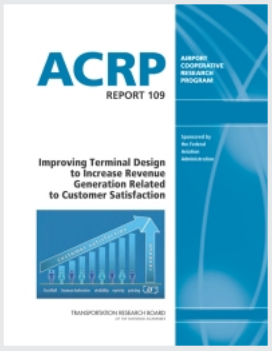

Improving Terminal Design to Increase Revenue Generation Related to Customer Satisfaction

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AIRPORT COOPERATIVE RESEARCH PROGRAM

ACRP REPORT 109

Improving Terminal Design to Increase Revenue Generation Related to Customer Satisfaction

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AIRPORT COOPERATIVE RESEARCH PROGRAM

Airports are vital national resources. They serve a key role in transportation of people and goods and in regional, national, and international commerce. They are where the nation's aviation system connects with other modes of transportation and where federal responsibility for managing and regulating air traffic operations intersects with the role of state and local governments that own and operate most airports. Research is necessary to solve common operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the airport industry. The Airport Cooperative Research Program (ACRP) serves as one of the principal means by which the airport industry can develop innovative near-term solutions to meet demands placed on it.

The need for ACRP was identified in *TRB Special Report 272: Airport Research Needs: Cooperative Solutions* in 2003, based on a study sponsored by the Federal Aviation Administration (FAA). The ACRP carries out applied research on problems that are shared by airport operating agencies and are not being adequately addressed by existing federal research programs. It is modeled after the successful National Cooperative Highway Research Program and Transit Cooperative Research Program. The ACRP undertakes research and other technical activities in a variety of airport subject areas, including design, construction, maintenance, operations, safety, security, policy, planning, human resources, and administration. The ACRP provides a forum where airport operators can cooperatively address common operational problems.

The ACRP was authorized in December 2003 as part of the Vision 100-Century of Aviation Reauthorization Act. The primary participants in the ACRP are (1) an independent governing board, the ACRP Oversight Committee (AOC), appointed by the Secretary of the U.S. Department of Transportation with representation from airport operating agencies, other stakeholders, and relevant industry organizations such as the Airports Council International-North America (ACI-NA), the American Association of Airport Executives (AAAE), the National Association of State Aviation Officials (NASAO), Airlines for America (A4A), and the Airport Consultants Council (ACC) as vital links to the airport community; (2) the TRB as program manager and secretariat for the governing board; and (3) the FAA as program sponsor. In October 2005, the FAA executed a contract with the National Academies formally initiating the program.

The ACRP benefits from the cooperation and participation of airport professionals, air carriers, shippers, state and local government officials, equipment and service suppliers, other airport users, and research organizations. Each of these participants has different interests and responsibilities, and each is an integral part of this cooperative research effort.

Research problem statements for the ACRP are solicited periodically but may be submitted to the TRB by anyone at any time. It is the responsibility of the AOC to formulate the research program by identifying the highest priority projects and defining funding levels and expected products.

Once selected, each ACRP project is assigned to an expert panel, appointed by the TRB. Panels include experienced practitioners and research specialists; heavy emphasis is placed on including airport professionals, the intended users of the research products. The panels prepare project statements (requests for proposals), select contractors, and provide technical guidance and counsel throughout the life of the project. The process for developing research problem statements and selecting research agencies has been used by TRB in managing cooperative research programs since 1962. As in other TRB activities, ACRP project panels serve voluntarily without compensation.

Primary emphasis is placed on disseminating ACRP results to the intended end-users of the research: airport operating agencies, service providers, and suppliers. The ACRP produces a series of research reports for use by airport operators, local agencies, the FAA, and other interested parties, and industry associations may arrange for workshops, training aids, field visits, and other activities to ensure that results are implemented by airport-industry practitioners.

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FOREWORD

By Theresia H. Schatz
Staff Officer
Transportation Research Board

ACRP Report 109: Improving Terminal Design to Increase Revenue Generation Related to Customer Satisfaction is a handbook of global best practices for airport management and industry professionals. It will inform airport practitioners of innovative airport planning and terminal design and will promote profitable revenue generation and customer satisfaction at a variety of airport sizes and types. The handbook includes consideration of how to facilitate innovation in improving the customer experience through the use of technology and other resources.

Traditional terminal planning and design approaches typically focus on passenger and baggage processing and functional requirements. While the movement of passengers and baggage between the curb and the aircraft is the basic functional role of a terminal, the atmosphere created by the mix of services and facilities in a terminal can greatly impact the economics of the airport and passenger satisfaction. A more satisfied passenger experience can lead to increased revenue generation through additional concession sales. As a result, overall passenger activity may increase as travelers select a particular airport in part due to the terminal layout and amenities offered. Further dwell time can vary due to irregular operations and other conditions that often result in passengers remaining in their terminals for extended periods of time. In addition to the challenges of day-to-day operations, airports also face a highly dynamic and volatile operating environment with frequent changes in security and technology.

This research was conducted under ACRP Project 07-08 by Landrum & Brown in association with AirProjects, Inc., Aerotropolis Business Concepts, and Envirosell. As part of the research, the firm completed a data collection plan to identify where there are correlations between above-average non-aeronautical revenue generation and customer satisfaction as potentially driven by unique terminal design and planning characteristics. Their data collection included a sample of large, medium and small hub airports both in the United States and abroad for four primary categories of information: airport characteristics and design features, non-aeronautical revenues, passenger satisfaction levels, terminal design features and future trends in concession planning and design.

AUTHOR ACKNOWLEDGMENTS

The research reported was performed under ACRP Project 07-08 by Landrum & Brown as the prime contractor with the assistance of subcontractors AirProjects, Inc.; Aerotropolis Business Concepts, LLC; and Envirosell.

Bruce Anderson, Vice President of Landrum & Brown, served as the Principal Investigator and Ann Ferraguto, President of AirProjects, served as Co-Investigator. The other valuable contributors to this research project included: from Landrum & Brown, Logan Smith and Larry Hilton; from AirProjects, Lauren Meurlin and Dawit Beru; from Aerotropolis Business Concepts, John D. Kasarda, Ph.D., Director; and from Envirosell, Matt Richard, Project Manager. Also, additional contributions were made by James G. Walsh, Deputy Executive Director and Chief Financial Officer, Baltimore/Washington International Airport; Alan M. Gluck, C.M., Business Development Director, AIRMALL USA, Inc.; Jay Kruisselbrink, AIRMALL USA, Inc.; and Roger Wilson, Director, Chatman Taylor.

Additionally, the research team would like to acknowledge the contributions of the key individuals and their staffs at the seven case study airports including: at the Budapest Listz Ferenc International Airport (BUD), Bagoly János, Head of Retail Services; at John F. Kennedy International Airport (JFK), Mitch Nadler, Director of Concession Programs, and Brian Holtman, Manager of Concession Programs; at London Heathrow Airport (LHR), Phil Wilbraham, Heathrow Airport Ltd., Design and Development Director; at Minneapolis–St. Paul International Airport, Eric Johnson, CCIM, Director of Commercial Management and Airline Affairs, and John Greer, Assistant Director of Concessions and Business Development; at the Pittsburgh International Airport (PIT), Bradley D. Penrod, A.A.E., President and Chief Strategy Officer; at Portland International Airport, Vince Granato, Chief Operating Officer, and Chris Madsen, General Manager of Business and Properties; and at Savannah-Hilton Head International Airport, Patrick S. Graham, A.A.E., Executive Director, and Colette W. Edmisten, A.A.E., Airport Operations Manager, Savannah Airport Commission.

The authors are very grateful for the guidance and help provided by the ACRP Project 07-08 panel.

CONTENTS

Note: Many of the photographs, figures, and tables in this report have been converted from color to grayscale for printing. The electronic version of the report (posted on the Web at www.trb.org) retains the color versions.

CHAPTER 1

Introduction

This introduction provides the basic premise behind Transportation Research Board (TRB) Airport Cooperative Research Program (ACRP) Project 07-08, "Improving Terminal Design to Increase Revenue Generation Related to Customer Satisfaction." It includes (1) the background behind the primary research goal and objectives, (2) the detailed research approach undertaken, and (3) the organizational structure of the final deliverable for the research project, this Handbook.

1.1 Primary Research Goals and Objectives

The primary goal of ACRP Project 07-08 was to prepare a handbook for the aviation industry providing airport management and industry professionals with a thorough understanding of key factors to consider when planning and designing terminal facilities in the ever-evolving commercial aviation market. More specifically, the handbook's primary goal was to tie together industry Guiding Principles for the physical planning and design of airport terminals as they relate to increasing revenue from an airport's concession program in balance with customer satisfaction. The research approach involved in preparing this Handbook examined quantitative and qualitative data to identify seven airports on which to perform case studies in order to investigate potential Guiding Principles in more detail. The detailed case study information combined with the research team's investigative efforts and industry experience was used to identify these Guiding Principles. These Guiding Principles promote best practices and innovations in the physical layout of airport passenger terminal facilities that enhance revenue generation and promote overall customer satisfaction.

For the purpose of this Handbook, "revenue" is defined as the portion of concession income/sales received by an airport operator, typically paid by concessionaires as their rent or privilege fee for the opportunity to do business at the airport. Revenue has a direct relationship to income/sales in that most concession business agreements set revenue payable to the airport operator as a percentage of the concession income/sales. While the Handbook occasionally refers to concession business agreements, this area is not discussed in detail as prior research projects include it in depth, including *ACRP Report 33: Guidebook for Developing and Managing Airport Contracts* and *ACRP Report 54: Resource Manual for In-Terminal Concessions.*

1.1.1 Terminal Design

Within the context of this research project, "terminal design" is considered to be the planning and design process for preparing the layout of the concession program within the context of the physical terminal facilities. Typically, airport management and their consultants are presented with one of two situations. The first is the "greenfield" opportunity to begin from scratch and design and build a new terminal facility; the second option is the redevelopment of a terminal to improve and renovate

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an existing concession program. Creating a brand new facility provides significantly more options and flexibility to the planner and architects when manipulating concession size and placement with the objective of maximizing revenues and increasing customer satisfaction.

Conversely, a retrofit of an existing terminal's concession program restricts the facility elements that can be changed, such as primary paths of passenger flows and physical shape and size of space available to accommodate concessions.

This Handbook identifies Guiding Principles applicable to determining the best strategies and practices in developing terminal plans for both new and renovated terminal facilities. However, due to the aforementioned limitation on existing facilities, not all Guiding Principles can be applied universally to both situations.

1.1.2 Increasing Revenue Generation

For the purposes of this research project, "revenue generation" in relation to concessions is defined as revenue generated by airport concessions located inside an airport terminal. Revenue generation opportunities located outside of the physical boundaries of an airport terminal, such as revenue generated from public vehicle parking, hotels, and office complexes situated on airport property, were generally deemed not to be within the focus of this research project. This interpretation does not mean that these potential sources of revenue are any less important than in-terminal concessions, but rather that it was not the primary mission of the research involved in ACRP Project 07-08. Chapter 5 does discuss the merits of collateral commercial development and consideration for the concept of "airport cities" as a component of revenue generation for airports. Other ACRP resources include detailed information about collateral development and other revenue generation opportunities, including *ACRP Synthesis 19: Airport Revenue Diversification*, *ACRP Synthesis 1: Innovative Finance and Alternative Sources of Revenue for Airports*, and *ACRP Report 47: Guidebook for Developing and Leasing Airport Property*.

1.1.3 Increasing Customer Satisfaction

The research team's interpretation of "customer satisfaction" focused primarily on the customers as all *airport passengers* using the airport's terminal instead of just those that purchase a commodity or service. This interpretation was particularly valid in the identification of the airport case study targets. The research team used (1) periodicals, such as *Travel & Leisure* and *Conde Nast*, that perform annual surveys and rankings of airports and (2) rating data from the *Skytrax* annual airport survey and limited data from the J.D. Power & Associates' survey to identify airports with high customer satisfaction ratings.

1.2 Research Approach

The underlying ACRP Project 07-08 research approach included the development of a data collection plan for the purpose of identifying between five to eight airports for more detailed investigation and information gathering. The process for selecting the airports focused on identifying a correlation between (1) above-average non-aeronautical revenue generation and (2) customer satisfaction, as potentially driven by innovative airport terminal planning, design, and new technologies. The goal of this strategy was to select airports with above-average revenue generation and a high level of customer satisfaction. This process of airport selection helped to justify the correlations established and subsequent suggestions in this Handbook, known as the Guiding Principles. By selecting only those airports with an overall high performance in customer satisfaction and revenue generation, this Handbook focuses on those factors that were most likely influencing the airports high rankings.

Data collection encompassed a sample of large, medium, and small hub airports, both in the United States and abroad, for five primary categories of information: including *airport characteristics and design features*, *non-aeronautical revenues*, *passenger satisfaction levels*, *terminal design features*, and *future trends in concession planning and design.* A three-tier approach was followed to plan and arrive at the final airports to study in detail. The tiers and the efforts undertaken for each tier are illustrated below in Figure 1.1.

1.2.1 Tier 1

For 25 percent of the top small, 50 percent of the medium, and all of the large hub U.S. airports (as defined by the Federal Aviation Administration [FAA]), the FAA's airport financial report database and airport enplanement reports were examined to rank these airports based on concession revenue per enplanement (CRPE) and the more aggregate non-aeronautical revenue per enplanement (NARPE). The top 15 highest-performing CRPE/NARPE airports in the small, medium, and large hub categories were identified for further analysis. Additionally, *Airport Revenue News*' annual airport survey of commercial airports and the J.D. Power & Associates survey were consulted in evaluating those that are top performing.

The Tier 1 process also identified innovative concession approaches and terminal design features based on industry experience, combined with a research effort to identify such information in industry-related publications such as *Passenger Terminal World*, American Association of Airport Executive's *Airport Magazine*, Airports Council International–North America's *Centerlines*

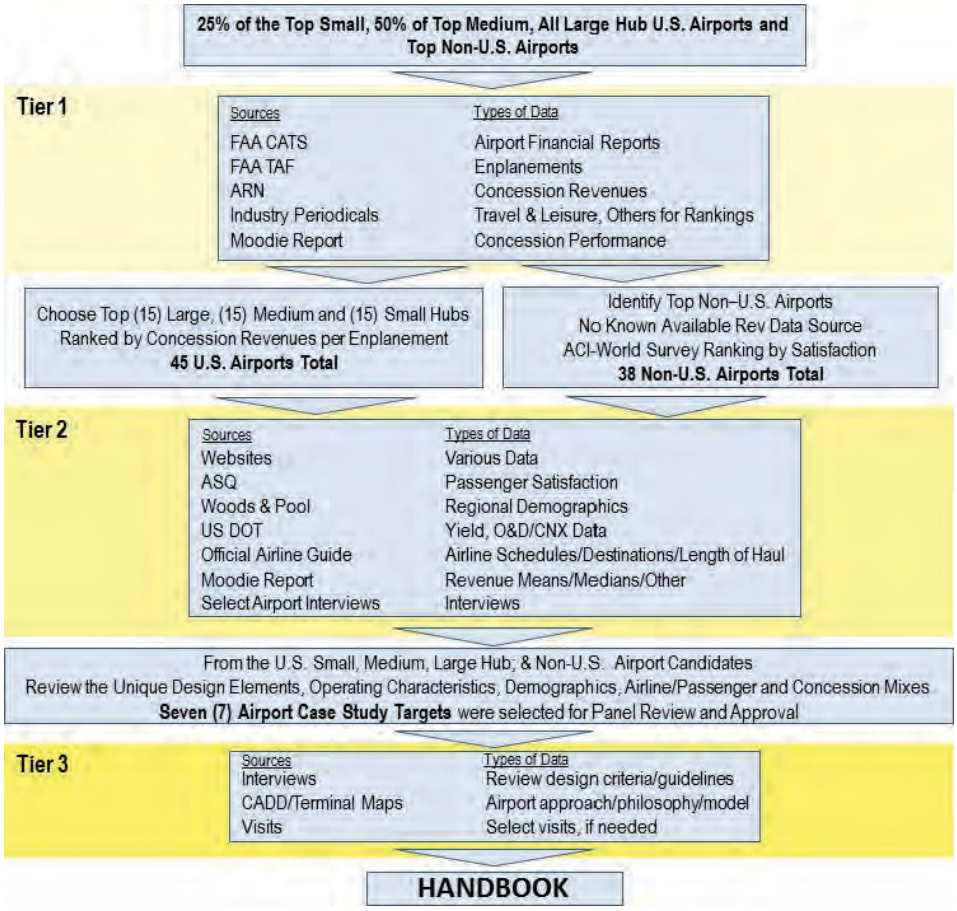

Figure 1.1. Data collection plan, tiered approach.

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Magazine, *Architectural Record*, and other similar publications. Some airports did not rank in the top 15 in their hub category but, based on industry experience, such airports deserved to be in the top 15 CRPE, particularly if research and knowledge of these airports revealed innovative and creative approaches to terminal design and concession development. A few small hub airports were further studied because their scale in terms of facility size, design, and enplanement levels did not generally produce high-performing concession programs.

With respect to non-U.S. airports, several data sources were consulted to obtain non-aeronautical and concession revenue information for the 38 non-U.S. airports candidates for further study. The main revenue data source was *Airport Benchmarking Report 2011*, *Global Standards for Airport Excellence* (produced by the Air Transport Research Society). The *Moodie Report*, an international airport journal, assisted in identifying high-performing airport concession programs. Other periodicals that perform annual surveys and rank international airports, including *Travel & Leisure* and *Conde Naste*, were also consulted. Additionally, rating data from *Skytrax* annual airport survey and limited data from the J.D. Power survey were used to identify airports with high customer satisfaction ratings.

