatives that maximize linkages with public transportation, promote recycling and waste minimization, increase energy efficiency (including the use of alternative energy sources), reduce airport-related emissions, and increase interactions with neighboring residents and businesses.
- b. The rapid pace of change in the aviation industry is expected to continue for years to come. Planners should examine industry trends and identify those that will influence airport capacity and facility needs. An important consideration in airport planning is to encourage the development of flexible concepts that can be adapted to the rapidly changing environment.

803. DESIGN HOUR DEMAND

- a. For master plans, estimates of annual and peak-hour demand for airline passengers, aircraft operations, cargo, and vehicle trips should be used to identify future facility needs. Peaking characteristics can provide insight on seasonal and time-of-day variations in demand; failure to consider these characteristics can result in high congestion and low levels of service during peak hours.
- b. In the U.S., the evaluation of peak-hour demand is often based on the peak hour of the average day of the peak month. This approach provides sufficient facility capacity for most days of the year, but recognizes there will be some very busy days that experience congestion, queues, and delays and that it is important that facilities are neither under nor overbuilt. However, for some critical airport systems, the peak hour of the average day of the peak month can substantially understate the demand at peak times, resulting in unacceptable levels of service or overloading of systems to a point that may approach gridlock. Some components of the passenger terminal complex, such as baggage handling systems and security checkpoints, are particularly sensitive to this issue.
- c. To address these problems, planners may wish to consider alternate methodologies for determining peak-hour demand, such as the percentile of busy hours throughout the year (for example, 90th or 95th percentile). A facility sized to meet such demands should have sufficient capacity and service levels during 90 percent or 95 percent of the hours throughout the year. The specific percentile will depend on the facility being evaluated, the desired level of service, and the unique demand characteristics of the study airport.

804. SECURITY CONSIDERATIONS

Security requirements have become very important in planning airport facilities. Planning for security early in the development process can produce designs that accommodate security requirements in a more efficient, less costly, and less intrusive manner. However, specific measures for implementing security requirements will vary in response to shifting threats, evolving technology, and the physical and operational circumstances of individual airports. Planners should meet with representatives of the Transportation Security Administration (TSA) early in the process and be familiar with the current versions of applicable documents, including TSA's *Recommended Security Guidelines for Airport Planning, Design, and Construction* and

and the cost to users of not being able to use the airport when it is not accessible. Important navigational aids include instrument landing systems (ILS), approach lighting systems (ALS), Precision Approach Path Indicators (PAPI) or other visual approach slope indicators, and global positioning systems (GPS), such as the Wide Area Augmentation System (WAAS). Airport users can assist planners in identifying the need for navigational aids and the development of WAAS approaches. The installation of new navigational aids may require airspace coordination.

- e. Air traffic control facilities include air surveillance radars, airport surface detection equipment, remote transmitters and receivers, wind shear detectors, weather observing equipment, and others. The general siting of future air traffic control facilities should take place during the master plan process so that adequate space is reserved for them and their critical areas are protected from development that would interfere with their operation.
- f. **Airspace Requirements** – For complex master plans, particularly for a commercial service airport located near another commercial service airport, determining airspace requirements may require a detailed investigation, often using computer simulations. Such efforts need to be carefully coordinated with FAA air traffic representatives so as to reach agreement regarding key modeling assumptions. In addition, if the airfield capacity analyses call for new runways or major airfield reconfigurations, significant airspace changes or redesign may be required and FAA air traffic representatives should participate in the discussions.

In most master plan studies, however, the focus will be on reviewing the airport's existing airspace classifications and determining if growth at the study airport or at neighboring airports could require an upgrade to a higher airspace classification.

At non-towered airports, the master plan should determine if the growth in aircraft operations will exceed threshold values for the establishment of an airport traffic control tower. For towered airports, line of sight investigations may reveal that the airport traffic control tower should be relocated. See FAA Order 6480.4, *Airport Traffic Control Tower Siting Criteria*, for help in making such a determination.

Planners should identify penetrations of imaginary surfaces (as defined in 14 CFR Part 77, *Objects Affecting Navigable Airspace*) to determine their disposition. Obstacle clearance surfaces associated with *United States Standard for Terminal Instrument Procedures (TERPS)*, and obstacle clearance requirements found in FAA AC 150/5300-13, *Airport Design*, should be evaluated as appropriate. In some cases, the TERPS surface may be the controlling airspace surface.

806. COMMERCIAL SERVICE PASSENGER TERMINAL COMPLEX

- a. **Scope of Analysis** – The commercial service passenger terminal complex extends from the aircraft parking positions on the airside interface to the vehicle curbside on the landside interface. The role of the study airport in the national and regional air transportation system will influence passenger terminal facility requirements. A major connecting hub, for example, will need terminals that are functionally different from

those at an origin and destination airport. Similarly, airports serving major tourist destinations will have special needs. Planners should create a scope of analysis based on the size and type of airport, annual number of passengers served, demographics of the passengers served, airport goals and needs, and available funding. Planners should also consider the level of detail needed for the master plan. It may be appropriate to provide only the general location and footprint of a future terminal complex in the master plan, and complete a more extensive terminal analysis in a separate study, especially if existing facilities will not accommodate future demand or industry requirements. Figure 8-1 shows a typical passenger terminal complex at a large commercial service airport.