1.2.2 Tier 2

In the second tier of data collection and analysis, data collection and research efforts were intensified by examining a large set of airport-specific data, including websites, demographic databases, passenger profiles, airline schedule data, terminal and concession area plans, as well as select airport concessionaire interviews and architect surveys. To filter the 45 U.S. airports and 38 non-U.S. airports down to between five and eight airports in Tier 3, significant analysis of all available and accessible data was required. Many factors and drivers were compared and contrasted in this 83-airport subset, including passenger traffic levels, general demographics (e.g., income, age), airport and passenger profiles (e.g., length of haul, number of destinations, origin/destination versus connecting, business/leisure split), and concession management model (e.g., master concessionaire, developer for U.S. airports only). Additionally, terminal configurations, age of the facilities, concession locations/sizes, and innovative practices were examined. To allow the widest range of airports to be included in the final handbook, 11 U.S. airports and 8 non-U.S. airports were derived from the set of airports considered in Tier 2 and passed into Tier 3 for consideration as potential case study airports.

1.2.3 Tier 3

As a result of the Tier 2 research analysis, 19 airports were selected representing a broad spectrum of airport types as potential case studies. Among these airports were the following "types": U.S. small, medium, and large hubs (as defined by the FAA); a large legacy carrier hub; a low-cost carrier (LCC) focus city; a U.S. international gateway; and medium and large non-U.S. airports—two Canadian, two Asian, two Middle Eastern, and two European. Terminal design features (e.g., terminal configuration, locations of concessions, location of security checkpoints, airport hotels) were researched. Additionally, terminal operational features such as call-to-gate procedures and general product screening and delivery practices were reviewed.

Based on the Tier 3 data collection effort that used 2011 statistics, seven airports were identified for case study:

- **U.S. large hub**
  - John F. Kennedy International Airport (JFK), Terminal 5—10.5 million annual passengers (MAP)
  - Minneapolis–St. Paul International Airport (MSP), Terminal 1—30.0 MAP

- **U.S. medium hub**
  - Portland International Airport (PDX)—13.6 MAP
  - Pittsburgh International Airport (PIT)—8.3 MAP
- **U.S. small hub**
  - Savannah/Hilton Head Island International Airport (SAV)—1.6 MAP
- **Non-U.S. large airport**
  - London Heathrow Airport (LHR), Terminal 5—26.6 MAP
- **Non-U.S. medium airport**
  - Budapest Ferenc Liszt International Airport (BUD)—8.9 MAP

These seven airports ranked above average in both customer satisfaction and revenue generation. This allowed the research team to understand and identify the planning, design, and management factors—known as the "Guiding Principles"—that were responsible for the relative success of these facilities.

Where possible, site visits and interviews were conducted with key airport staff, concessionaires, and industry professionals associated directly with the concession programs at these seven airports. All available quantitative and qualitative information was collected, comparatively assessed and cross-referenced to identify key drivers and common attributes among the case study airports. This comparative performance data combined with the research team's insights about each case study airport was used to establish a list of primary Guiding Principles for terminal planning and design projects targeted at increasing revenues and passenger satisfaction. These guidelines are supplemented by more detailed planning and design considerations to assist the user in incorporating these principles into the development of a successful concessions program for airport terminals.

1.3 Organization of the Handbook

Following this introduction, this Handbook is subdivided into four chapters. Chapter 2, Guiding Principles, provides an overview of the primary guidelines for increasing revenues and customer satisfaction when developing a concession program for airport terminal facilities. Chapter 3, Terminal and Concession Planning and Design Considerations, describes in more detail the relevant factors for concession-related decisions pertinent to achieving the objectives set forth in the principal guidelines during the planning and design of new or the reconfiguration of existing airport terminal facilities. Chapter 4, Human Engineering Considerations, examines airport customer behaviors and the emotional processes behind them that provide insights to improving concession sales, related revenue production, and customer satisfaction. Chapter 5, Ancillary Land Development Considerations, provides an overview of innovative approaches being employed to generate additional revenue while improving customer satisfaction by developing commercial complexes on airport land adjacent to, or near, terminals.

In the PDF of the Handbook available on the TRB website (www.trb.org), the discussion of Guiding Principles described in Chapter 2 contains hypertext-linked references to the more detailed factors to consider during the planning and design of concession programs and cited examples in other chapters of the Handbook that support each Guiding Principle. As previously described, the overall goal of the Handbook is to assist the user in fostering innovations in the physical layout and design of airport passenger terminals aimed specifically at increasing concession revenues and overall customer satisfaction by following the tenets of these key Guiding Principles.

CHAPTER 2

Guiding Principles

The following chapter summarizes the primary Guiding Principles for increasing concession revenue and customer satisfaction in this Handbook. These principles include factors that influence facility design and concession selection and placement, and generally result in higher levels of customer satisfaction. While this research project included an extensive analysis of airport data to develop the Guiding Principles for terminal design, it is not intended to provide a framework for measuring the performance of commercial operations at an airport. *ACRP Report 19: Developing an Airport Performance-Measurement System* outlines an approach to performance measurement in the airport environment, while *ACRP Report 54: Resource Manual for Airport In-Terminal Concessions* includes a discussion of several concession-specific performance metrics.

2.1 New Terminals versus Existing Terminals

The development of airport concessions within an existing terminal facility poses unique challenges. An existing terminal may have limited space for circulation, seating, queuing, and back-of-house operations. However, designing a new terminal allows for greater flexibility, such as the ability to design and implement more robust and customer-friendly concession programs. Later sections in this Handbook discuss the limitations of existing facilities, strategies adapted for new facilities, and techniques to mitigate challenges relating to concession placement in existing facilities.

- Existing terminals may have constraints that limit flexibility in improving and updating concession configurations.
- New terminals offer greater flexibility to develop optimal concession configurations.

For related topics, see Section 3.3.

2.1.1 Centralized and Decentralized Terminals

Airport terminals typically occur as either single centralized facilities or decentralized facilities with multiple "unit" terminals. Many airports initially develop as a single terminal building and then expand to unit terminals as additional capacity is needed. However, there is an increasing propensity, particularly in Asia and Europe where aviation is rapidly growing, to develop single mega-terminals capable of processing large passenger volumes.

- Centralized and unit terminals each require unique approaches to concession configurations, wayfinding systems, and passenger circulation.
- Understanding how unit and centralized terminals differ is critical in managing passenger expectations and perception of level of service.

For related topics, see Section 3.3.4.

2.2 Concentrating Passenger Footfall

Passenger footfall, as it relates to airport concessions, is the number of passengers traveling past or within proximity of a particular store or concession node. There is a critical link between revenue and passenger footfall. In essence, an increase in footfall results in an increase in sales opportunities. Centralized terminal solutions tend to increase the flow of passengers exposed to concession offerings while also eliminating the need for duplicating concession locations (which is often required in a decentralized planning approach). Separate unit terminals typically require some degree of concession duplication, and separate unit terminals most often result in less concentrated passenger footfall in each individual terminal.

- Passenger footfall is often one of the key determinants in predicting concession revenue or gauging the value of a particular concession location.
- Due to passengers' perceived level of congestion, complexity of wayfinding, and anticipated wait times, there are implications for customer satisfaction when comparing centralized and decentralized facilities.

For related topics, see Section 3.4.2.

2.2.1 Amassing Concessions

Increasing concession revenue, as it relates to the concept of agglomeration economics, can be somewhat attributed to the amassing or concentration of concession facilities into distinct nodes. Agglomeration economics determines that the concentration of businesses maximizes consumer choices and helps to maintain a competitive business environment. This is ultimately good for passengers because it results in additional choices, prices, and improved service.

- Agglomerating concessions provides customers with more choices and the ability to comparison shop.
- Landside, customers spend the majority of their time at check-in. In an observational study, few customers visited any retail or food service concessions, and surveyed customers showed little interest in offerings prior to the security checkpoint.
- The activities airside passengers pursue post-security highlight that once the anxieties regarding the check-in and security processes have passed, travelers are open to exploring the airport. This exploration provides the greatest potential during their visit to increase airport revenue.
- Overall, airport customers spend over two-thirds of their total time in the airport airside.

For related topics, see Section 3.7.4.1.

2.2.2 Major Nodes

Major concession nodes are essentially an agglomeration of concessions, most often including the full gamut of concession offerings. Major nodes are typically located at major transit points where multiple passenger types intersect. This positioning allows concessionaires to capitalize on departing and connecting passenger footfall, and in some cases arriving passenger footfall.

- The success of major concession nodes ultimately depends on the effective consolidation of passenger traffic within the terminal.
- In order to capture the majority of passenger footfall, major nodes are most often placed at junctions of major passenger thoroughfares in the terminal.

For related topics, see Section 3.4.2.2.

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2.2.3 Minor Nodes

Minor concession nodes are typically smaller and offer less diverse concession opportunities than major concession nodes. The positioning of minor nodes serves those passengers who have already passed through the major node or passengers within nearby holdrooms that are unwilling to leave their gate/holdroom or traverse the distance to the major node.

- Minor concession nodes are typically placed along the midpoint or end-point of concourses.
- Minor nodes favor a more targeted selection of concessions and have greater flexibility with regard to positioning within the terminal.

For related topics, see Section 3.4.2.2.

2.3 Diversity and Amount of Concession Offerings

The diversity of, and total space dedicated to, concessions varies among airports. Concessions typically fall into one of four categories: food and beverage, specialty retail, duty-free, and convenience retail. The amount dedicated to each type of concession will vary greatly depending on factors including passenger volume, passenger demographics/characteristics, passenger flows, the terminal and concourse configuration, and anticipated revenue.

When planning a concession program at an airport, an adequate mix of concessions must be provided to meet passengers' wants and needs. The following general Guiding Principles can be applied to assist with the initial planning process at most airports that have both domestic and international passengers:

- Allocate approximately one-half of the total concession space to food and beverage concessions. Then distribute the remaining space to specialty retail, duty-free retail, and convenience retail, with at least half of the total retail space allocated to specialty retail.
- Allocate at least one-half of the total food and beverage service space to quick-service concepts.
- Allocate the largest amount of food and beverage service space to casual dining and quick-service concessions.
- A large portion of the food and beverage service concessions should be nationally branded.
- A large portion of the specialty retail concessions should be nationally branded.
- When determining brand diversity, consider variety both within the airport concession program and at other airports. Brands that already saturate the airport market may not perform as well and potentially detract from the freshness of a program.

For related topics, see Sections 3.7.3 and 3.7.5.

2.3.1 Food and Beverage

Food and beverage (F&B) concessions include any establishment that serves food or drinks. F&B excludes convenience stores, which often sell pre-packaged food and bottled or canned drinks. The amount of each F&B type varies depending on airport and passenger flow conditions.

- F&B concessions are diversified into four categories typically found at airports: quick service, coffee, bar (with food), and casual/sit-down restaurants.
- Coffee shops and quick-service food are typically found throughout the airport and outnumber bars and sit-down restaurants.
- Among customers surveyed about their needs post-security screening, food and beverages were most often the first priority.

For related topics, see Sections 3.7.1 and 3.7.6.1.

2.3.2 Specialty Retail

Specialty retail concessions typically cater to customers seeking luxury or specialty merchandise. The types of products carried by specialty retail concessions may include jewelry, leather goods, electronics, personal care products, apparel, toys, and souvenirs.

- Specialty retail can be found within most airports and includes national, regional, and local brands.
- Geared toward passenger "wants" rather than "needs," specialty retail must appeal to passengers and have creative marketing techniques to generate sales.
- In an era of Internet shopping where many customers "showroom" traditional retail outlets (i.e., view products in a store and then order online), there is an opportunity to encourage airport concessions as the showrooms.

For related topics, see Sections 3.7.1 and 3.7.6.2.

2.3.3 Convenience Retail

Convenience retail concessions typically carry grab-and-go items such as snacks, beverages, newspapers, and magazines. Additionally, some of these stores may:

- Sell other high-demand necessities such as beauty aids, souvenirs, books, and candy.
- Have expanded product lines that include coffee and pre-packaged sandwiches.

For related topics, see Sections 3.7.1 and 3.7.6.3.

2.3.4 Duty-Free Retail

Duty-free shops offer international passengers an opportunity to purchase goods free of the taxes typically levied upon merchandise.

- Duty-free shops attract passengers hoping to save money on expensive goods such as luxury items, alcohol, and tobacco.
- Duty-free shops are often the anchor tenant of a larger concession program, often serving to attract passengers to a node of concessions.

For related topics, see Sections 3.7.1 and 3.7.6.4.

2.3.5 National versus Local

Recent trends have shown an increase in demand for local brands. While passengers enjoy the reliability and known expectations of nationally recognized brands, they also enjoy the new experiences, cuisines, and products offered by local brands.

- Local brands also help bolster the airport's regional image, which is ultimately good for the airport's home city and local businesses.
- The proper mix of local and national brands differs among airports and depends heavily on passenger sentiment toward local and national brands and chains.

Frequent fliers often complain about predictable concession programs (comprising mostly national brands) present at the majority of airports.

For related topics, see Sections 3.7.1 and 3.7.10.

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2.4 Passenger Awareness to Concession Offerings

Creating awareness of the available concessions in an airport terminal improves the passenger experience by informing potential customers of the types of food service and retail that can meet their needs and wants. This awareness can be generated in a variety of ways:

- Locate concessions so that they are visible from primary circulation routes.
- Use signage to create awareness and draw passengers into a store or restaurant (including static, blade, digital, and three-dimensional signage).
- Use static and digital directories and signage to improve wayfinding and help passengers find concessions.
- Offer a map of retail and food concessions to the queue, which can increase customer satisfaction in two ways: by making the concessions easier to locate and by allowing shoppers to plan their next moves while they are purchasing concessions.

For related topics, see Section 3.7.4.2.

2.4.1 Signage

Aside from concession location and visibility, signage is one of the most important factors in marketing and advertising a business.

- Concession signage provides consumers with important information, such as the type of business and the products or services they might provide.
- Signage is the first impression of an airport concession and is critical in generating passenger interest and revenue.
- An abundance of departure flight information display systems (FIDSs)—within retail outlets, at waiting areas, and even at individual tables—allows passengers to keep control of the situation and continue exploration of the airport.
- All restaurants should have easy-to-read menu boards to aid in the selection of an establishment.

For related topics, see Section 3.7.7.

2.4.2 Advertising and Marketing

With the influx of new technologies and ever-sharper and more efficient high-definition displays, airport advertising and marketing is evolving.

- Companies are using progressively more creative and unique advertising techniques to capture passenger attention to increase revenues.
- Emerging marketing techniques utilizing targeted passenger advertising, near field communication, and high-definition display marketing kiosks are new trends to follow since they may have a significant impact on revenue generation through customer awareness.

For related topics, see Sections 3.7.10 and 3.7.7.

2.5 Optimizing Size of Concession Blocks

Airport concession spaces must have sufficient space for merchandise, passenger queuing, and seating areas (if applicable), as well as back-of-house operations including storage, offices, and kitchens. Determining the proper amount of space is critical to ensuring the future success of each airport concession. Without sufficient space, concessions may experience congestion, resulting in long wait times and walk-away customers. In addition, if back-of-house operations are constrained, concessions may not be able to provide the level of service that passengers expect.

This constraint may ultimately reduce customer satisfaction, decrease concession sales, and result in reduced revenue. Optimizing concession block sizes reflects the need to determine the width and depth or overall square footage needed, which varies depending on the type and requirements of each individual concession:

- Retail concessions often have anywhere from a 1:1 width–to-depth ratio to a 1:3 width-to-depth ratio. This ratio also tends to vary by type of retail.
- Quick-service concessions, especially those in a food court, and casual/sit-down restaurants tend to have a 1:3 to 1:4 width-to-depth ratio.
- Coffee concessions can operate with as low as a 1:1 ratio.
- Bar width-to-depth ratios can vary widely depending on location and may even have an inverted ratio of 2:1 or 3:1 width-to-depth.

For related topics, see Section 3.7.5.

2.6 Optimizing Location of Concession Types

The location and positioning of concessions are primarily dependent on the actual size and configuration of an airport terminal. This does not mean that strategic placement is not possible or not worthwhile. The placement of concessions within a terminal building in relation to other concession types and passenger flows is a critical factor for success. The following Guiding Principles can be applied to assist with optimizing the placement of concessions:

- Creation of a central concession core is critical for success.
- Grouping concessions near the flow of passengers traveling to and from automated people mover (APM) stops increases footfall exposure to concessions.
- Holdroom dining and food service delivering systems are the newest trend and may pose future planning implications for holdroom sizing should this trend continue to be popular and result in revenue gains.
- Placement of FIDS monitors directly adjacent to or within a concession can assist with drawing in passenger traffic to a concession.
- To the greatest extent possible, food service units should be located in clusters in concentrated areas that are within eyesight of specialty retail.
- To the greatest extent possible, multiple factors need to be considered when determining the optimal locations for specialty retail, including passenger exposure, terminal configuration, and passenger mix.
- To the greatest extent possible, there should be numerous convenience retail units located throughout the main areas of a terminal that can serve both departing and arriving passengers. Additionally, convenience retail should also be placed near specialty retail to increase footfall and passenger exposure to the specialty retail concessions.
- Duty-free concessions can play a dual role of generating revenue and serving as anchors for other concessions.

For related topics, see Section 3.7.4.

2.6.1 Food and Beverage

Successful F&B concessions are often clustered in groups in the form of food courts, similar to those typically found in shopping malls.

- The food court concept allows passengers to quickly make decisions based on food preferences, prices, seating, and wait time.
- Food courts typically comprise only fast-food restaurants rather than sit-down full-service restaurants.

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- The airport operators' objective should be to make food concessions easy to find, cater to those who planned ahead, and offer fast service for those who may be making an unplanned stop.