Figure 8-1: Commercial Service Terminal Complex



Source: Philadelphia International Airport, Terminal F (opened in 2001), www.phl.org (Photograph by Richard McMullin, Philadelphia Airport System)

- 1) ***Airside Requirements*** – Planners should identify the number of aircraft parking positions that will be needed to accommodate future activity. The mix of aircraft expected to operate at the airport during the design hour will determine the linear feet of apron frontage and the gate dimensions required. The location of aircraft parking positions relative to air traffic movement areas should be considered to avoid or limit the effects of aircraft pushbacks on aircraft taxiing flows. The parking and storage of ground service equipment should also be considered in determining apron frontage requirements. Planners should strive to separate ground vehicle movement areas from aircraft movement areas as much as possible to ensure safety.
- 2) ***Passenger Terminal Building Requirements*** – Within the terminal building, requirements are commonly expressed in terms of square footage for major functional elements, such as ticket counter areas, security screening checkpoints, departure lounges, concessions, airline operations, baggage makeup, baggage claim, circulation, public space, restrooms, airport offices, and mechanical space. Airports that serve international flights also require facilities for customs and immigration. Planners

should evaluate the special requirements for these facilities by referencing the latest guidance from U.S. Customs and Border Protection (CBP) and the Centers for Disease Control and Prevention (CDC).

Understanding the space requirements of these elements will assist planners in configuring the terminal complex. In master plans where terminal building expansion is recommended for the long term, it may be appropriate to provide only a general location and footprint of the future terminal building, rather than specific functional area requirements. Industry rules of thumb are often used to develop generalized gross terminal space requirements necessary to properly size the terminal footprint (refer to Section 806.c for relevant reference materials).

- 3) ***Landside Requirements*** – The length of curbside area required is a function of the modal splits of originating and terminating passengers, pedestrian circulation, dwell time assumptions and occupancies for the vehicles at the curbside, and the assignment of different types of vehicles to the curbside. The availability of convenient and inexpensive short-term parking, public transit, and door-to-door shuttles will reduce the amount of curbside area required. To facilitate the flow of traffic in front of the terminal, the number of lanes should be assessed.
- b. **Passenger Convenience** – Evaluation of existing and future airside, landside, and terminal facilities must include consideration of passenger convenience and the related issues of accessibility for passengers and ground access (Section 810.e provides specific information on passenger convenience as it relates to ground access). Passenger convenience will be perceived differently by every passenger at every phase of travel. It is a function of a passenger’s trip purpose, demographic characteristics, place of residence, and travel habits.

Planners should consider the services provided to travelers at various points within the terminal building, the degree of congestion, and waiting and processing times. Shorter wait times, intuitive wayfinding, shorter walking distances, airport amenities and ambiance, and reliable flight information will all contribute to passengers feeling as if they have had a successful travel experience. Providing resources to make passenger wait time more productive or more entertaining will improve passenger perception of their journeys. Examples include dedicated work areas, power connections, Wi-Fi, full-service concessions, exhibits, and entertainment.

- 1) ***Access to Airport Facilities*** – Access to airport facilities is defined by the convenience of the airport facility layout for passengers, especially passengers with mobility and sensory impairments, elderly passengers, families with small children, and passengers who do not read or understand English. Key measures of convenience focus on passengers being processed in an efficient amount of time and with minimal discomfort. Passengers should be able to access the airport, the landside area, terminal building, and connections between each in a seamless flow.

Planners should evaluate parking and curbside capacity and designated areas for travelers waiting for their next mode of transportation. Access to shuttles, buses,

trains, and automated people movers (APM) should be evaluated, as well as the frequency of service relative to aircraft arrival and departure times.

Inside the terminal building, planners should evaluate passenger pathways, vertical transitions, clarity of signage and wayfinding, space and queue lengths at check-in and security, space and wait times at baggage claim, access to airport information and airline schedules, and convenience of restrooms, concessions, and departure lounges. Planners at international airports should evaluate the comfort of CBP facilities where immigration and infectious diseases are addressed.

Many publications describe common metrics and accepted standards for evaluating the passenger experience at an airport. Some of these publications are listed in Appendix B of this AC. Planners should consult the appropriate publications depending on the size and scope of the project. Airport surveys or comment kiosks can also be useful in determining the public's perception of the functionality and convenience of the terminal facility. Airport customer service representatives, airport volunteers, Travelers Aid agencies and the United Service Organization (USO) also provide valuable insight to improvements needed in terminal facilities.

- 2) ***Access for Individuals with Disabilities and Elderly Passengers*** – Access to airport facilities for people with disabilities, impairments, and limited mobility can be particularly challenging. Planners should evaluate whether airport facilities meet the Americans with Disabilities Act (ADA) requirements and other building codes. Existing facilities that are in noncompliance with these requirements should be remedied as soon as possible or as required by law. New facilities should be planned and designed to improve accessibility and convenience for all passengers while meeting the special needs of disabled passengers.

Planners should be cognizant of the growing market segment of elderly passengers, who are creating new demands on airports as their propensity to travel increases. This group includes passengers using wheelchairs or walkers and those with specific medical requirements. Planners should identify any specific terminal layout requirements, amenities (including concessions, information booths, and restroom facilities) and staffing considerations necessary to best accommodate these passengers and improve their travel experience.