For related topics, see Sections 3.7.6.1 and 4.1.5.

2.6.2 Specialty Retail

Specialty retail concessions, which may sell luxury or specialized goods, require excellent visibility and passenger exposure to succeed in the airport environment.

- Passengers do not typically plan their visits to specialty retail; therefore, visibility and advertising is paramount.
- It is important that the stores generate interest and draw in customers to make impulse purchases.

For related topics, see Section 3.7.6.2.

2.6.3 Convenience Retail

Convenience retail concessions sell mostly grab-and-go items, such as snacks, reading materials, and other necessities.

- Convenience retail performs best near other concessions, such as specialty retail.
- Convenience retail is best positioned within areas that are convenient for arrival and departure passengers to make grab-and-go purchases.

For related topics, see Section 3.7.6.3.

2.6.4 Walk-Through Duty-Free Retail

Duty-free concessions, available only to passengers traveling internationally (with the exception of the duty-paid merchandise, which is offered to all domestic and international passengers), are found in international terminals or those terminals processing a combination of domestic and international flights. Duty-free concessions are either positioned as independent storefronts or are in clusters surrounding circulation areas. The latter is known as walk-through duty free.

- Walk-through duty free blurs the line between circulation and concession, allowing concessionaires to maximize passenger exposure to products and services.
- Walk-through duty free has been shown to increase concession revenue.

For related topics, see Section 3.7.6.4.

2.7 Controlling Passenger Behavior

As demonstrated by the concept of walk-through duty-free concessions, revenue is highly dependent on passenger exposure.

- Through the strategic placement of concessions, holdrooms, wayfinding, and circulation space, airports have found ways to increase passenger exposure to concessions.
- When considering concession space within the context of the terminal as a whole, concession planners can begin to predict and control when, where, and how passengers use or flow through concession spaces.
- Call-to-gate procedures have shown an ability to generate additional concession sales.

For related topics, see Section 3.5.

2.7.1 Wayfinding

Wayfinding within airports, especially larger facilities, can be a significant challenge and source of anxiety for many passengers. Due to increasingly large and complex airport systems, adequate wayfinding is critical in maintaining high customer satisfaction.

- Wayfinding for concessions can be in the form of concession signage, airport directories, or even through concession advertisements.
- Wayfinding allows passengers to quickly identify and choose among the available concession choices.
- Intuitive wayfinding can be enhanced by facilitating clear sightlines in the passenger primary direction as well as creating spatial voids and sources of natural light that can indirectly influence a passenger's path of travel.

For related topics, see Section 3.4.4.3.

2.7.2 Casino Effect

The "casino effect" shows that interior design and architecture affects gambling revenue and customer satisfaction. Designers can choose to apply similar principles to airport terminal concession areas.

- Strategic colors, spaces, textures, and lighting have been shown to reduce anxiety and increase satisfaction.
- Certain design elements may increase customer satisfaction, dwell time, and concession revenue.

For related topics, see Section 3.5.4.

2.7.3 Call-to-Gate Operation

Call-to-gate boarding procedures, popularized mostly by European and other overseas airports, attempt to control a passenger's transition to holdroom areas until their plane is prepared for boarding. This form of controlling the movement of passengers can be leveraged to benefit airport concessions.

- Call-to-gate terminals hold passengers within a common area. As each gate is prepared and ready for boarding, passengers are informed of the specific gate location of their flight.
- At some airports, call-to-gate areas also serve as concession courts.
- Concession court call-to-gate configurations are potentially another way to increase concession revenue due to the added dwell time passengers have at nearby shops, restaurants, and other stores.

For related topics, see Section 3.6.3.3.

2.7.4 Limited Public Seating

Traditional holdroom seating (situated in long linear rows) is not configured in favor of groups of travelers or those traveling with families. However, airport designers are beginning to use non-traditional circular or rectangular seating configurations. This type of seating arrangement allows families and small groups of traveling companions to cluster and face one another while waiting in the holdroom.

- The linear seating configuration is optimized for business travelers or those traveling by themselves.
- Families are not easily able to sit near or face one another in the linear seating configuration.

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- Providing non-traditional seating configurations tends to reduce passenger anxiety and increase overall customer satisfaction.

For related topics, see Sections 3.6.3.1 and 4.1.3.2.

2.8 Human Engineering Factors

The concept of human engineering is rooted in the ability to develop, configure, and optimize spaces to meet the emotional and behavioral needs of humans.

- When applied to the airport environment, human engineering translates into factors such as walking distances, wayfinding, self-service technologies, and level of service.
- Human engineering allows for better understanding and provision of passengers in the terminal environment.

For related topics, see Section 4.1.

2.9 Customer Satisfaction

The level of service (LOS) has been the most widely used and accepted form of translating passenger satisfaction into a measurable and comparable format.

- LOS parameters include passenger walking distance, number of level transitions, passenger density, quality of wayfinding and navigation aids, and wait times.
- Recent ACRP research has shown that the ratio of passenger density to area occupied is often an overemphasized factor relative to LOS.

For related topics, see Section 3.4.4.

2.9.1 Minimizing Passenger Walking Distances

Walking distances are often cited as one of the elements having the most impact on LOS. As walking distances increase, passengers' LOS begins to diminish. However, these effects can be mitigated by providing transport assistance via APM or moving walks as well as video monitors, advertisements, and other distractions to occupy passengers during their journey.

- LOS decreases when passengers are acutely aware of how long they have been walking or when they become fatigued.
- The addition of APM systems or moving walks also decreases transit time and passenger fatigue.

For related topics, see Section 3.4.4.1.

2.9.2 Walking Distances and Centralized Flow Tradeoff

It is often debated whether it is better to have airport facilities in the form of unit terminals with shorter walking distances or a single concentrated facility with longer walking distances. The better option depends on the passengers' LOS in each scenario.

- In the case of a single centralized facility, passenger density is typically greater with longer walking distances thereby increasing the perception in some cases of a low LOS. The compromise is that in a single centralized facility passengers flowing past concessions are more concentrated with less need to duplicate concession locations.
- In the case of multiple unit terminals, shorter walking distances may result with lesser concentrations of passengers at each terminal that result in a higher LOS and customer satisfaction.

The compromise is that passengers flowing past concessions are less concentrated with a need to duplicate concession locations in multiple unit terminals, often resulting in less concession variety for the passengers.

For related topics, see Sections 3.3.4.1 and 3.3.4.2.

2.9.3 Self-Service Technologies

Self-service technology allows passengers to bypass traditional agent positions in lieu of automated kiosk systems. While the computerized systems may be intimidating for some passengers, most airport users are comfortable with and use self-service systems regularly.

- New concession ordering systems have allowed passengers to remotely order food and beverage items to be delivered to their gate.
- Self-service technologies are now expanding into U.S. airports, including self-bag tagging, automated passport control, and automated boarding. Efficiencies in passenger processing could result in longer dwell times in the terminal, allowing for the opportunity for increased sales.

For related topics, see Sections 3.6.1.2 and 3.6.3.4.

2.9.4 Reduction in Passenger Anxiety

From a customer satisfaction perspective, reducing passenger stress and anxiety is critical. A partial solution is better communication of wait times and wayfinding to passengers.

- Departing passengers cited the most stressful parts of the airport experience as check-in and security. Therefore, by minimizing the anxiety of these two processes, the landside does offer an opportunity to improve overall customer satisfaction.
- Improvements in communication allow airport users to determine when and where they need to be and how to get there.
- Boosting passenger confidence in the airport environment ultimately results in reduced anxiety and a higher LOS.
- The more airport terminal design reduces anxiety and uncertainty among airport customers, the more customers will be open to the idea of exploring food and retail offerings, resulting in increased sales and revenue to the airport operator.
- One best practice is the use of display signage that explicitly states the average wait time at certain points, as this helps customers plan and, in turn, alleviate anxiety.

For related topics, see Section 3.4.4.5.

2.10 Variety of Concession Types and Pricing

Passengers often assume that goods and services within the airport will cost more than those same goods and services elsewhere. To combat this notion, airports have implemented pricing structures that require concessionaires to match their prices to street standards. In some cases, airports allow a specific percentage above street pricing. This policy means that the price of airport goods and services may be more than the price paid outside of the airport.

- Street pricing structures help to alleviate the burden of inflated costs customers expect, increasing customer satisfaction.
- Communication to passengers that pricing structures ensure fair prices may attract additional shoppers.

For related topics, see Section 3.7.8.

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2.11 Ancillary Land Development

Airports are utilizing ancillary land development to generate additional revenue while improving customer (air traveler) satisfaction.

- In some cases, this landside development has contributed a substantial portion of airport revenues.
- Additionally, it has provided commercial facilities and services that enrich the passenger experience.
- In sum, airports from Amsterdam to Zurich and from Athens to Seoul are pursuing ancillary land development as a pivotal means to financing airport operations while contributing to their profitability, cost competitiveness in attracting airlines, and passenger satisfaction.

For related topics, see Section 5.1.

CHAPTER 3

Terminal and Concession Planning and Design Considerations

This chapter describes some of the basic planning and design considerations that have a significant influence on increasing revenue generation and customer satisfaction when configuring new or renovating existing airport terminal facilities.

3.1 Terminal Environment

The first factor to consider when planning an airport terminal environment is the users of the airport terminal: passengers, visitors and employees. They are the primary drivers of purchases of concession products and services.

The airport users and their flow patterns through the terminal environment have a direct correlation on the productivity of the concession program and on the satisfaction of the customer. As a general rule, concession products and services are primarily purchased by departing passengers (either an originating or connecting passenger) because their dwell times in the airport are typically longer than those of arriving passengers who have reached their final destination and are typically in a hurry to claim their luggage and find their ground transportation. Departing passengers are therefore most likely to spend time in concessions. Connecting passengers typically have a shorter dwell time due to the limited amount of time in their schedule to get to their connecting flight, which may be a distance away from their arrival gate and often in a different terminal; in some cases, this means they do not have time to visit concessions. Conversely, arriving domestic and international passengers are typically unwilling to dwell for any length of time in the terminal once they have reached their final destination. These passengers are focused on moving on to their local destination rather than spending any more time in the airport. Other airport users, such as visitors and employees, also visit concessions. Visitors on the landside of the terminal seek out concessions as they wait to meet a passenger or after the passenger departs the airport. In the case of employees, they frequent concessions as they break for a meal or shop after their shift. Concession planners may too often overlook these examples of non-flier users of concessions.

From a terminal planning perspective, the flow of departing passengers through various departure processing functions and spaces (such as check-in, security screening, and holdrooms) and the requirement to appropriately park aircraft influence the configuration of the terminal building and its concourses. When designing a new terminal, the arrangement of passenger processing functions and flows are not limited by pre-existing conditions (such as structural columns, heating and ventilating ducts, restrooms, and other difficult to relocate functions), thereby allowing designers the freedom to consider various ways to maximize the concession program. For an existing terminal facility, there are more physical limitations and often little flexibility to change the path of passengers processing through the terminal and concourses.

This constraint also applies to the specific locations where concessions may be placed, due to pre-existing impediments inherent from the original design.

To focus the user of this Handbook on the most important aspects in the planning and design of a terminal's concession program, the remainder of this chapter is organized into six primary sections. Section 3.2 describes the various passenger, visitor, and employee types and flows. Section 3.3 presents the generic types of terminal configurations. Section 3.4 summarizes aircraft and passenger considerations. Section 3.5 discusses planning for concessions in the terminal environment; Section 3.6 covers trends in passenger processing, and Section 3.7 highlights concession needs in the terminal environment.

3.2 Passenger, Visitor, and Employee Types and Flows

This section describes the main types of airport users and their patterns of usage as they relate to concessions. By identifying how, when, and where these users interact with the airport terminal facilities, the planner or designer can begin to identify their behaviors and carefully position airport concessions to best meet their needs. This strategy increases not only customer satisfaction but also overall profitability and patronage of airport concessions. The goal of this section is to explain in detail the characteristics of the three primary airport users associated with the concession program—passengers, visitors, and employees—and how they interact with the airport terminal facilities. This knowledge allows the planner or designer to identify the opportunities and limitations regarding the marketing and placement of concession offerings and advertisements.

Among these users, passengers are clearly the main focus of the concession program. The basic passenger flows as well as the related processes involved for enplaning and deplaning passengers have changed significantly with regard to concession planning since the advent of commercial air travel. One of the most significant of those changes occurred in late 1972 when, in response to a series of aircraft hijackings, the FAA required that all airlines begin screening passengers and subsequently, by January 5, 1973, also their carry-on baggage (*1*).

Visitors can no longer escort air travelers to their aircraft, which has significantly affected concession planning. The addition of the security screening for passengers and their carry-on luggage formed a line of demarcation that separated the airport terminal into very distinct airside and landside components. Because most passengers do not wish to go through the rigors of security screening more than necessary, passengers do not venture from the airside back to the landside unless absolutely essential. Since departing passengers are the primary buyers of concession goods and services, the 1973 security mandate relocated the majority of concession goods and services to airside of passenger security screening.

Following the terrorist attacks of September 11, 2001, the Transportation Security Administration (TSA) implemented more stringent security screening processes, such as physical pat-downs and, more recently, advanced imaging technology (AIT) devices commonly referred to as "whole-body scanners." The most noticeable effect of these more advanced security screening techniques has been the increase in processing time at the security checkpoint, requiring passengers to arrive at the airport much earlier than prior to September 11, 2001.

As previously mentioned, visitors are not permitted to pass beyond the Security Screening Checkpoint (SSCP) unless accompanied by badged airport personnel. Allowing visitors beyond the SSCP would increase the number of individuals that would need to be screened during peak periods, which in turn would require additional TSA staffing. In the future, TSA policy may change allowing non-fliers beyond the SSCP, but as of 2013 this appears unlikely since current federal budget constraints limit the TSA's ability to provide additional TSA staffing. Such

a change would allow airports to market and capitalize on additional shoppers in the secure, airside areas of the terminal, much as they had prior to September 11, 2001. A more likely scenario is that non-fliers enrolled in known traveler programs, such as TSA Pre✓™ or CLEAR with their faster SSCP processing rates, would be allowed to pass through expedited lanes into secure areas of the terminal.

The SSCP is the most time-consuming and stressful part of the airport experience for departing passengers. The often unpredictable nature of the SSCP has resulted in passengers waiting until after they have been processed to visit airport concessions. It is for this reason that consideration of SSCP is an important aspect of concession planning.

Figures 3.1 and 3.2 show simplified generic passenger flows and processing functions for U.S. domestic and international arrival and departure passengers. The figures show the primary processes as passengers flow to and from landside, terminal, and airside components of the terminal complex. Figure 3.1 illustrates U.S. domestic arrivals and departures, while Figure 3.2 shows U.S. international arrivals and departures. Each figure shows the location of the SSCP in relation to these types of passenger processing functions and demarks the separation between the non-secure

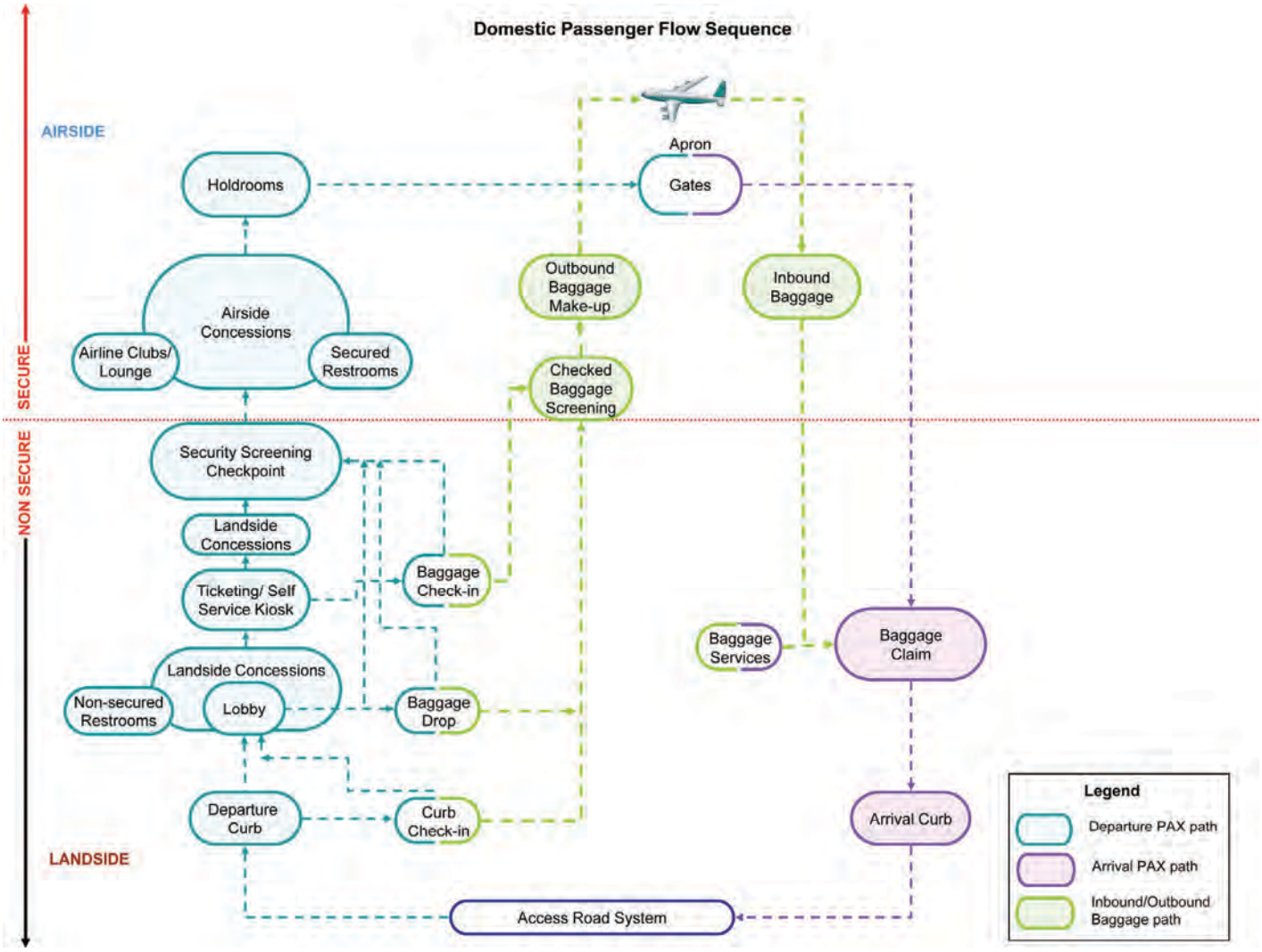

Figure 3.1. Passenger flow diagram for U.S. domestic arrivals and departures.

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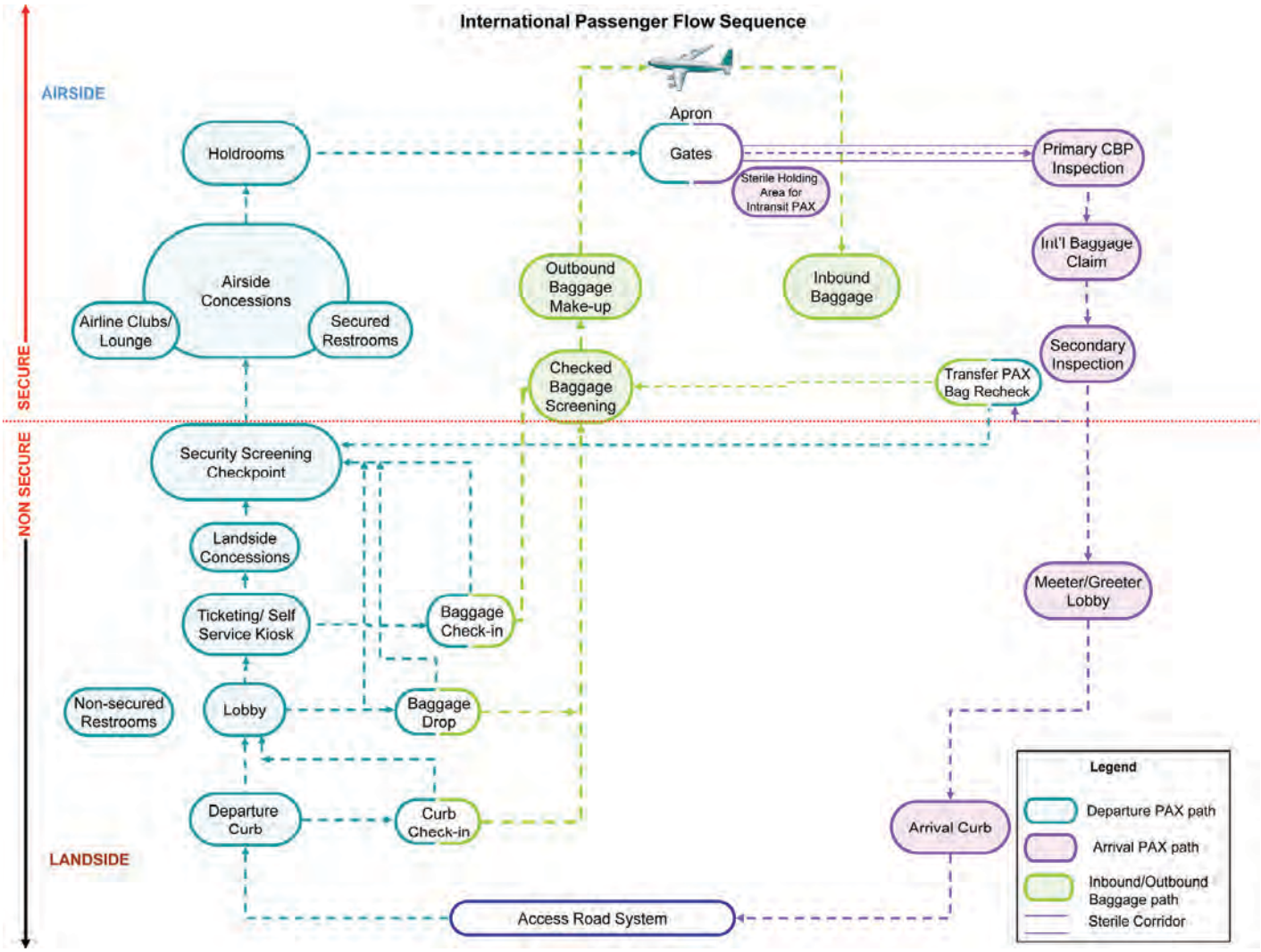

Figure 3.2. U.S. international arriving and departing passenger flows.

landside and secure airside area of the terminal (each with its own distinct ramifications to the types, number, size, and location of concessions).

3.2.1 Passengers

3.2.1.1 Domestic Departing Passengers

Domestic departing passengers are among the most likely to purchase concession goods due to their extended dwell time within a terminal facility. These passengers often arrive at an airport check-in area as much as two hours before their scheduled departure flight. Most passengers complete the check-in process as quickly as possible, and then proceed to security screening. Typically, passengers do not dwell in the non-secure areas of the terminal; this reduces the need and effectiveness of non-secure concession programs. In some circumstances, the time required to process through ticketing and security screening is less than anticipated. The additional time resulting from shorter processing times is often spent in concessions rather than waiting idly in holdroom spaces. This additional dwell time in the secure side of the terminal can result in additional concession sales. Therefore, any planning, design, or technological innovations that

can speed passengers through the SSCP process and/or reduce passengers' stress levels are beneficial to the concession program.

3.2.1.2 Domestic Arriving Passengers

The domestic arriving passenger is in many cases not a major target for concession operators, because these passengers have reached their destination and have no reason to dwell within the airport terminal. Arriving passengers disembark their aircraft and navigate toward the exit doors into the non-secure departures hall or baggage claim areas. While these passengers may be willing to purchase grab-and-go or convenience items on their way out, they typically will not spend time shopping or dining at the airport. Concessions targeted toward arriving passengers should be situated alongside those targeted toward other passenger types, such as departing passengers. The concessions located in the secure concourses along the exiting path of arriving passengers allow the concession operators to benefit from multiple passenger types with different habits rather than depending only on arrival passengers.

3.2.1.3 International Departing Passengers

Airports yield high concession revenues from international departing passengers, perhaps even more so than they do from their domestic counterparts on a per passenger basis. Airlines typically require that international departing passengers arrive up to three hours prior to their scheduled departure time. Depending on processing times at check-in and security screening, this may result in additional idle time that may be spent shopping at airport concessions. In addition, unlike domestic departing passengers, international departing passengers are eligible to purchase goods at duty-free stores. At many international airports, duty-free concessions are a major source of revenue.

3.2.1.4 International Arriving Passengers

As with domestic arriving passengers, international arriving passengers are typically focused on exiting the airport rather than spending additional time in concessions. In most U.S. airports, arriving international passengers typically exit from Federal Inspection Services (FIS) at a single point after processing through immigration and custom procedures required by U.S. Customs and Border Protection (CBP). These exit points are an opportunity to centralize concessions around a concentrated flow of international arriving passengers. These concessions should focus on services that are needed by arriving international passengers such as currency exchange or tourism information. Since these spaces may also serve as a meeting area for visitors (typically referred to as the meeter/greeter area), having basic food and beverage concessions available for those waiting for arriving passengers or for a meal or beverage after arrival is an important aspect from a customer service perspective.

3.2.1.5 Connecting Passengers

Connecting passengers are those who have single or multiple airport stops between their origin and destination. In most cases, they must exit their aircraft and board a different plane to continue on to their final destination. In the majority of U.S. airports, these passengers remain on the secure side of the terminal. Due to the terminal configuration or location of the connecting flight, some connecting passengers may have to exit into the non-secure areas of the airport. In this scenario, these transferring passengers must be re-screened to reach their connecting gate. In most cases, due to short layover times, there is little if any extra time to spend in concessions. To target grab-and-go products at connecting passengers, it is critical that the concessions be located conveniently on the pathway between the arriving and departing gates.

3.2.2 Visitors

As previously mentioned, visitors are not typically the primary purchasers at airports, but they should be taken into consideration when developing the concession program in the terminal to ensure customer satisfaction. Airport visitors can be separated into two primary categories: meeter/greeters and well-wishers. Meeter/greeters are visitors meeting an arriving passenger. In some cases, there are dedicated areas with seating and other amenities for these visitors. Well-wishers accompany a departing passenger to the airport and visit until reaching the SSCP. These areas for visitor waiting are important locations to allow for some degree of concession services, such as food and beverage or specialty products such as flowers, even if such services are only available through a vending machine.

3.2.3 Employees

Airport employees are often overlooked during the concession planning process. Employees working in both the secure and non-secure portions of the airport should be considered when determining the types and locations of concessions. These employees can be a significant source of revenue in the food and beverage and retail sectors. Because of limited availability of food and beverage opportunities typically surrounding many airports, employees may find it more convenient to either dine or make grab-and-go purchases at their place of employment—the airport. During the concession planning process, airport management, planners, and designers should consider ways to capture concession revenue from airport employees. Additionally, airport employees (who have daily exposure to the concession program) may also be a good source for feedback regarding the service, quality, and product selection of the shops they patronize on a daily basis.

3.3 Terminal Configuration

The physical configuration of the passengers' route through the various passenger processing functions to the gates during initial planning is one of the primary contributing factors to increasing revenue generation and achieving customer satisfaction. The initial decisions that airport management and their consultants make with regard to the terminal configuration of a new greenfield terminal has an enormous effect on the ability to maximize revenue and influence the users' perception of satisfaction in the terminal. Development of a greenfield terminal has the advantage of allowing designers to maximize the effectiveness of the concession program. During new terminal projects, concession planning should be introduced during the initial design stages rather than waiting until the terminal shape, size, and interior spaces have already been determined. In many cases, planners do not have the opportunity to design a "new" terminal; rather, the task involves increasing the revenue and effectiveness of an existing concession program within the constraints of an existing terminal configuration.

Airport management and their technical consultants are more limited in their ability to control all of the key factors that influence revenue generation and customer satisfaction when reconfiguring an existing terminal facility. This section of the Handbook will address factors associated with the physical layout of the terminal environment, many of which are more applicable from the viewpoint of planning and designing new terminal facilities. Some of the Guiding Principles and factors mentioned apply to both new and renovated facilities, with the latter being more restricted by the legacy of the planning, design, and operating decisions made when the terminal and its concourses were originally designed and constructed.

3.3.1 Single versus Multiple Terminals

The first stage of planning a new terminal at a high-passenger-volume airport is deciding whether all of the future passenger traffic will be accommodated in a single processing building or if it will be decentralized into multiple processing buildings. These buildings are typically referred to as "unit" terminals. There are many factors that influence this decision. Two determinates in this decision process are (1) the scale of the passenger volume anticipated in the terminal's foreseeable future and (2) the type of airlines anticipated to use the facility. When making this determination, it is important to understand the impact on concessions. Subsequent Section 3.3.4, Centralized and Decentralized Terminal Facilities, will discuss in greater detail examples of single verses multiple terminals and the respective impacts on concession functionality and effectiveness.

3.3.2 Size and Complexity of the Airport's Passenger Operations

The magnitude of an airport's concession program is typically based on the number and type of passengers using the terminal facilities, among other factors. The number of passengers enplaning at the airport is typically how the size of the airport is determined and typically referenced.

The FAA uses several classifications for public use airports that serve civil aviation. For the purposes of ACRP Project 07-08, only the primary commercial service classification of an airport having more than 10,000 passenger boardings each year was included in the research. More specifically, as described in the Chapter 1, only large, medium, and small hub commercial airports were considered. These airport hub-type classifications are determined by calculating individual airport passenger volumes as a percentage of the annual passenger boardings in the United States. These hub classifications are defined as follows:

- **Large hub:** 1 percent or more
- **Medium hub:** At least 0.25 percent, but less than 1 percent
- **Small hub:** At least 0.05 percent, but less than 0.25 percent

When classifying an airport terminal in relation to passenger volumes, not only its hub size, but also the characteristics of its passenger mix are considered. While the sheer number of passengers using the terminal drives the overall size of the terminal's facilities, the departing passengers are the principal consumers of goods and services. While connecting passengers typically do not process through the front door of the terminal, they do enplane from the airside contact gates and remote aircraft parking positions. Departing passengers include all of the originating passengers from the airport's locale and all of the connecting passengers using the airport as a transfer point. The volume of departing passengers from the terminal is referred to as "enplanements," which equates to the total number of revenue passengers boarding the aircraft. Therefore, the most commonly used and best metric when assessing concession program performance is sales per enplaned passenger. For general planning purposes, annual passenger enplanements typically equate to one-half of the total MAP at an airport.

There are diverse opinions in the industry and among the traveling public as to how large a single, consolidated terminal processor can be before it is perceived as being too big and complex for passengers to process through conveniently or without anxiety and confusion. How passengers orient themselves in physical space and navigate from place to place is commonly referred to as "wayfinding." Along with a passenger's comprehension of the amount of time needed to reach their gate, wayfinding affects a user's perception of the level of service being provided by airport management and their impression of the physical design of the facility. If not addressed with clarity during the planning and design process, the negative aspects of complicated passenger wayfinding, extensive walking distances, and the uncertainty of processing time through the terminal can result in customer dissatisfaction.

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Table 3.1. Top 10 hub airports, 2011.

Rank	ID Code	City	Airport Name	CY 2011 Enplanements	Number of Terminals	Date of Newest Terminal
1	ATL	Atlanta	Hartsfield–Jackson Atlanta International	44,414,121	1 International 1 Domestic[i]	2012
2	ORD	Chicago	Chicago O'Hare International	31,892,301	1 International 3 Domestic	1993
3	LAX	Los Angeles	Los Angeles International	30,528,737	1 International 8 Domestic[ii]	1984
4	DFW	Fort Worth	Dallas/Fort Worth International	27,518,358	1 International[iii] 4 Domestic and/or Transborder	2005
5	DEN	Denver	Denver International	25,667,499	1 Terminal[iv]	1995
6	JFK	New York	John F. Kennedy International	23,664,832	7 Terminals[v]	2008
7	SFO	San Francisco	San Francisco International	20,056,568	1 International 3 Domestic	2000
8	LAS	Las Vegas	McCarran International	19,872,617	1 International 1 Domestic	2012
9	PHX	Phoenix	Phoenix Sky Harbor International	19,750,306	3 Domestic[vi]	1990
10	IAH	Houston	George Bush Intercontinental/ Houston	19,306,660	3 Domestic 1 International	2002

Source: FAA's Air Carrier Activity Information System 9/27/2012.
[i] Includes north and south side domestic processing.
[ii] Several of LAX domestic terminals also contain FIS arrivals facilities.
[iii] Includes five terminals and one FIS arrivals facility; Terminal D/FIS—international (foreign flag carriers), Terminal E/FIS—domestic and international (United).
[iv] Includes FIS and east and west domestic processing.
[v] Several JFK terminals also include FIS arrivals facilities.
[vi] Terminal 4 includes FIS arrivals facilities.

As Table 3.1 indicates, most of the top 10 large hub airports contain multiple terminals, with the exception of Denver International Airport (DEN) which has a single terminal for both domestic and international passengers, including three midfield concourses. Hartsfield–Jackson Atlanta International Airport (ATL) has one domestic and one international terminal, including four midfield concourses connected by a single APM system (for all intents and purposes, this terminal configuration operates as a single consolidated airport facility). Las Vegas International Airport (LAS) has just recently opened its new Terminal 3 (primarily for international passengers) and demolished its 20-year-old Terminal 2. The remaining Terminal 1 and Terminal 3 are now connected by an underground APM. Terminal 1's gates effectively serve as a satellite concourse, thereby integrating the complex into a single consolidated operation. ATL opened in 1980, DEN opened in 1995, and LAS Terminal 3 opened in June of 2012.

Therefore, within the time continuum of large U.S. hub airports, DEN, ATL, and LAS are considered newer airport terminal/concourse complexes, built after deregulation of the airline industry in 1978. When compared to the planning alternative of multiple separate unit terminals, these consolidated terminal complexes are driven by the operational efficiencies gained through the more simplistic movement of passengers and baggage between fewer locations and the benefits of staff efficiencies for both passenger security screening and airline personnel. From a concession program perspective, these types of consolidated terminal planning concepts tend to focus major concentrations of origin and destination (O&D) passengers through centralized terminal processors and additionally concentrate connecting passenger volumes through the APM

Table 3.2. Large, non-U.S. airport mega-terminals.

ID Code	City	Airport Name	Terminal	Sq. Ft.	Year Initially Opened
DXB	Dubai, United Arab Emirates	Dubai International	T3	21,300,000[i]	2008
PEK	Beijing, China	Beijing Capital International	T3	10,610,000[ii]	2008
MAD	Madrid, Spain	Madrid-Barajas	T4	8,180,600[iii]	2006
HKG	Hong Kong, SAR China	Hong Kong International Airport	T1/T2	6,135,000[iv] 1,507,000	1998/2007
ICN	Incheon, South Korea	Incheon International	Main Terminal	5,340,000[v]	2001
LHR	London, England	London Heathrow	T5	4,442,000[vi]	2008

[i] http://www.dubaiairport.com/en/media-centre/facts-figures/Pages/factsheets-reports-statistics.aspx
[ii] http://www.airports-china.com/beijing-zbaa-pek.htm
[iii] http://www.madrid-airport.info/facilities.html
[iv] http://www.hongkongairport.com/eng/business/about-the-airport/facts-figures/facts-sheets.html
[v] http://www.airport.kr/iiacms/pageWork.iia?_scode=C3002020000
[vi] http://www.richardrogers.co.uk/Asp/uploadedFiles/Image/1065_t5/RSHP_A_JS_1065_L_E_GB.pdf

connection at the centroid of satellite concourses. As such, the location of the APM station becomes a primary location for concessions and services.