- c. **Methodologies** – Information on methodologies that can be used to determine passenger terminal facility requirements is provided in several sources, including:

- 1) FAA Advisory Circulars 150/5360-13, *Planning and Design Guidelines for Airport Terminal Facilities*, and 150/5360-9, *Planning and Design of Airport Terminal Facilities at Non-Hub Locations*
- 2) *Airport Development Reference Manual*, published by the International Air Transport Association
- 3) *ACRP Report 25, Airport Passenger Terminal Planning and Design, Volume 1: Guidebook* (<http://www.trb.org/Publications/Blurbs/163252.aspx>)

ACRP Report 25, Airport Passenger Terminal Planning and Design, Volume 2: Spreadsheet Models and User's Guide
(<http://www.trb.org/Publications/Blurbs/163171.aspx>)

- 4) *Recommended Security Guidelines for Airport Planning, Design and Construction*, published by the Transportation Security Administration
(http://www.tsa.gov/sites/default/files/assets/pdf/airport_security_design_guidelines.pdf)

Proprietary computer simulation modeling tools can also be used to evaluate passenger and baggage flows through airport terminals.

807. GENERAL AVIATION REQUIREMENTS

- a. General aviation (GA) encompasses a variety of users and activities, such as corporate flight departments, cargo operators, recreational flyers, business commuters, flight training, agricultural applications, law enforcement, and fixed base operators (FBOs). As a result of the variety of GA aircraft activity, GA needs include aircraft storage facilities, transient parking aprons, terminal facilities, automobile parking areas, and vehicle access from adjacent roads. Planners should consult appropriate publications for specific information regarding GA airport facilities planning, such as FAA AC 150/5300-13A, *Airport Design*.
 - 1) ***Aircraft Storage Facilities*** – Physical requirements of GA users vary from tiedown aprons to large conventional hangars with major maintenance services and transient aircraft aprons. Conventional hangars and T-hangars protect aircraft from the weather and provide security against vandalism or theft. Planners should evaluate the square footage allocated to outdoor aircraft parking versus hangars based on demand. The demand for hangars will be higher in northern climates with severe winter weather conditions.
 - 2) ***Transient Aircraft Parking Aprons*** – Temporary parking for visiting aircraft may be provided on a transient apron adjacent to the terminal building, or on aprons managed or leased by an FBO. Planners should determine the percentage of transient activity compared to annual aircraft operations at the airport.
 - 3) ***Terminal Facilities*** – Terminal buildings at GA airports range from very modest structures with little more than a waiting room and a telephone to multistory buildings with extensive amenities, such as pilot briefing rooms and lounges, restaurants, gift shops, conference and training rooms, and rental car counters. At GA airports, the terminal building may also house administrative offices. At commercial service airports, general aviation terminal facilities are often provided by one or more FBOs. In such cases, the facilities are provided principally for customers of the FBO and access for the general public is limited.
- b. Planners should identify future requirements for GA facilities which are primarily a function of the forecasts of aircraft to be based at the airport and of transient aircraft operations. Planners of GA airports should understand the role of the GA airport in the region's transportation network, as well as the strategic and economic value of the

airport, as they will also influence facility requirements. More information on evaluating airports as part of a system is provided in FAA AC 150/5070-7, *The Airport System Planning Process*.

- c. Planners should be aware of factors that may influence existing demand for GA facilities. For example, if facilities are in disrepair compared with facilities at nearby airports with overlapping service areas, demand may shift from the study airport to the nearby airport. The airport sponsor's pricing policies may also affect demand. A useful barometer of facility needs, particularly short-term needs, is the existence of waiting lists for hangars, T-hangars, and aircraft tiedown positions.
- d. The number of business jets is increasing at a more rapid rate than other GA aircraft. Planners should carefully evaluate the existing and future GA aircraft fleet mix. Business jets have different facility and service requirements than single-engine aircraft.
- e. Passenger convenience considerations for GA facilities at commercial service airports and at GA airports include automobile parking, rental car company options, aircraft parking (transient and long term), signage, comfort and cleanliness of FBO facilities, services such as aircraft maintenance and catering, and dedicated work areas for pilots.

808. AIR CARGO REQUIREMENTS

- a. For commercial service airports and larger GA airports, air cargo activity is generated by a diverse collection of companies with differing business strategies and market roles, including the following:
 - 1) ***Integrated Carriers***, which transport freight from door-to-door using their own fleet of trucks and aircraft.
 - 2) ***Freight Forwarders***, which act as brokers that link shippers with freight carriers; they coordinate the shipment of freight, but do not transport it.
 - 3) ***All-Cargo Operators***, which sell space to freight forwarders or individual companies and ship the air cargo on their aircraft.
 - 4) ***Combination Carriers***, which carry both passengers and freight on a single aircraft, typically with a reconfigured cabin.
 - 5) ***Belly Freight Carriers***, which carry cargo in the baggage compartment or belly of a passenger aircraft.