There seems to be a recent trend, particularly in large hub airports, toward more consolidated terminal complexes with either a single, large passenger processing unit or with a single domestic processor combined with a single international processor. It is believed that this is primarily a result of the previously mentioned passenger, baggage, security, and airline efficiencies. This trend is most likely further supported by the ability to achieve a superior concession program with increased exposure to passenger flows for retail and food and beverage concessions. Table 3.1 depicts the current top 10 hub airports in the U.S. based on 2011 passenger statistics. This hypothesis is further supported by the wave of recently constructed overseas mega-terminals at large passenger activity airports built since the turn of the century, shown in Table 3.2.

3.3.3 Airline Mission of the Airport

An airport's role in the national and regional system of air traffic and the specific airlines serving the airport and their business strategies for routing flights into and out of a particular airport influence both the size and configuration of an airport's airfield, terminal, and landside facilities.

An airport's mission is typically dependent on the size of the community it serves and its geographical location within the United States. Airports situated on U.S. coasts in large metropolitan areas, such as the JFK in New York and LAX in California, are in an advantageous geographic position to provide air service as international gateway airports to the United States. To a large extent, these gateways are influenced by the stage length capabilities of aircraft to reach distant overseas destinations across the Atlantic and Pacific Oceans. As aircraft technologies have improved over time, the stage lengths of new generations of aircraft have increased the distances that they can fly, which in turn has increased the potential for more international activity at major metropolitan airports located internally in the United States [for example, at Chicago O'Hare International Airport (ORD)].

Airport terminals with any type of international passenger activity must have CBP arrivals facilities for primary, secondary, and customs inspections that must comply with CBP Airport Technical Design Standards. It is important that passengers have direct pathways to and from

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these international facilities to their domestic flights that minimize the connection times for both passengers and their baggage. These arriving and connecting passenger pathways have a significant impact on a passenger's dwell time and route of travel, which affects the location and type of concessions in the terminal facilities.

The flight network established at each airport by the primary airline(s) is a factor influencing the mission of the airport and terminal facilities. The majority of the U.S. passenger airlines use a "hub-and-spoke" network to route their flights to and from the various cities they serve. A "hub" is a central airport location through which many of the airlines' flights are routed. In the United States, ATL is an example of a large connecting domestic hub terminal for Delta Airlines with a separate U.S. CBP international arrivals terminal. A "spoke" is typically a smaller metropolitan city that has fewer, if any, connecting flights and consists primarily of O&D passenger traffic. An example of a spoke airport is one of the case study airports, SAV, which consists primarily of O&D passenger activity.

The U.S. government's policy to deregulate the airline industry in 1978 greatly increased the use of the hub-and-spoke system. Prior to deregulation, airlines were required to have direct flights between small city pairs. Typical point-to-point service prior to deregulation more often than not produced low passenger loads on these government-mandated routes, resulting in lower revenues for airlines on these flights.

Both the scale and mission of the airport terminal greatly influence the magnitude and type of concession offerings that can realistically be included in an airport terminal. One of the most significant factors that influences the ability of the concession program to yield its maximum potential is whether passenger flows are concentrated to expose all potential customers to as many concession offerings as possible. Consequently, for a new terminal facility, an initial decision is whether to consolidate all airport passengers into a single terminal or divide passenger volumes into multiple unit terminals.

There are two primary configuration factors to consider. The first factor addresses the organization of terminal passenger processing into either a centralized or decentralized airport terminal complex and is discussed in Section 3.3.4, Centralized and Decentralized Terminal Facilities. The second configuration factor involves organizing the terminal facility into one of four generally recognized concept types of terminal/concourse configurations which are depicted in Section 3.3.5, Generic Terminal/Concourse Concepts.

3.3.4 Centralized and Decentralized Terminal Facilities

One of the most important decisions initially facing planners and designers is whether the terminal complex should have one centralized processing terminal or whether the mission of the airport warrants multiple, decentralized passenger processing unit terminals. Many factors enter into the decision of a single versus multiple unit terminal planning approach. Some of these factors include the magnitude of passenger and aircraft activity, the specific mission of the terminal facility, and whether the project is starting with a clean slate (such as a greenfield site) or supplementing an existing terminal infrastructure (whereby a new single terminal project becomes part of a series of existing unit terminals). These overarching, large-scale, strategic planning decisions have a long-lasting impact on the viability of the airport's concession revenue generation potential.

3.3.4.1 Centralized Terminal Facilities

As the name implies, the underlying premise of a centralized terminal is that all passengers and baggage at an airport are processed through a single primary facility complex. There are

many examples of centralized, single terminal processing facilities in the small and medium hub airport categories. Among the case study airports examined in this project, SAV, BUD, PIT, and PDX fall within this category. There are even some very large passenger volume facilities that fall into this category. Two examples are DEN and the Hong Kong International (HKG) airports that utilize a single terminal facility and concentrate passengers through a single terminal building and a single APM system spine that routes passengers to and from gates. While HKG has a second terminal, Terminal 2, it is a check-in–only facility and supplements the consolidated terminal complex along a central spine of passenger flows through a single APM system. There is also the beginnings of a trend to consolidate previously built unit terminals such as at the Cincinnati/Northern Kentucky International Airport (CVG) where three unit terminals have been consolidated into one facility, Terminal 3. Similar consolidations of multiple unit terminals into a larger concentration of passenger flows through a single, larger terminal are currently being planned in Kansas City International Airport (MCI) and contemplated at JFK in New York. In general, the simpler and more concentrated passenger volumes tend to promote a stronger concession program.

While small hub passenger volumes typically do not warrant the need for more than a single centralized terminal building, airports with medium to large hub passenger volumes are sometimes faced with the decision of expanding an existing terminal/concourse configuration, building a new consolidated single replacement terminal, or building a second unit terminal to handle the airport's future growth. It is during this strategic planning decision that the potential influences of the non-aviation revenue generated from the concession program needs to be one of the key factors to consider.

There are many other advantages to a centralized, single consolidated terminal facility configuration and operating strategy. This strategy can take the form of a single mega-terminal like DEN or dual headhouse processors like ATL's domestic and international terminals that still utilize a single, concentrated flow of passengers along its APM spine. Some of these advantages have a direct impact on concession revenues and customer satisfaction, while others are more focused on operating efficiency:

- **Maximizes concession revenue opportunities:** In a centralized facility, it is possible to achieve the maximum exposure of the departing passengers to a central concession core, which boosts sales and revenue while eliminating the need to duplicate concessions, as is sometimes required with a multiple unit terminal strategy.
- **Maximizes the use of facilities and staffing:** A single consolidated terminal facility configuration and operating strategy:
  - Maximizes passenger processing capacity and often eliminates unnecessary facility duplication.
  - Minimizes staffing requirements for certain passenger processing, such as areas for SSCPs. This approach can have a direct effect on customer satisfaction since a correctly sized and staffed single centralized SSCP area has the capability to better absorb passenger peaks than smaller distributed SSCP areas.
  - Provides a better opportunity to operate as a common-use facility by utilizing common-use terminal equipment and common-use passenger processing systems technologies to share gates and airline-related passenger processing facilities.
- **Minimizes interline and intraline connections:** Since all airlines are operating within a single consolidated terminal facility, the connections of passengers and baggage between airlines are typically closer and less complex than the connections between unit terminals. Efficient, uncomplicated passenger connections tend to increase customer satisfaction at an airport.

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- **Simplifies wayfinding resulting in higher customer satisfaction:**
  - From a macro-wayfinding perspective on the landside, there is only one location at which passengers arrive and depart, which typically simplifies the ground access infrastructure and decision making on approaching or departing the airport and terminal complex. There is less opportunity for passengers to show up at the wrong terminal since there is only one centralized terminal destination, resulting in fewer missed flights.
  - From a micro-wayfinding perspective inside the terminal, single centralized terminals tend to simplify decision making by involving fewer decision points.
- **Minimizes duplication of landside facilities:** A single consolidated terminal strategy allows mass transit (such as a single bus or rail transit station) to serve all passengers, thereby simplifying wayfinding and minimizing the duplication of facilities and the need for connecting services within a multiple unit terminal complex.
- **Adapts to airline flexibility:** A single consolidated terminal provides adaptability to meet the changing needs of the airlines, such as minimizing relocations from one unit terminal to another due to airlines changing code-share alliances and partnership mergers.
- **Increases gate flexibility and utilization:** A single consolidated terminal that is appropriately designed to process both international and domestic arriving and departing aircraft and passengers through the use of swing gates eliminates the need to taxi or tow an internationally arriving aircraft to a different domestic departing gate.
- **Provides comparable LOS:** Operating from the same terminal building typically provides a comparable set of facilities and LOS for the dominant carrier(s) and other competing airlines. This consolidation also results in all airlines having a more similar quality of concession program than if major and minor airlines are operating out of separate unit terminals.

3.3.4.2 Decentralized Terminal Facilities

Several unit terminals create different needs from those of a single consolidated terminal. Multiple unit terminals represent the most decentralized concept. This multiple terminal configuration is most often associated with larger passenger volume airports and airports with more than one major airline, such as LAX and JFK, one of the case study airports. In these examples, each terminal operates independently of the other terminals and duplicates most facilities, such as concessions, restrooms, building services, vertical circulation, mass transit interfaces, and related structures.

Most airports with multiple terminals do not evenly split activity, so each unit terminal must be capable of responding to individual peaks. Decentralized terminals sometimes require concessionaires to duplicate certain concession offerings in multiple terminals where the volume of airport passengers may be sufficient in one unit terminal and insufficient in the other unit terminal to support such concessions. This approach can result in significant quality and profitability differences between the concessions in each terminal.

An airport also may have different types of airline service that require different types of terminals. A domestic terminal, or one targeted at low-cost carriers, has different needs and characteristics than a large international terminal. Each of these characteristics should be considered when deciding on the specific allocation of types of concession offerings.

At a certain point, as traffic increases, a single terminal may expand piecemeal and develop multiple passenger processing locations within a single centralized terminal. For example, to keep walking distances within desired maximums for O&D passengers, a terminal may require multiple SSCPs that, in turn, produce multiple passenger paths and vertical circulation cores. These multiple paths may then require duplication of concessions and other services to make them accessible to all passengers. The concession core can also be a "centralized" node of concessions

accessed from multiple points of entry from the landside as illustrated by MSP. Thus, a single terminal can sometimes have similar operational characteristics to a decentralized terminal within a single structure.

3.3.5 Generic Terminal/Concourse Concepts

Once a decision has been reached about whether the terminal complex will take a centralized or decentralized processing approach, an initial investigation of concepts can begin by exploring any of four basic concept types and variations on their principal mode of operation. These generic concepts differ in the way passengers are processed from the main terminal to the aircraft gate and, in particular, the configuration of the aircraft parking positions at the terminal and/or concourse. Each concept has a slightly different effect on the concession program requirements and location placement. Although at many airports, the overall airport terminal complex often combines elements of several of these types. For clarity, these generic concepts are presented and discussed separately in the following paragraphs.

Historically, four generic terminal/concourse concept types have been recognized by the industry at large: linear, pier, satellite, and transporter. These concept types are referenced in various publications, including *The Apron-Terminal Complex* (*2*), which was prepared for the FAA, and in the FAA planning document, *The Apron & Terminal Building Planning Manual* (*3*). These terminal concept types are based on a specific relationship between the aircraft and the passenger processing and boarding areas. The transporter concept, which involves a unique type of transport vehicle called a mobile lounge that moves passengers from the terminal processing building directly to an aircraft's boarding door, has proven to be very limited in its application and will not be addressed in this Handbook.

3.3.5.1 Linear Terminal Concept

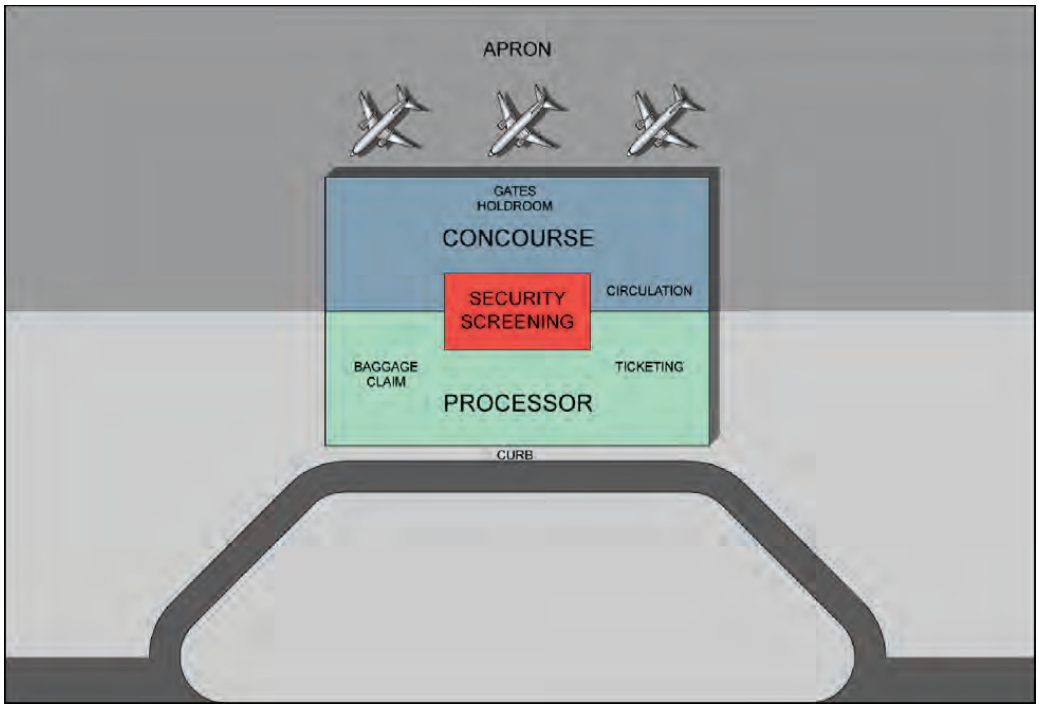
The linear terminal concept consists of a single terminal processor with an integrated, single-sided linear gate arrangement that can be configured in a straight or curvilinear configuration. The typical internal arrangement of functions in a linear terminal is as follows:

- Passenger ticketing along the front side of the landside portion of the building
- Single or multiple SSCPs along the center of the building
- Holdroom area and corresponding aircraft positions along the back or apron-side of the building

Figure 3.3 depicts an example of a simple linear terminal. The linear concept works effectively in lower passenger activity situations and can be arranged into a series of individual linear unit terminals in order to accommodate larger passenger volumes. In general, the primary advantage of the simple linear configuration is that there is a direct relationship between curbside and the aircraft, and walking distances for passengers are generally relatively short. A linear concourse may be located parallel to, or integrated with, the terminal.

Shown in Figure 3.4, BUD, one of this project's case study airports, is a classic example of a linear terminal that centralizes terminal passenger flows so that maximum footfall is achieved with sightlines to the majority of the airport's concessions in its centralized Skycourt.

Variations of the linear terminal concept include the "drive-to-gate" terminals at MCI and Dallas/Fort Worth International Airport (DFW). These examples utilize a curvilinear form and narrow depth, which originally made them convenient and efficient with short walking distances to and from the aircraft to ground transportation. The MCI and DFW configurations have decentralized passenger processing areas, making it difficult to centralize passenger footfall past concession locations and sometimes hindering the ability to generate higher sales and maximize concession revenues.



Source: "Considerations for Selecting a Terminal Configuration," David A. Daileda, FAIA, FAA White Paper.

Figure 3.3. Linear terminal concept.