Airport planners should assess the capacity of existing cargo processing facilities and determine future requirements for buildings, aircraft parking aprons, and ground access facilities. Each type of cargo operation has somewhat different site requirements, so a range of spaces will need to be provided for cargo development. In planning for future air cargo facilities, planners should consider: (1) the type of cargo companies expected to expand or initiate operations; (2) annual air cargo operations projected for all cargo operators; (3) the number of existing apron parking spaces; (4) projected growth in annual enplaned cargo tonnage; (5) the availability of ground

access for the heavy commercial trucks associated with cargo activity; (6) the availability of ground access and parking for employees in air cargo facilities, and (7) any security needs and requirements. Planners should consider providing a means of separating cargo trucks from other airport traffic for security purposes.

- b. At most GA airports, air cargo facilities are included in the broad category of general aviation facilities. Air-cargo-related activities are accommodated in the hangar, apron, and ground access facilities of the general aviation tenants and operators. In such cases, an independent analysis of air cargo needs is unnecessary.

809. SUPPORT FACILITIES

- a. Support facilities at an airport encompass a broad range of functions that ensure the smooth, efficient, and safe operation of the airport. As applicable, the future requirements for the following support facilities should be assessed:
 - 1) ***Aircraft Rescue and Firefighting*** – For airports that require 14 CFR Part 139 certification, planners should review the aircraft operations forecast to determine if the airport’s Aircraft Rescue and Firefighting (ARFF) index will change during the planning period. If 14 CFR Part 139 certification is not currently provided at the study airport, but will be required during the planning period, the applicable ARFF building and equipment requirements should be defined in the master plan. See 14 CFR Part 139, *Certification of Airports*, particularly sections 139.315 through 139.319, for ARFF index definitions, and FAA AC 150/5210-15, *Aircraft Rescue and Firefighting Station Building Design*, for standards and guidance in planning an ARFF station. Planners should also consider if multiple ARFF stations will be required to meet response time requirements as defined in 14 CFR Part 139. For airports that do not require 14 CFR Part 139 certification, planners should identify any existing mutual aid agreements with local authorities for emergency response services, or the lack thereof.
 - 2) ***Airport Maintenance*** – Airports provide a wide variety of services to ensure that a safe, efficient, and reliable environment is provided for airport tenants and users. The facilities needed to support these services include administrative offices, buildings for storage and maintenance of airport equipment, shop space, and buildings for supply storage. Northern airports need equipment for snow removal operations (refer to FAA AC 150/5220-18A, *Buildings for Storage and Maintenance of Airport Snow and Ice Control Equipment and Materials*).
 - 3) ***Fuel Storage*** – FBOs often provide fuel storage and supply at general aviation airports. At some airports, unattended self-service facilities may be provided when activity does not warrant full-time attendants. At commercial service airports, fuel storage facilities provide jet fuel if the supply through pipelines or tanker trucks is interrupted. To support general aviation, planners should address the types of approved aviation fuel needed to meet current and future public demand, as new engine technologies permit the use of automobile fuel and diesel in today’s aircraft.

- 4) **Aircraft Maintenance** – For the general aviation community, aircraft maintenance is typically provided by an FBO. The types of services provided include, but are not limited to, airframe and power plant repair by an FAA-certified repair station. The facilities required to sustain these services include: (1) an aircraft maintenance hangar with sufficient work space for any aircraft upon which maintenance is being performed; (2) suitable storage and shop space for equipment and tools; (3) office space, customer lounge, restrooms, and telephone; (4) apron area with pavement type and strength adequate to support the expected aircraft fleet; (5) adequate automobile parking and ground access; and (6) proximity to the engine run-up area to limit taxiing times and fuel costs. At larger airports, a tenant airline may have established a maintenance base for the periodic inspection and maintenance of its aircraft. To determine the space requirements for such a maintenance facility, planners should ask airline representatives about the types of aircraft they plan to service at the airport and their expected facility needs.
- 5) **Deicing** – Airports in locations with winter weather conditions that can cause accumulation of frost, snow, slush, or ice on aircraft surfaces must have aircraft deicing facilities. These airports should provide deicing pads to maintain departure flow rates and avoid unacceptable aircraft delays. Any new aircraft deicing facility must have runoff mitigating structures to collect deicing fluid runoff, and must comply with U.S. Environmental Protection Agency (EPA) requirements. See FAA AC 150/5300-14B, *Design of Aircraft Deicing Facilities*, for standards and guidance in planning deicing facilities.

Guidance for assessing the future needs of aviation support facilities is provided in the referenced ACs. In many cases, planners should rely on interviews with airport tenants and users in combination with observation of the methods and procedures used at existing airport facilities.

810. GROUND ACCESS, CIRCULATION, AND PARKING REQUIREMENTS

One of the key elements in choosing a mode of travel to the airport is the total trip time between the point of origin and the destination. If total trip time is less than 3 hours, travelers are particularly sensitive to the duration of the ground access portion of an air travel trip. The regional roadway network, on-airport circulation roadways, and parking facilities are the principal components of the ground access system. The capacity and reliability of this system will determine the levels of service and convenience provided to air travelers during the ground access segment of their trips.

- a. **Regional Transportation Network and Public Transportation** – Coordination with local transportation planning authorities during the review of existing conditions should produce enough information to enable an assessment of ground access capability, and to confirm whether or not the existing and planned networks can accommodate projected aviation demand.