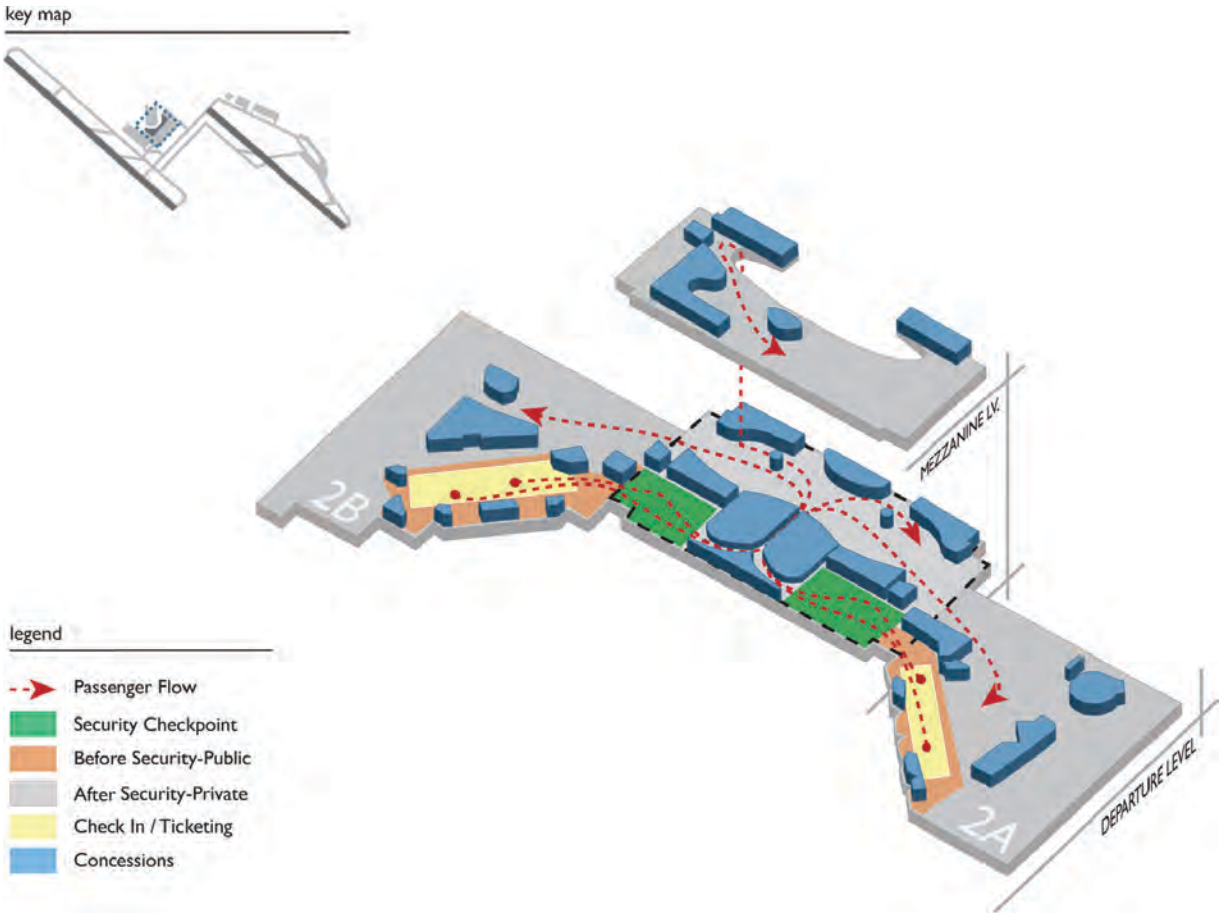
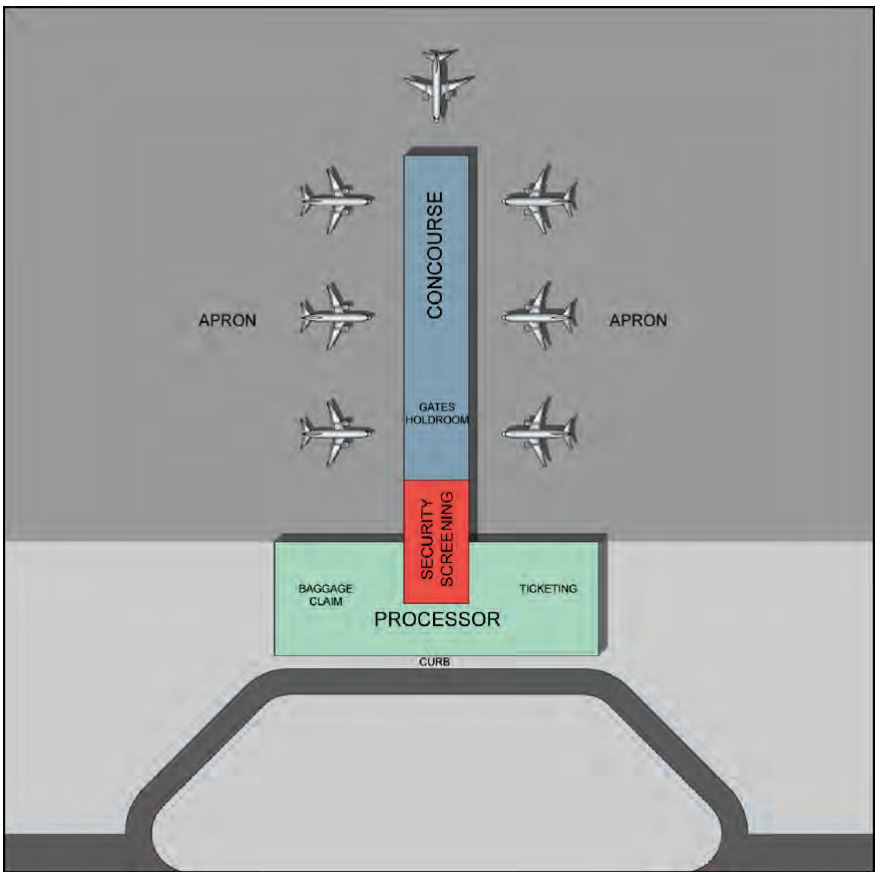


Figure 3.4. Budapest Ferenc Liszt International Airport.

3.3.5.2 Pier Terminal Concept

The pier concept consists of a single centralized passenger processing building with either a single concourse or multiple double-loaded concourses attached to the terminal. In this configuration, aircraft are parked on either side along the spine of the concourse or concourses. Circulation in the pier concept is linear; passengers enter from the front of the building, passing through ticketing, security, and then into the secure concourse(s) extending out from the terminal. Located on either side of the concourse are holdrooms, concessions, and other passenger amenities. This double-loaded configuration shortens passenger walk times and allows for concession nodes at the beginning as well as the midpoint of the concourse. This configuration concentrates a large percentage of O&D passengers into the concession nodes, providing greater visibility and increased revenue.

As a pier airport expands, the length of the initial pier may be extended, branching into a "Y" shape, or additional piers may be developed parallel to the original pier. New parallel piers are spaced according to the size of aircraft, utilizing the inner gate positions. As the single-pier concept expands into multiple piers, passenger walking distances increase. Examples of pier concepts are found at LaGuardia Airport (LGA) in New York, Reagan Washington National Airport (DCA) in Virginia, and Miami International Airport (MIA) in Florida. Figure 3.5 depicts an example of a single-pier terminal concept.



Source: "Considerations for Selecting a Terminal Configuration," David A. Daileda, FAIA, FAA White Paper.

Figure 3.5. Single-pier concourse concept.

A classic example of a single-pier terminal is one of the case study airports, SAV, shown in Figure 3.6. The terminal processing functions are organized in a straightforward manner with passengers first going to ticketing and check-in, then going to security, and then out to the secured concourse holdrooms. However, a unique aspect of SAV is the design feature of the Savannah Square concession node located landside of the SSCP. Savannah Square is reminiscent of one of Savannah's iconic open green space public squares that are part of the city's historic planning heritage.

Figure 3.7 depicts a multi-pier terminal concept. From the airport case study research, an example of a multi-pier concourse configuration is shown in Figure 3.8. Some multi-pier terminal airport examples include large passenger activity airports, such as ORD, MIA, and Fort Lauderdale/Hollywood International Airport (FLL). Overseas airports include HKG, Frankfurt Airport (FRA), and Amsterdam Schiphol Airport (AMS).

3.3.5.3 Satellite Terminal Concept

The satellite terminal concept consists of a separate airside building that accommodates all of the aircraft gates and is linked to the main passenger processing building (often referred to

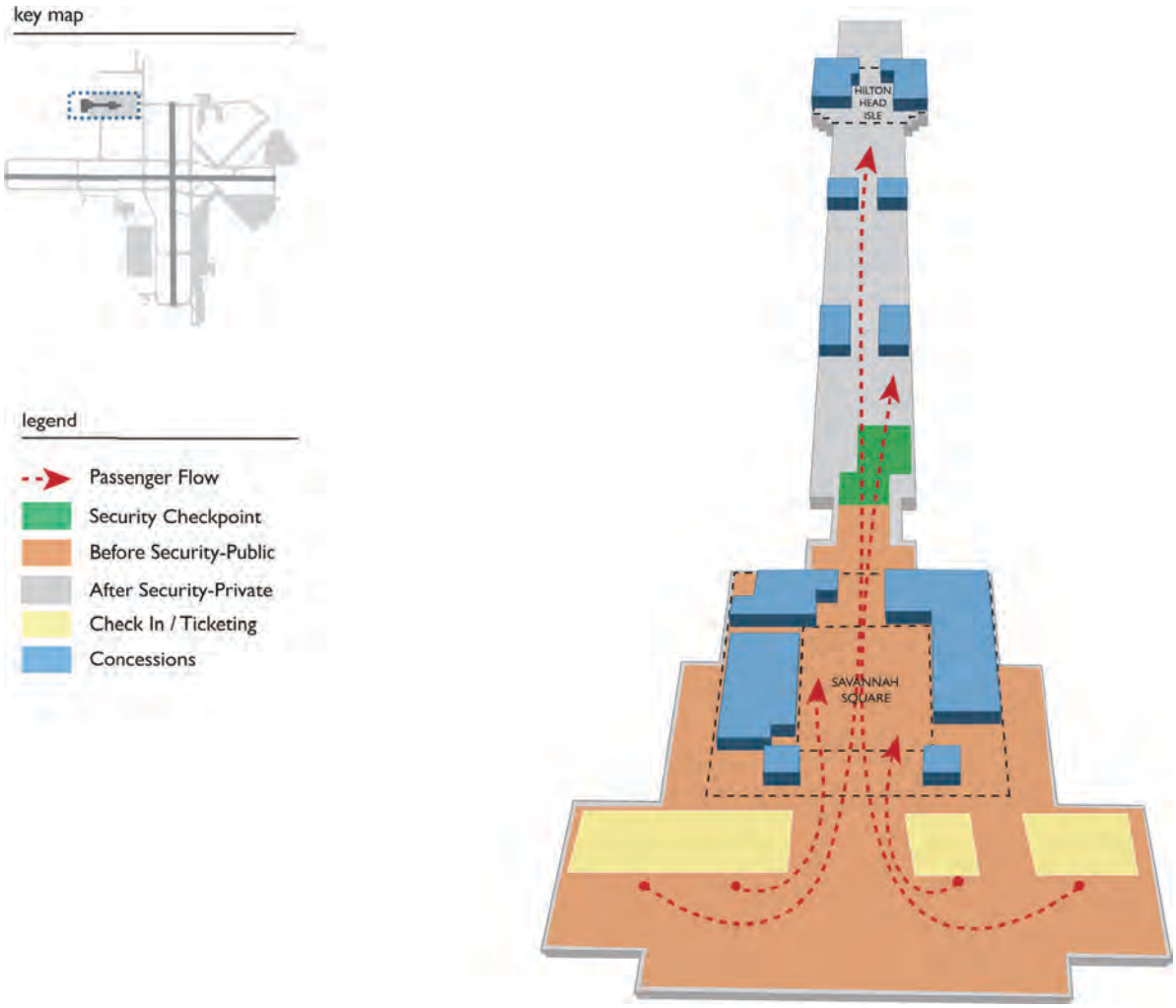
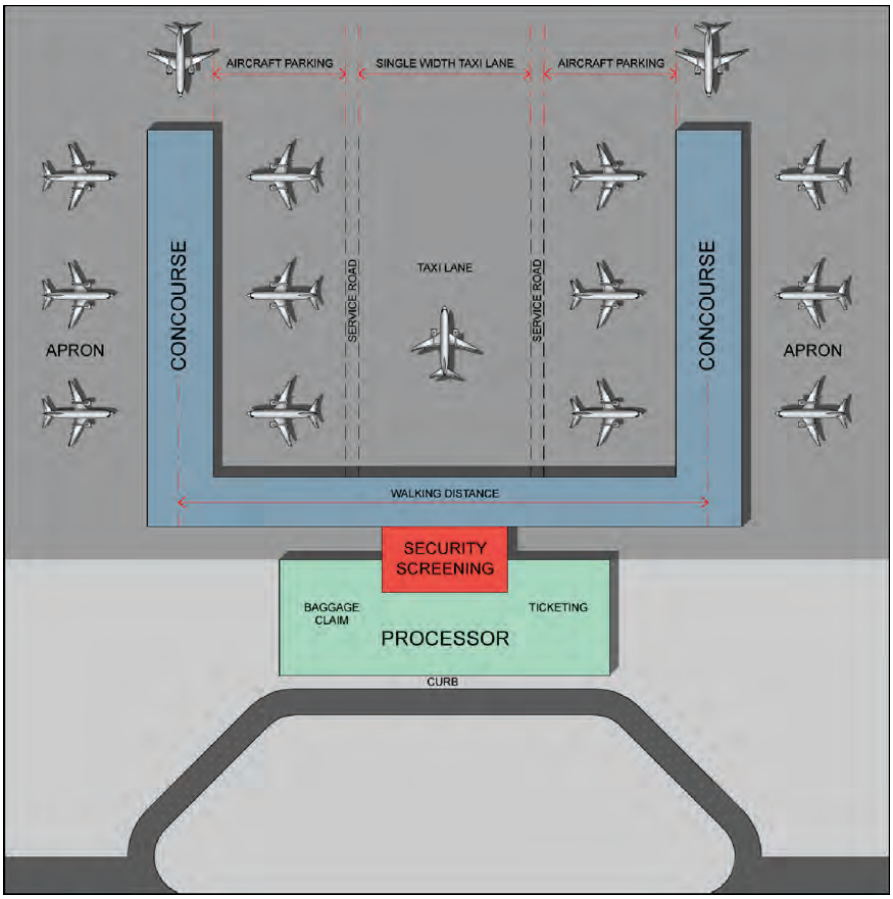


Figure 3.6. Savannah/Hilton Head International Airport.



Source: "Considerations for Selecting a Terminal Configuration," David A. Daileda, FAIA, FAA White Paper.

Figure 3.7. Multi-pier terminal concept.

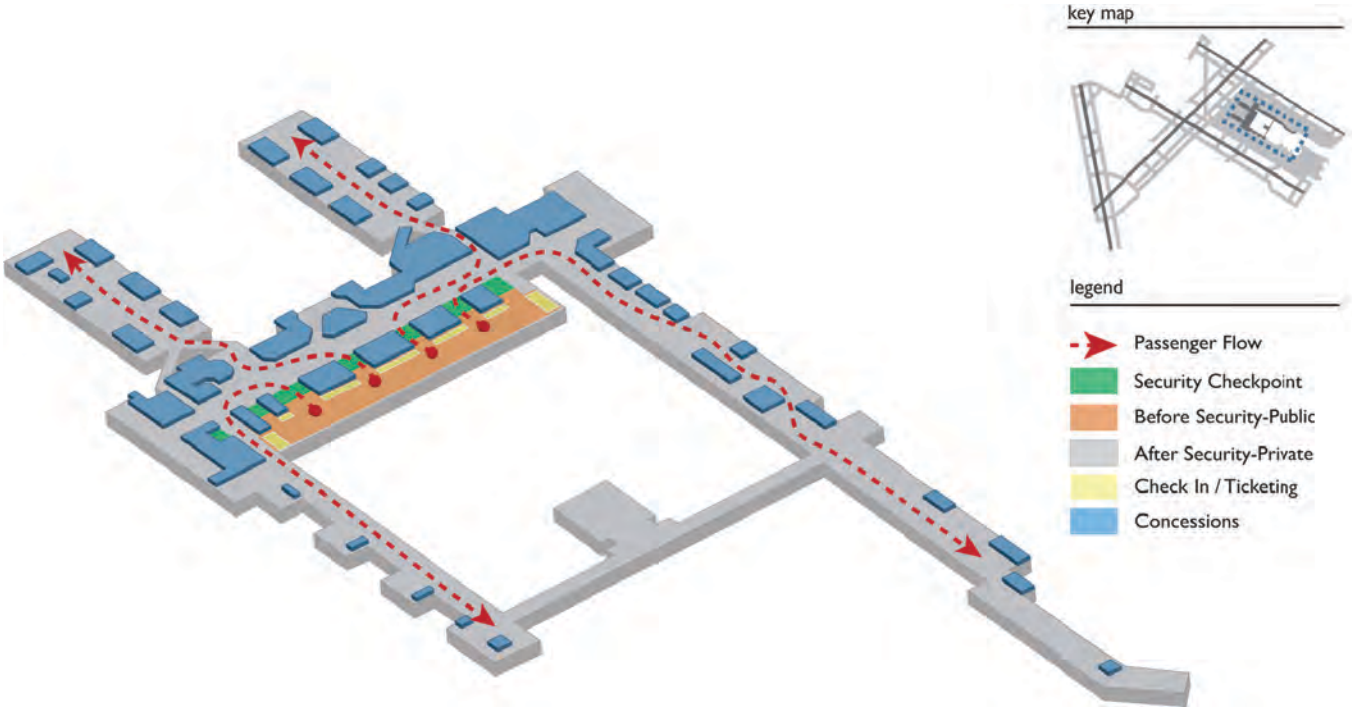


Figure 3.8. Minneapolis–St. Paul International Airport.