At airports where ground access is an issue, discussions with local transportation planners can help quantify the capacity shortfalls of the regional roads. At busy and complex airports, planners can benefit from the use of a variety of analytical computer models and simulation models to determine how best to address capacity issues. A Metropolitan

Planning Organization (MPO) or other regional planning agency may be able to provide assistance to airport planners. Planners may determine the need to conduct a separate ground access study.

Public transportation has the potential to reduce roadway congestion and the amount of land required for automobile parking while reducing total air pollutant emissions and impacts on the environment and increasing sustainability initiatives. Public transportation services, including scheduled bus service, light rail systems, intermodal stations, or other alternate modes of transportation, are often examined as part of airport master planning.

- b. **On-Airport Circulation Roadways** – This roadway access system is shared by a wide range of users having different trip purposes, which include:
- 1) ***Originating and terminating airline travelers*** who most often arrive at the airport in a private vehicle, but may also use a taxicab, limousine, courtesy bus, mass transit, charter bus, door-to-door shuttle, or rental car.
 - 2) ***Employees*** who travel to and from the airport each day using private vehicles or public transportation.
 - 3) ***Delivery vehicles*** that supply the goods and materials consumed or purchased at the airport.
 - 4) ***Other vehicles*** that may require access to air cargo facilities, general aviation facilities, support facilities, and other activity centers.

Each user group has a different pattern of arrival and departure times for its airport trips. Analytical methods and computer models may be used to evaluate roadway capacities and the levels of service they provide. Such analyses should also identify potential capacity increases in the form of additional lanes or operational modifications. Security provisions for vehicle screening may be required. Other users of the roadway facilities that should be evaluated may include:

- 1) ***Taxicab/Limousine/Courtesy Shuttle Staging Areas*** – Locations where vehicles can be parked and dispatched as needed to pick up passengers at terminal curbsides. A staging area is a critical resource at busy airports where terminal curbside space is scarce.
- 2) ***Rental Car Facilities*** – At smaller airports, the rental car ready and return parking spaces are often located in lots adjacent to the terminal building or in the public parking garage. At larger airports, ready and return spaces may be provided in a consolidated rental car facility or at remote locations that are accessed via courtesy shuttles or buses. Rental car operations also require space for cleaning, fueling, maintaining, and storing vehicles.
- 3) ***Courtesy Shuttles and Buses*** – Courtesy buses and other types of shuttles serving on- and off-airport rental car facilities, hotels, and parking facilities are major users of on-

- airport roadways. At the larger commercial service airports, courtesy vehicles are often allocated dedicated curbside space to pick up and drop off passengers.
- 4) **Charter Bus Operations** – Airports that are gateways to major tourist destinations must accommodate significant charter bus operations. Cruise ships, for example, impose extraordinary passenger surges on airport facilities used by charter buses to transfer passengers between the airport terminal and the marine port.
- b. **Public Parking Facilities** – Public parking facilities at general aviation airports are generally small surface lots located next to the terminal building, while parking facilities at commercial service airports range from surface lots next to the passenger terminal to a complex combination of garages and surface lots. Close-in parking may include separate areas for hourly and daily parking. At larger airports, remote parking lots with shuttle bus service may need to be considered. The development of cell phone lots is gaining popularity at many commercial service airports because they reduce the amount of recirculating traffic on airport roadways.
 - c. **Employee Parking** – At small commercial service airports, parking for employees whose worksite is inside the commercial passenger terminal building can usually be accommodated in small surface lots near the terminal. At larger airports, however, public parking in surface lots or garages is often given higher priority than terminal area employee parking. In these cases, planners should evaluate terminal area employee parking and remote area employee parking, as well as employee shuttle bus service, in calculating future facility requirements.
 - c. **Passenger Convenience** – Planners should examine all ground access, circulation, and parking components for their ability to enhance the passenger experience. Passengers that need to travel to and from an airport must select a mode of transportation for that travel, taking into account mode efficiency and comfort, cost of trip, duration of trip, vehicular traffic, complexity of routing, and potential impacts of road closures and accidents. On the airport, signage should be simple, concise, and uniform to aid in wayfinding. Poor signage can reduce the level of service provided to airport patrons and result in increased recirculating traffic (refer to FAA AC 150/5360-12E, *Airport Signing and Graphics*). Passengers traveling by automobile will be most concerned with how easy it is to find parking and parking options and costs, whether hourly, daily, or long-term.

Good connectivity between an airport terminal and the various modes of transportation is essential. Public transportation options should be examined for frequency, travel time, cost, and number of segments (additional time required for connections), as well as type of intermodal facilities available on the airport to provide seamless and convenient connections for passengers on the next leg of their journeys. Walking distances to parking garages, frequency of shuttles to rental car facilities and nearby hotels, and amount of curbside for vehicle staging should be examined for passengers not using public transportation.

811. UTILITIES

The master plan should also address future utility needs, such as for water, sanitary sewer, drainage and deicing, industrial waste, communications, power supply, and back-up power and water in case of emergencies. Existing systems should be evaluated and their capacity verified at the airport boundary. Historical ratios of utility demand to the level of enplanements or aircraft operations can form the basis for projecting future demand. Since an airport can be a large consumer of utility services, planners should discuss their projections with local utility providers to ensure that the airport's needs are included in their long-term service plans.

812. OTHER REQUIREMENTS

Many airports have significant acreage devoted to non-aeronautical uses, such as industrial parks, recreational uses, agricultural or grazing leases, or retail businesses. Some uses are considered temporary, to remain only until a higher aviation use materializes, while others are expected to remain as surplus to anticipated aviation needs. In either case, the revenue from these activities provides supplemental revenue to the airport and improve the airport's overall financial position. The planner should review the infrastructure needs of such activities and identify improvements that preserve the revenue-generating performance of a valuable asset.

813. DOCUMENTATION GUIDELINES

- a. A stand-alone chapter of the technical report should describe the analyses and techniques used to determine future facility requirements. A summary at the beginning or end of the chapter and in the report's executive summary should highlight findings for key components.
- b. Planners should use appendices to improve the readability and organizational flow of the documentation. However, they should avoid making the appendices a depository for unnecessary information, which can result in massive reports that may confuse and discourage the reader.
- c. It is not necessary for the chapter documentation to mirror the outline of major sections provided in this chapter of the AC. However, it should follow the structure of the chapter of the technical report that describes existing conditions.

Appendix B Useful Reference Materials

1. FAA ADVISORY CIRCULARS

Most of these Advisory Circulars are available for viewing and/or printing on the FAA website at http://www.faa.gov/regulations_policies/advisory_circulars/. See the most recent versions.

70/7460-1 Obstruction Marking and Lighting. Describes the FAA standards for marking and lighting structures to promote safety.

90-66 Recommended Standard Traffic Patterns and Practices for Aeronautical Operations at Airports without Operating Control Tower. Calls attention to regulatory requirements and recommended procedures for aeronautical operations at airports without operating control towers. It recommends traffic patterns and operational procedures for aircraft, lighter than air, glider, parachute, rotorcraft, and ultra-light vehicle operations where such use is not in conflict with existing procedures in effect at those airports.

90-98 Simultaneous Closely Spaced Parallel Operations at Airports Using Precision Runway Monitor (PRM) Systems. Notify pilots and operators about the establishment of specific air traffic procedures to conduct flight operations into airports identified for simultaneous closely-spaced parallel approaches using PRM systems.

150/5020-1 Noise Control and Compatibility Planning for Airports. Provides general guidance for noise control and compatibility planning for airports. Provides specific guidance for preparation of airport noise exposure maps and airport noise compatibility programs by airport sponsors for submission under FAR Part 150 and the Aviation Safety and Noise Abatement Act of 1979.

150/5060-5 Airport Capacity And Delay. Explains how to compute airport capacity and aircraft delay for airport planning and design.

150/5100-14 Architectural, Engineering, and Planning Consultant Services for Airport Grant Projects. Provides guidance for airport sponsors in the selection and employment of architectural, engineering, and planning consultants under Federal Aviation Administration airport grant programs.

150/5100-17 Land Acquisition and Relocation Assistance for Airport Improvement Program Assisted Projects. Provides guidance to sponsors of airport projects developed under the Airport Improvement Program to meet the requirements of the Uniform Relocation Assistance and Real Property Acquisition Act of 1970 (PL 91-646, as amended) and the regulations of the Office of the Secretary of Transportation, 49 CFR Part 24.

150/5100-19 Guide for Airport Financial Reports Filed by Airport Sponsor. Provides airport sponsors with guidance for complying with the airport financial reporting requirements required by 49 USC §47107(a)(15).

150/5190-4 Model Zoning Ordinance to Limit Height of Objects around Airports. Provides a model zoning ordinance to be used as a guide to control the height of objects around airports.

150/5190-7 Minimum Standards for Commercial Aeronautical Activities. Provides basic information about the FAA's recommendations on commercial minimum standards and related policies.

150/5200-30 Airport Winter Safety and Operations. Provides guidance to assist airport owners/sponsors in the development of an acceptable airport snow and ice control program and to provide guidance on appropriate field condition reporting procedures.

150/5200-31 Airport Emergency Plan. Provides guidance for the preparation of emergency plans at civil airports.

150/5200-33 Hazardous Wildlife Attractants On or Near Airports. Provides guidance on locating certain land uses having the potential to attract hazardous wildlife to or in the vicinity of public-use airports.

150/5200-34 Construction or Establishments of Landfills Near Public Airport. Contains guidance on complying with new Federal statutory requirements regarding the construction of establishment of landfills near public airports.

150/5210-15 Airport Rescue and Firefighting Station Building Design. Provides standards and guidance for planning, designing, and constructing and airport rescue and firefighting station.

150/5220-18 Buildings for Storage and Maintenance of Airport Snow and Ice Control Equipment and Materials. Provides guidance for site selection, design and construction of buildings used to store and maintain airport snow and ice control equipment and materials.

150/5300-7 FAA Policy on Facility Relocations Occasioned by Airport Improvements or Changes. Reaffirms the aviation community of the FAA policy governing responsibility for funding relocation, replacement and modification to air traffic control and air navigation facilities that are made necessary by improvements or changes to the airport.

150/5300-9 Predesign, Prebid, and Preconstruction Conferences for Airport Grant Projects. Provides guidance for conducting predesign, prebid, and preconstruction conferences for projects funded under the FAA airport grant program.

150/5300-13 Airport Design. Contains the FAA's standards and recommendations for airport design.