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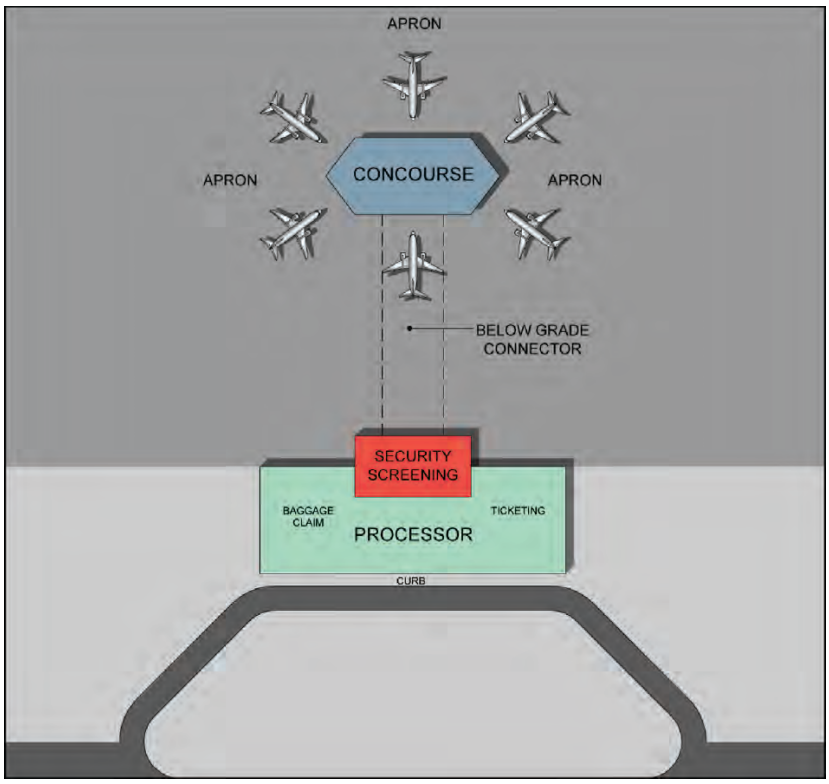
as a headhouse terminal) via an APM or moving walkways either in an underground tunnel or elevated as a bridge to allow aircraft taxiing. The satellite building contains all airside components, including holdrooms and aircraft gates, and is typically surrounded on all sides by aircraft. The main advantage of the satellite terminal concept is improved maneuverability on the airside. Another advantage is that the terminal processor and satellite concourse(s) can expand or be remodeled independently without affecting one another's operations. This independence allows additional satellites or additional passenger processing areas to be constructed with minimal impact to existing operations. Additionally, the satellite configuration allows aircraft to use the full linear frontage of the structure because there are no attached landside structures. Figure 3.9 depicts an example of a satellite terminal concept.

This configuration lends itself to the development of concession nodes at the APM or tunnel connections along each satellite concourse. The central APM nodes correspond with the flow of the majority of the passengers passing through the terminal(s), maximizing the number of passengers moving into and through the concession areas. For concession operators, this increase in passenger footfall typically translates to increases in sales, which ultimately results in higher revenue to the airport operator.

Examples of satellite concepts include Orlando International (MCO), ATL, DEN, Terminal 1 at ORD, and Terminal 3 at CVG. From the airport case study research, PIT, shown in Figure 3.10, is an example of a satellite concourse configuration.



Source: "Considerations for Selecting a Terminal Configuration," David A. Daileda, FAIA, FAA White Paper.

Figure 3.9. Satellite terminal concept.

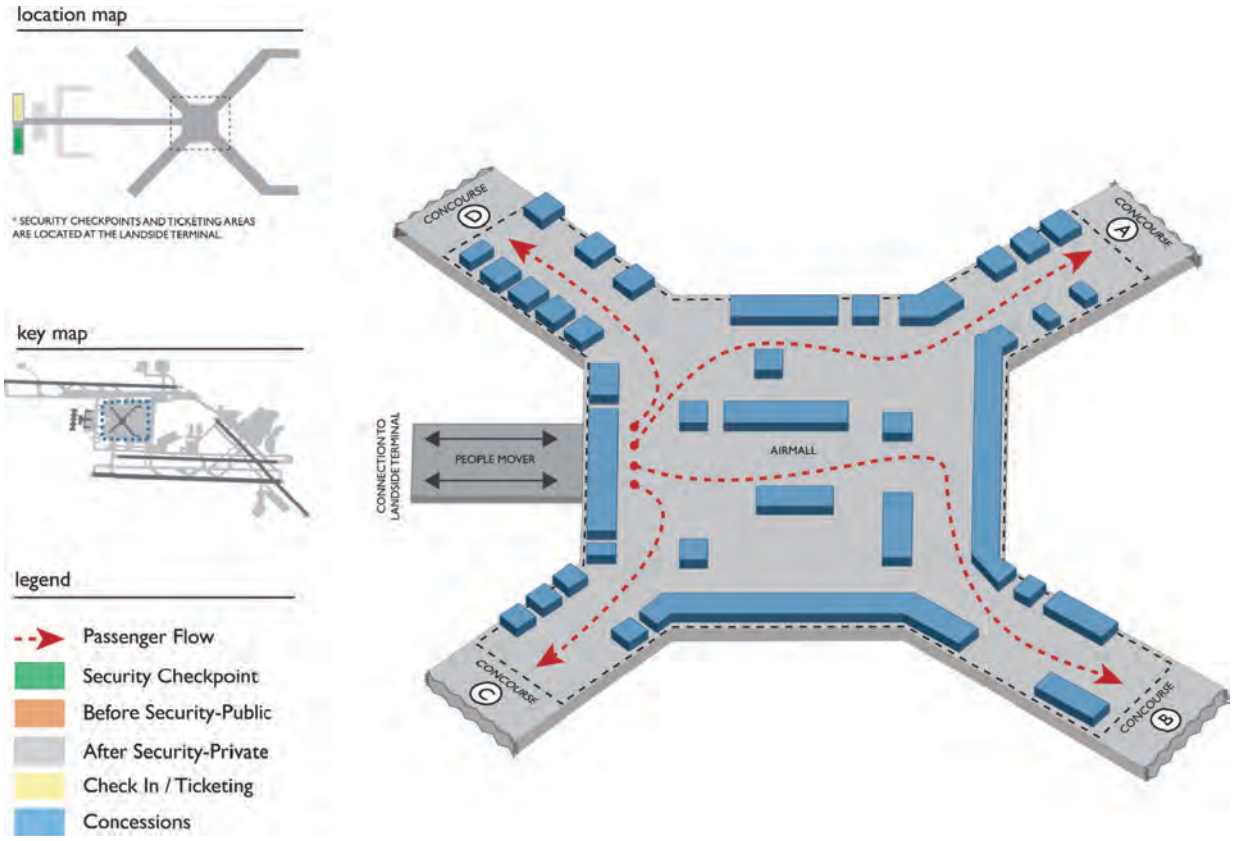


Figure 3.10. Pittsburgh International Airport.

3.4 Aircraft and Passenger Considerations

It is important that non-aviation revenues from concessions be taken into consideration from the outset when developing a new terminal or renovating an existing terminal. However, for a new greenfield terminal, some primary aspects of airport terminal planning must occur prior to planning for in-terminal concessions. Any new terminal planning effort must initially identify the best location for the terminal in relationship to the airport's airfield configuration and landside access system. In particular, the taxiways and taxilanes that serve the terminal apron and the configuration of an efficient aircraft parking plan set the beginning framework for the terminal project.

An appropriate time to consider the placement of in-terminal concessions begins when the most viable terminal aircraft parking plans have been determined, and when the most logical location has been identified for where arriving passengers depart the airport by various modes of ground transportation. With the general location of the private and commercial vehicle curbs, and parking and transit system station locations identified, planners and designers can begin to depict the primary paths of travel between the various modes of ground transportation and the aircraft gates at the terminal. While concession placement may not be the primary criterion in determining the selection of a preferred terminal configuration, it should be a major consideration even at this very early stage.

3.4.1 Aircraft Apron and Taxiway/Taxilane Factors

A major step in determining the size and configuration of a new terminal begins with an understanding of the number of passengers and aircraft that are forecast. The number of aircraft gates and the size of the terminal facilities are based on these demand forecast parameters. Annual and peak-hour passenger and aircraft operations forecasts for the 10- and 20-year horizons are typically needed to determine the number and size of aircraft likely to serve the airport at peak times in the terminal's future. As the terminal's aircraft parking plan begins to take shape, the groupings of aircraft and their passenger capacities associated with a particular configuration will begin to set the quantitative and spatial requirements for the primary pedestrian corridors and other critical airside-related functional spaces, such as passenger holdrooms, restrooms, and just as importantly, the size and locations of concession offerings to satisfy airport customers.

It is usually the aircraft parking plan that begins to define the boundaries and configuration of the terminal and its concourses. Due to the limited maneuverability of commercial aircraft and the required FAA dimensional criteria for airfield taxiways and taxilanes and their relationship to the airport's runways, the development of the aircraft parking plan is most often one of the first steps taken once the runway system and its associated taxiways are identified. Various aircraft terminal parking plans are usually explored in coordination with developing the supporting terminal curbs, access roadways and transit rails that connect to the regional transportation network. In some cases, the location of an existing transit or roadway system greatly affects the configuration of a new terminal complex, but typically the airside requirement dictates the most feasible terminal configuration that works effectively with the airport's runway system.

It is during this stage of terminal concept planning that the rough planning of concession sizes and locations should initially be considered.

3.4.2 Passenger Movement Considerations

The pathway that departing passengers take through the terminal is one of the key determinants in the success or under-performance of a concession program. Passenger footfall on pathways that lead through (as is the case in some flow-through duty-free shops) or in front of a concession

offering is one of the key terminal plan and design attributes that can increase concession revenue. Concurrently, there are critical passenger satisfaction and convenience factors that must be considered. These LOS factors include minimizing passenger walking distances; avoiding, wherever possible, transitioning levels particularly where passengers are still in possession of their bags; providing adequate wayfinding and navigation aids; and minimizing wait times. There is also an advantage to the concession program that passengers can lighten their load by checking their bags so that they are less burdened when they go to shop or dine.

Even at the early stages of planning a new terminal facility, there are significant differences between where concessions can be located within the basic, generic terminal concepts that are typically considered when exploring a new terminal development. Additionally, when generic terminal concepts are developed to reflect the specific demand-driven facility requirements to work with site-specific geometry, passenger LOS factors affecting customer satisfaction, such as passenger volumes, circulation, walking distances and wayfinding, need to be considered.

3.4.2.1 Passenger Circulation and Volumes

From the outset of determining the appropriate airside and landside configuration for a new terminal development, there are inherent attributes of the generic terminal concept types—linear, pier, and satellite—and their relationship to concession revenue generation. As described previously, the size of the passenger operation and mission of the airlines serving the airport assists in identifying which of the generic terminal types is the appropriate place to begin planning a new terminal development. Once the aircraft gate requirements have been identified in relationship to the passenger volumes in the peak hour along with the mission of the airlines serving the airport, a decision can be made about how aircraft gates and passenger activity can best be accommodated within the framework of a single terminal or a multiple unit terminal planning strategy.

From a concession revenue perspective, it is usually preferable to try to process all of the departing passenger traffic through one facility rather than dividing the traffic between terminals, since this approach consolidates 100 percent of the departing passengers into a single facility. The consolidated approach has the advantage of exposing the entirety of the departing passenger footfall past the concession offerings without duplicating concession spaces, as is the case with a decentralized approach with multiple unit terminals. There are certainly many other factors that come into play, such as the airlines' missions and the sheer volume of passengers processed through a single terminal. Many of today's single mega-terminals can accommodate upwards of 50 to 60 MAP depending on the mix of O&D and connecting passengers.

These LOS factors include the potential of the perception of longer wait times, additional anxiety from seeing larger security screening queues regardless of how quickly the line may move, and potentially longer walking distances associated with the larger scale of a single mega-terminal complex aircraft gate layout.

Many of the operational challenges from a large-scale single terminal can be overcome by careful planning and design that simulates smaller components within a large-scale facility. For example, using shorter, multiple concourses verses a long, single pier and the incorporation of people mover devices such as APMs and moving walkways can assist in reducing walking distances. By subdividing the security screening process into smaller queues rather than a single SSCP large queue, passengers' perceptions and perceived wait time can be improved, reducing anxiety. A long queue results in increased perception of wait time regardless of how quickly the queue may actually be processed, so subdivided queues counterbalance this.

All of these potential solutions to the scale of the facility are valid approaches in maintaining a goal of 100 percent passenger footfall for the concession program accomplished by maintaining a

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single-terminal approach. However, it should be understood that the decision regarding the type of terminal concept brings with it certain innate performance characteristics relative to passenger volumes, enplaning passenger splits, and walking distances that are presented in the following section.

3.4.2.2 Passenger Circulation and Volume Characteristics of Generic Terminal Concepts

When planning and designing new terminals, the initial decision of which generic type of terminal concept is the most appropriate to use carries with it certain facility operating and performance characteristics related to the concession program. This result can best be illustrated by showing simplistic terminal planning examples of three generic concepts: linear, pier, and satellite. These examples assume theoretical baseline parameters as well as lessons learned from the case study airports and other existing terminal facility examples.

To understand the inherent passenger circulation and volume characteristics associated with the linear, pier, and satellite generic terminal concepts, the principles are depicted in Figure 3.11 by using a simple example of a small, 10-gate pier terminal. For purposes of this and subsequent examples, all aircraft are assumed to carry the same seating capacities and load

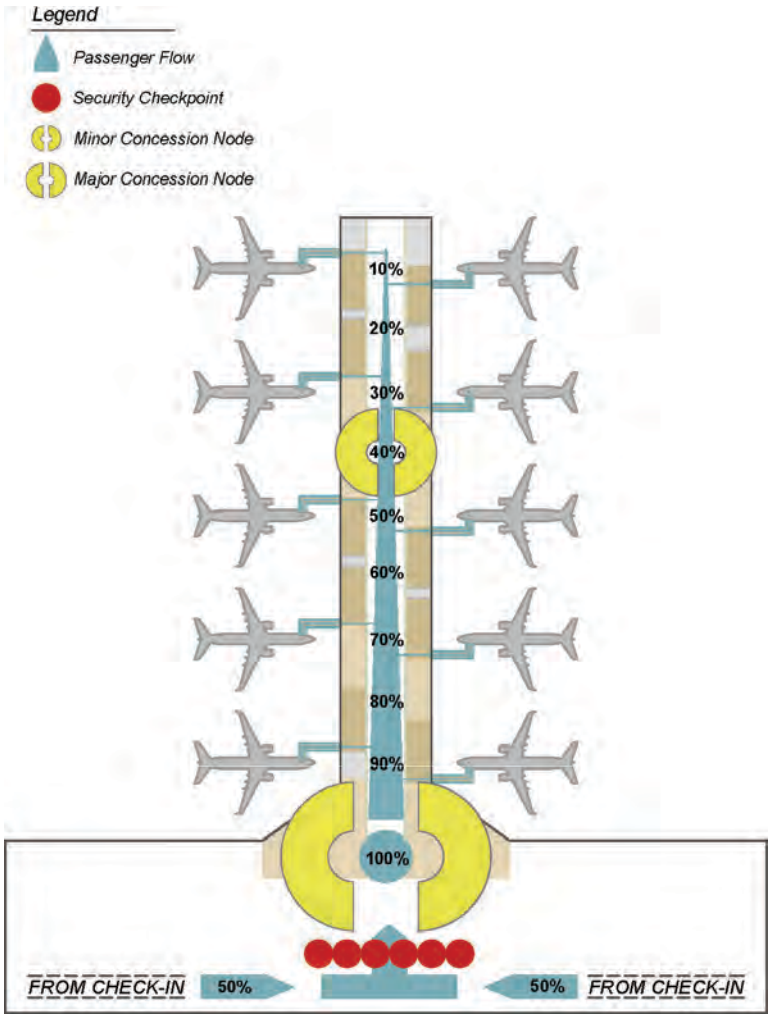

Figure 3.11. Single-pier, 10-gate terminal example.

factors of a typical narrow-bodied aircraft, a Boeing 737-800. This example shows five primary inherent characteristics:

- **Single footfall path:** There is a single passenger corridor for departures in a single path direction.
- **Wayfinding decision points:** This single-pier concept represents the simplest of passenger wayfinding options since enplaning passengers have only one pathway to follow in a straight-ahead direction in order to reach their departing aircraft.
- **100 percent footfall through a major concession node:** With a single, consolidated path of travel, 100 percent of the O&D passengers processed through a single SSCP are exposed to a major node of concession offerings prior to reaching the initial aircraft gate on the pier concourse.
- **Diminishing exposure to concession offerings:** As enplaning O&D passengers head out to the holdrooms for the aircraft gates of the double-loaded pier, there is a continuous diminishing of the volume of passengers along this footfall path until passengers reach the last aircraft parking positions. A typical concession location strategy is having a major concession node with the opportunity for concession offerings to be viewed by 100 percent of the O&D traffic and then positioning a minor node(s) of concessions that will be exposed to some percentage of the O&D passengers.
- **Finite capacity and walking distance characteristics:** This single, 10-gate pier example has a maximum passenger walking distance to its farthest gate of over 820 feet with an average walking distance of nearly 520 feet. At an 85 percent load factor with an average of 1.5 turns per gate and an assumed average seating capacity per aircraft of 165, a generic peak-hour enplanement capacity of this single, generic pier concept is approximately 2,100 passengers.

To gain an understanding of how the three generic terminal types—linear, pier, and satellite—compare to these inherent characteristics when examining a slightly larger scale of operation, the following examples focus on a 20-gate terminal. Each generic example assumes identical baseline parameters, including using the Boeing 737-800 seating capacity; each example also assumes an 85 percent load factor. Further assuming an average of 1.5 turns per gate and an average seating capacity per aircraft of 165, the peak-hour enplanement capacity for all examples is approximately 2,100 passengers. Another baseline parameter is that each generic configuration uses wingtip-to-wingtip clearances of 25 feet and allows for a concourse width sufficient for passenger circulation in both directions. Similar to the previous 10-gate pier example, Figures 3.12, 3.13, and 3.14 show the three generic terminal concepts and the effects on passenger circulation, wayfinding, footfall, and capacity based on these 20-gate aircraft parking configurations and a typical approach of developing major and minor concession nodes.