150/5300-14 Design of Aircraft Deicing Facilities. Provides standards, specifications, and guidance for designing aircraft deicing facilities.

150/5300-15 Use of Value Engineering for Engineering and Design of Airport Grant Projects. Provides guidance for the use of value engineering in airport projects funded under the FAA's Airport Grant Program. This Advisory Circular should be used by sponsors of

airport development projects considering the application of value engineering to projects involving grant funds.

150/5320-5 Airport Drainage. Provides guidance for engineers, airport managers, and the public in the design and maintenance of airport drainage systems.

150/5320-6 Airport Pavement Design and Evaluation. Provides guidance to the public for the design and evaluation of pavement at civil airports.

150/5325-4 Runway Length Requirements for Airport Design. Provides design standards and guidelines for determining recommended runway lengths.

150/5340-1 Standards for Airport Markings. Contains the FAA standards for markings used on airport runways, taxiways, and aprons.

150/5340-18 Standards for Airport Sign Systems. Contains the FAA standards for the siting and installation of signs on airport runways and taxiways.

150/5360-9 Planning and Design of Airport Terminal Facilities at Non-Hub Locations. Provides guidance material for the planning and design of airport terminal buildings at non-hub locations.

150/5360-12 Airport Signing and Graphics. Provides guidance on airport related signs and graphics.

150/5360-13 Planning and Design Guidelines for Airport Terminal Facilities. Provides guidelines for the planning and design of airport terminal buildings and related access facilities.

150/5390-2 Heliport Design. Provides recommendations and standards for heliport and helistop design.

150/5395-1 Seaplane Bases. Provides guidance to assist operators in planning, designing, and constructing seaplane base facilities.

2. FAA ORDERS

Virtually all of the following orders are available for viewing and/or printing on the FAA website at http://www.faa.gov/regulations_policies/orders_notices/.

1050.1 Environmental Impacts: Policies and Procedures. Provides policies and procedures to ensure FAA compliance with the provisions of the National Environmental Policy Act.

5050.4 National Environmental Policy Act (NEPA) Implementing Instructions for Airport Projects. FAA Airports guidance for complying with NEPA. Provides instructions and guidance for the preparation and processing of environmental assessments, findings of no significant impact, and environmental impact statements for airport development proposals and other airport activities.

5090.3 (current version) Field Formulation of the National Plan of Integrated Airport Systems. This order contains instructions for FAA Regional offices in the formulation and maintenance of the NPIAS computer database and on the preparation of the Secretary of Transportation's biennial Report to Congress.

5500.1 Passenger Facility Charge. Provides guidance and the processes to be used by FAA personnel in administering the Passenger Facility Charge program.

5100.38 Airport Improvement Program Handbook. Provides guidance and sets forth policies and procedures for the administration of the Airport Improvement Program by the FAA.

5100.39 Airports Capital Improvement Plan. Prescribes the development of the national Airports Capital Improvement Program that serves as the primary planning tool for systematically identifying, prioritizing and assigning funds to critical airport development and associated capital needs for the National Airspace Program.

8260.3 United States Standard for Terminal Instrument Procedures (TERPS). Contains criteria for instrument approach and departure procedures.

3. FEDERAL AVIATION REGULATIONS

Virtually all of the following Federal regulations addressing aviation are available for viewing and/or printing on the FAA website at http://www.faa.gov/regulations_policies/faa_regulations/.

14 CFR Part 77 Safe, Efficient Use, and Preservation of the Navigable Airspace

14 CFR Part 150 Airport Noise Compatibility Planning

14 CFR Part 158 Passenger Facility Charges (PFCs)

4. TRANSPORTATION SECURITY REGULATIONS

The following Transportation Security Regulations (TSRs) are available for viewing and/or printing on the Transportation Security Administration website at www.tsa.gov/.

TSR Part 1540 Civil Aviation Security: General Rules. Definitions and rules for all aspects of aviation.

TSR Part 1542 Airport Security. Requirements for airport security programs including establishment of secured areas, air operation areas, security identification display areas, and access control systems. Also describes requirements related to Security Directives.

TSR Part 1544 Aircraft Operator Security: Air Carriers and Commercial Operators. Applies primarily to operators holding certificates for scheduled and charter passenger operations. Details the requirements for security program and screening of passengers and property.

TSR Part 1546 Foreign Air Carrier Security. Discusses security and screening requirements.

TSR Part 1548 Indirect Air Carrier Security. Describes requirements for indirect carriers such as freight forwarders.

TSR Part 1550 Aircraft Security Under General Operating and Flight Rules. Applies to operation of all other aircraft such as general aviation aircraft.

5. SECURITY-RELATED PUBLICATIONS

Recommended Security Guidelines for Airport Planning, Design, and Construction. (Formerly DOT/FAA/AR-00-52, June 2001. TSA Revised May 2011.) Available from TSA at <http://www.tsa.gov/aviation-security-advisory-committee>.

Integrated Security System Standard for Airport Access Control. (RTCA DO-230C, June 2011) Available from RTCA at <http://www.rtca.org>.

6. FAA REPORTS

Airport Noise Compatibility Planning (ANCP) Toolkit, FAA Office of Environment and Energy
(http://www.faa.gov/about/office_org/headquarters_offices/apl/noise_emissions/planning_toolkit/).

FAA Airport Benefit-Cost Analysis Guidance, Office of Aviation Policy and Plans
(http://www.faa.gov/airports/aip/bc_analysis/).

FAA Guide to the Best Practices for Environmental Impact Statement Management, FAA Office of Airport Planning and Programming
(http://www.faa.gov/airports/environmental/eis_best_practices/).

Forecasting Aviation Activity by Airport, GRA, Inc., Office of Aviation Policy and Plans (APO-110) (http://www.faa.gov/data_research/aviation_data_statistics/).

Intermodal Ground Access to Airports: A Planning Guide, Federal Highway Administration, Intermodal Division and Federal Aviation Administration, National Planning Division, Report No. DOT/FAA/PP/96-3. Available from National Technical Information Service as PB97-189484 (www.ntis.gov).

National Plan of Integrated Airport Systems (NPIAS), Office of Airport Planning and Programming, Airport Planning and Environmental Division
(http://www.faa.gov/airports/planning_capacity/npias/).

Terminal Area Forecast (TAF), Office of Aviation Policy and Plans
(http://www.faa.gov/about/office_org/headquarters_offices/apl/aviation_forecasts/).

7. GENERAL AIRPORT PUBLICATIONS

Aerodromes, Annex 14 to the Convention on International Civil Aviation, International Civil Aviation Organization.

Aerodrome Design Manual, Part 1, Runways, International Civil Aviation Organization.

Aerodrome Design Manual, Part 2, Taxiways, Aprons and Holding Bays, International Civil Aviation Organization.

Airport Engineering, Ashford and Wright, John Wiley & Sons, Inc.

Airport Finance, Ashford and Moore, Van Nostrand Reinhold, Inc.

Airport Planning and Management, Smith, Odegard and Shea, Wadsworth Publishing Company.

Airport Planning and Management, Wells and Young, McGraw-Hill Companies, Inc.

Airport Planning Manual, Part 1 – Master Planning, International Civil Aviation Organization.

Airport Planning Manual Part 2 – Land Use and Environmental Control, International Civil Aviation Organization.

Airport Systems Planning, Design, and Management, deNeufville and Odoni, McGraw-Hill Companies, Inc.

Airport Terminals Reference Manual, International Air Transportation Association.

Construction of Visual and Instrument Flight Procedures (PANS-OPS), International Civil Aviation Organization.

Environmental Protection, Annex 16 to the Convention on Civil Aviation, International Civil Aviation Organization.

Planning and Design of Airports, Horonjeff and McKelvey, McGraw-Hill Companies, Inc.

STOL Port Manual, International Civil Aviation Organization.

8. AIRPORT COOPERATIVE RESEARCH PROGRAM (ACRP) REPORTS

The following ACRP publications are available for viewing and/or printing on the Transportation Research Board website at <http://www.trb.org/Publications/PubsACRPPublications.aspx>.

ACRP Synthesis 2, Airport Aviation Activity Forecasting, Airport Cooperative Research Program, March 31, 2007.

ACRP Synthesis 10, Airport Sustainability Practices, Airport Cooperative Research Program, October 23, 2008.

ACRP Synthesis 33, Airport Climate Adaptation and Resilience, Airport Cooperative Research Program, June 18, 2012.

ACRP Synthesis 37, Lessons Learned from Airport Safety Management Systems Pilot Studies, Airport Cooperative Research Program, August 6, 2012.

ACRP Report 1, Safety Management Systems for Airports, Airport Cooperative Research Program, September 4, 2007.

ACRP Report 4, Ground Access to Major Airports by Public Transportation, Airport Cooperative Research Program, July 9, 2008.

ACRP Report 10, Innovations for Airport Terminal Facilities, Airport Cooperative Research Program, February 26, 2009.

ACRP Report 23, Airport Passenger-Related Processing Rates Guidebook, Airport Cooperative Research Program, November 11, 2009.

ACRP Report 25, Airport Passenger Terminal Planning and Design, Volume 1: Guidebook, Airport Cooperative Research Program, April 7, 2010.

ACRP Report 25, Airport Passenger Terminal Planning and Design, Volume 2: Spreadsheet Models and User's Guide, Airport Cooperative Research Program, March 18, 2010.

ACRP Report 30, Reference Guide on Understanding Common Use at Airports, Airport Cooperative Research Program, May 26, 2010.

ACRP Report 35, Planning for Offsite Airport Terminals, Airport Cooperative Research Program, September 27, 2010.

ACRP Report 40, Airport Curbside and Terminal Area Roadway Operations, Airport Cooperative Research Program, December 2, 2010.

ACRP Report 55, Passenger Level of Service and Spatial Planning for Airport Terminals, Airport Cooperative Research Program, October 13, 2011.

ACRP Report 56, Handbook for Considering Practical Greenhouse Gas Emission Reduction Strategies for Airports, Airport Cooperative Research Program, January 7, 2012.

ACRP Report 77, Guidebook for Developing General Aviation Airport Business Plans, Airport Cooperative Research Program, November 15, 2012.

ACRP Report 80, Guidebook for Incorporating Sustainability into Traditional Airport Projects, Airport Cooperative Research Program, November 4, 2012.

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