20-Gate Linear Terminal Concept. This example shows the inherent operational and performance characteristics of a 20-gate, linear terminal concept. Two separate pathways are created just beyond the SSCP, so that an enplaning passenger is immediately confronted with a wayfinding decision to move either right or left. This arrangement allows a major concession node to be developed that has 100 percent of the O&D passengers coming through its concession offerings immediately past the single SSCP. As enplaning O&D passengers head out to the holdrooms for the aircraft gates of the single-loaded concourses, there is a continuous diminishing volume of passengers along this footfall path to the end aircraft parking positions. Additionally, there are opportunities for minor concession nodes at the corners of the two concourses, maintaining a line-of-sight connection to the farthest gates. These additional nodes capture passengers who may bypass the major concession node or those passengers waiting in nearby holdrooms. This configuration allows passengers to visit concessions while maintaining a visual connection to their holdrooms, reducing passengers' concerns that important boarding announcements or procedures might be missed.

A typical concession location strategy is based on having a major concession node with an opportunity to be viewed by 100 percent of the O&D traffic and then positioning minor nodes of concessions to be exposed to some percentage of O&D passengers. This 20-gate linear terminal

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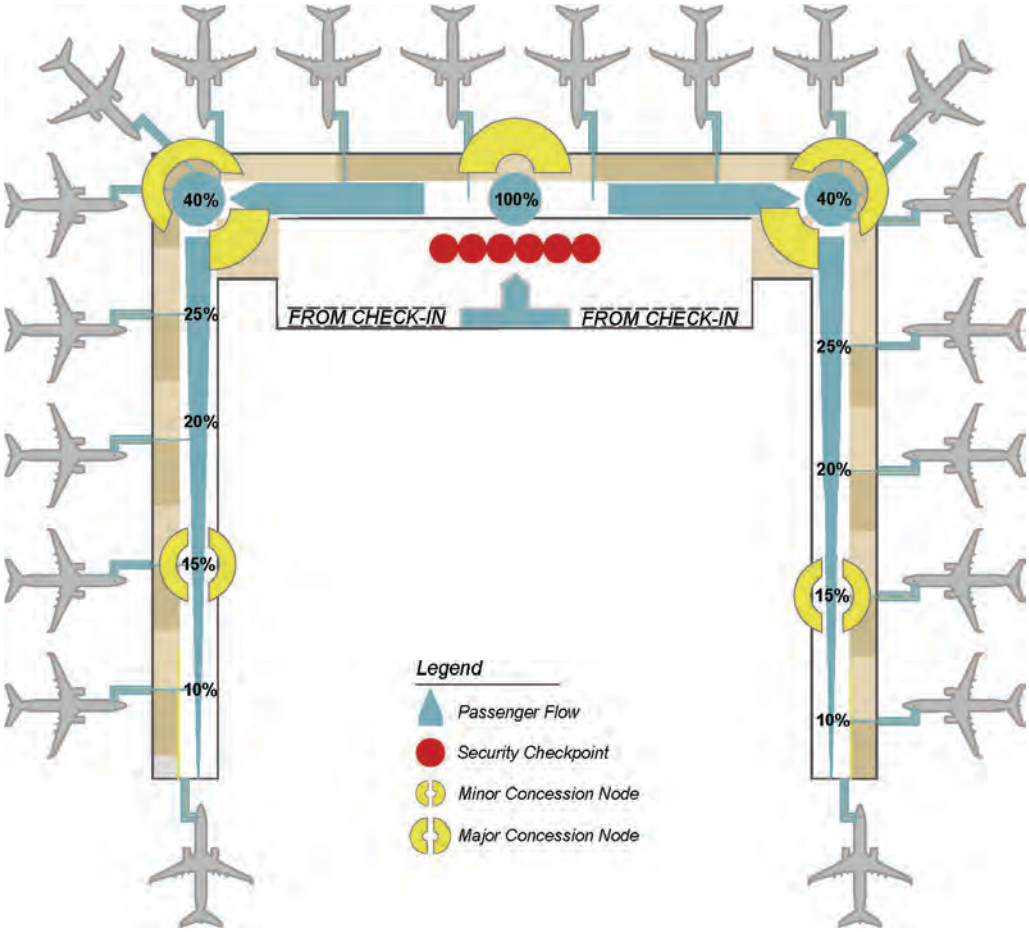

Figure 3.12. 20-gate linear terminal example.

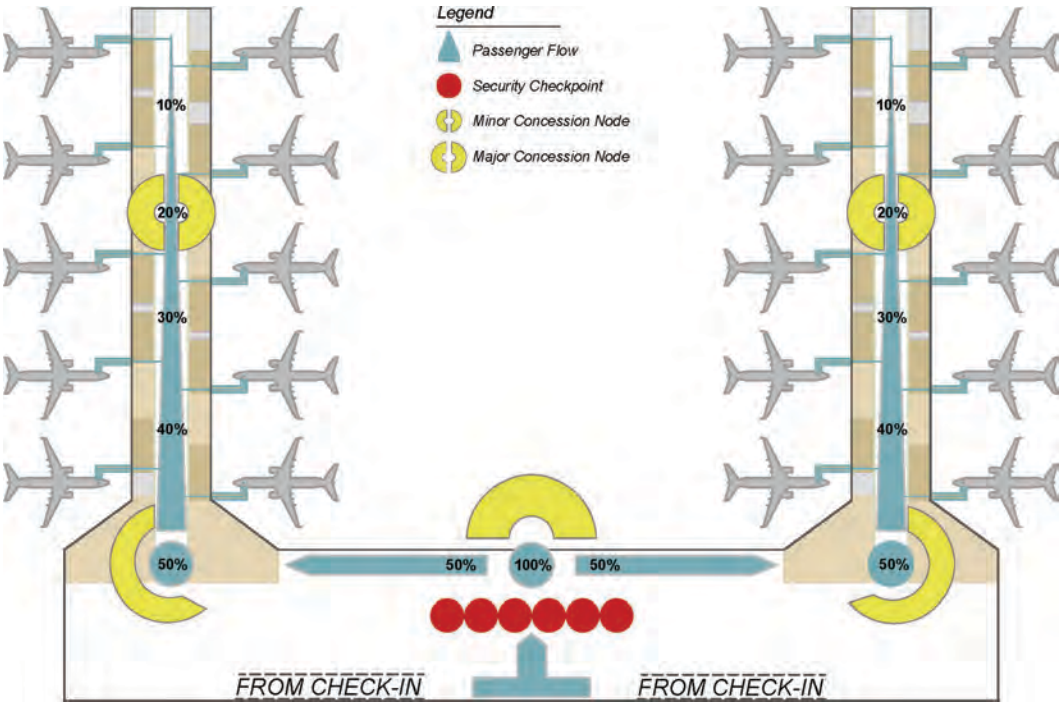

Figure 3.13. 20-gate, dual-pier terminal example.

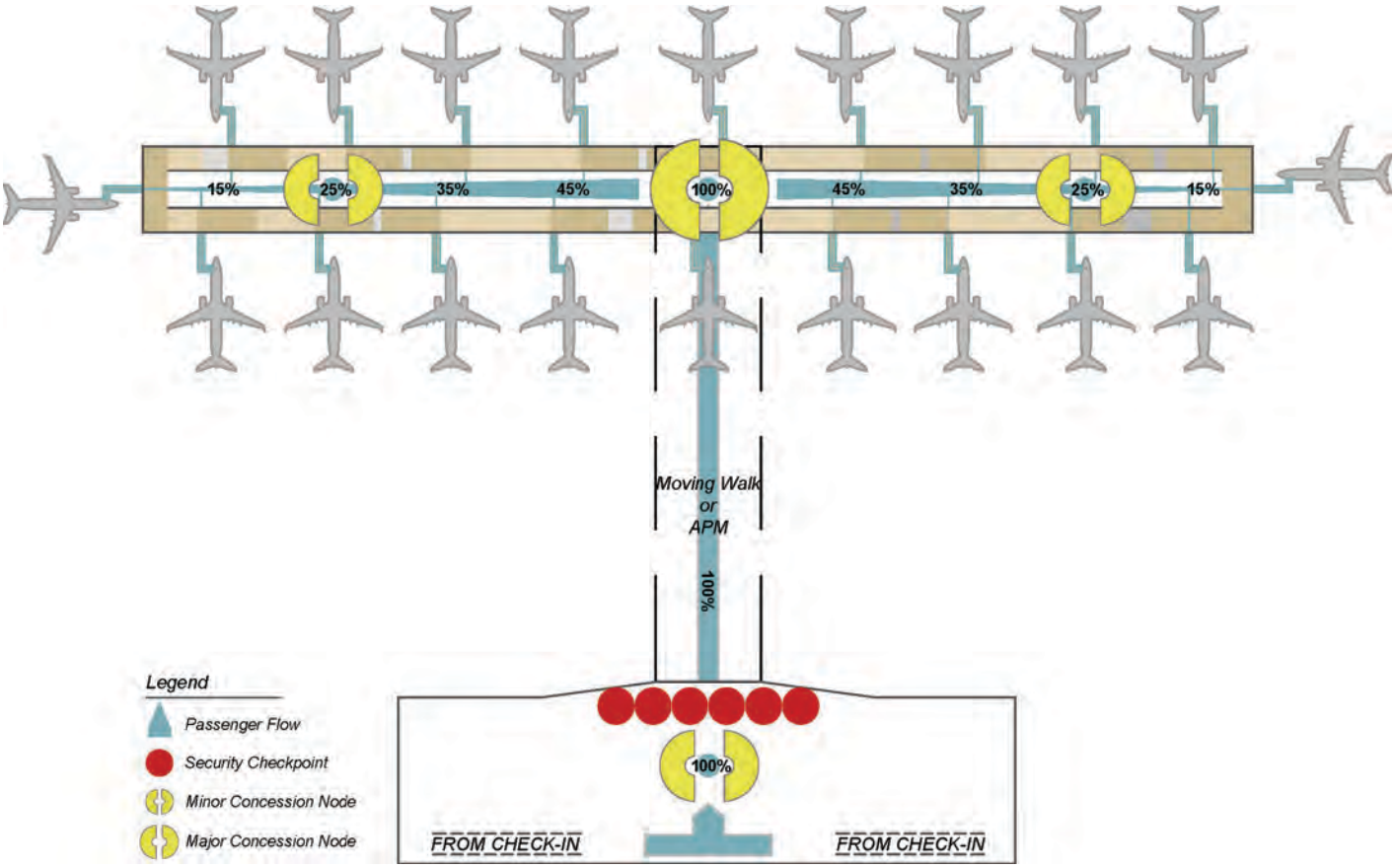

Figure 3.14. 20-gate headhouse terminal with satellite example.

concept has a maximum passenger walking distance to its farthest gate of almost 1,320 feet with an average walking distance of 755 feet.

20-Gate, Dual-Pier Terminal Concept. Figure 3.13 shows several inherent operational and performance characteristics of a 20-gate, dual-pier terminal concept. As previously mentioned, this example assumes that all 20 aircraft carry the same seating capacities and passenger load factors.

A dual-pier configuration is illustrated since the accommodation of 20 gates in a single pier would result in long walking distances for passengers. Separate pathways are created just beyond the SSCP, requiring an immediate decision from the enplaning passenger to move either right or left. This dual-pier configuration allows a major concession node to be developed that 100 percent of the O&D passengers pass through just past the SSCP. While similar to the linear concept in the way the passenger traffic is divided, the arrangement of gates is slightly different because passengers would need to walk a bit farther before reaching the nearest gate. As enplaning O&D passengers head out to the holdrooms for the aircraft gates of the double-loaded concourses, there is a continuous diminishing volume of passengers along this footfall path to the end aircraft parking positions. Additionally, there are opportunities for minor concession nodes at the corners and midpoints of the two pier concourses, maintaining a line-of-sight connection to the farthest gates. These additional nodes capture passengers who may bypass the major central concession node or those passengers waiting in nearby holdrooms. This configuration allows passengers to visit concessions while maintaining a visual connection to their holdroom, reducing passenger concerns that important boarding announcements or procedures might be missed.

The concession location strategy for this particular concept has a major concession node with an opportunity to be viewed by 100 percent of the O&D traffic and then smaller minor nodes of

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concessions that will each be exposed to some percentage of O&D passengers. This 20-gate, dual-pier terminal concept has a maximum passenger walking distance to its farthest gate of just over 1,300 feet, with an average walking distance of 1,000 feet.

20-Gate Satellite Terminal Concept. Figure 3.14 shows several inherent operational and performance characteristics of a 20-gate satellite terminal concept. There are no aircraft gates at the main terminal headhouse building. While some minor landside concessions can be provided at the landside terminal, the majority of the concession program will be situated airside. The satellite terminal concept requires some type of people mover device, either an APM or moving walkways, in order to maintain a reasonable LOS since the walking distances are longer in this concept unless an APM is utilized.

The wayfinding in the satellite terminal concept is fairly straightforward with enplaning passengers traveling in a single straight-ahead direction from the terminal, but once passengers arrive at the satellite concourse they must decide to head right or left to reach their gate. This arrangement does allow a major concession node to be developed at the APM transit point at the center of the satellite concourse that is exposed to 100 percent of the O&D passengers destined for that concourse. Similar to other generic terminal types, as enplaning passengers head out to the holdrooms for the aircraft gates on the double-loaded satellite concourse, there is a continuously diminishing volume of passengers along this footfall path to the end aircraft parking positions.

The concession location strategy for this particular concept has a major concession node with an opportunity to be viewed by 100 percent of the O&D traffic and minor nodes that are exposed to some percentage of the enplaning passengers. This 20-gate satellite concourse terminal concept has a maximum passenger walking distance to its farthest gate of 688 feet, with an average walking distance of 890 feet.

A comparison of the inherent characteristics relative to passenger satisfaction and concession node opportunities based on a 20-gate capacity for the three different generic terminal concepts—linear, dual pier, and satellite—is shown in Table 3.3. While there can be variations on the physical geometries that are developed during the planning and design of such concepts, in general some conclusions can be summarized. Within the context of a greenfield development at a 20-gate capacity, the linear concept yields the shortest minimum and average walking distances and times along with similar concession node opportunities when compared to the other two generic options of the dual pier and satellite without an APM system. If capital cost is not the driving factor, a satellite concept with an APM significantly cuts down walking distances and travel times, but does add two vertical transitions down and up from an underground APM tunnel. The comparison shows that even when deciding which generic terminal concept to address an airport's demand forecast and mission, there are inherent characteristics significant to the opportunities to maximize concession revenues and increase customer satisfaction. These characteristics affect the operational and capital costs as well as the non-aeronautical revenue potential of the planned and designed terminal facility.

3.4.3 Variation on Generic Types

From a concessions revenue perspective, having a single terminal processing building that consolidates passenger footfall into a concentrated flow that passes by or through the majority of an airport's concession offerings should be considered as the first option whenever practical. Conversely, concentrating all passenger activities can be perceived by some passengers as adding undesired walking distances and larger volumes of passengers in security screening lines.

The lessons learned from MCI illustrate the differences in concessions revenue and SSCP staffing between a single terminal processor and multiple unit terminals. In Kansas City in 1972, an innovative approach to terminal processing, the "Drive to Your Gate" concept, placed

Table 3.3. Comparison of 20-gate generic terminal concepts.

Performance Factors	Linear	Dual Pier	Satellite	
			With APM	Without APM
Passenger Satisfaction				
Walking Distances (ft)				
• Minimum	265	700	175	720
• Maximum	1,315	1,305	790	1,340
• Average	755	1,000	530	1,075
Time to Reach Gate (min)				
• Minimum	1.2	3.2	1.0	3.3
• Maximum	6.1	6.0	3.9	6.2
• Average	3.5	4.6	2.6	5.0
Vertical Transitions	0	0	2	2
Concession Nodes				
Major Nodes (pax %)	3 (100%, 40%, 40%)	3 (100%, 50%, 50%)	1 (100%)	1 (100%)
Minor Nodes (pax %)	2 (15%, 15%)	2 (20%, 20%)	3 (100%, 25%, 25%)	3 (100%, 25%, 25%)
Cost Factors				
Footprint Size (sq ft)	159,000	151,000	169,000	169,000
Requires APM	No	No	Yes	No
Escalators/Elevators	No	No	Yes	Yes

aircraft gates only 75 feet from the arrivals and departures curbs of a single-level terminal facility, depicted in Figure 3.15, and consisted of three separate and virtually identical unit terminals.

When the FAA mandated the security screening of all departing passengers in 1973, this design concept became functionally flawed right after the facilities opened. The inflexibility of the limited 75-foot depth between the aircraft gates of the poured-in-place concrete terminal and the roadway curbs bordered by close-in parking garages made installation of SSCPs and basic customer services such as restrooms and concessions on the airside of security problematic. This limited depth and the linear configuration of the gates necessitated installing 14 different SSCP locations with multiple passenger screening devices associated with no more than two or three gates distributed throughout the three unit terminals as shown in Figure 3.16.

The operational impacts of this distributed security screening are significant. The staffing of the three unit terminal SSCPs at MCI exceeds the staffing required at all three Port Authority of New York & New Jersey airports—JFK, Newark Liberty International Airport (EWR), and LGA—combined. This staffing level requires an enormous ongoing operational cost from the airport operator. From a concession revenue perspective, the three unit terminals have limited opportunities. These limitations are due to the decentralized concessions caused by the limited post-security airside depth and dispersed gate locations. This terminal layout results in the duplication of many concessions and provides limited passenger footfall, resulting in very poor sales per passenger and reduced revenue to the airport operator for an airport of MCI's traffic volume. As a result, passenger services are virtually non-existent downstream of the SSCP in the gate areas. In some gate locations, no or undersized restrooms are available. To reach retail shops, restaurants, newsstands, ATMs and other passenger services not readily available in these secured holdroom areas, passengers must exit these secure areas and be re-screened upon re-entering the holdroom.

Forty years after construction, MCI is a medium hub airport serving 5.1 million annual enplanements in 2012 with 7.2 million annual enplanements projected in 2030. The three existing unit terminals are currently being evaluated and a single new terminal complex is being considered

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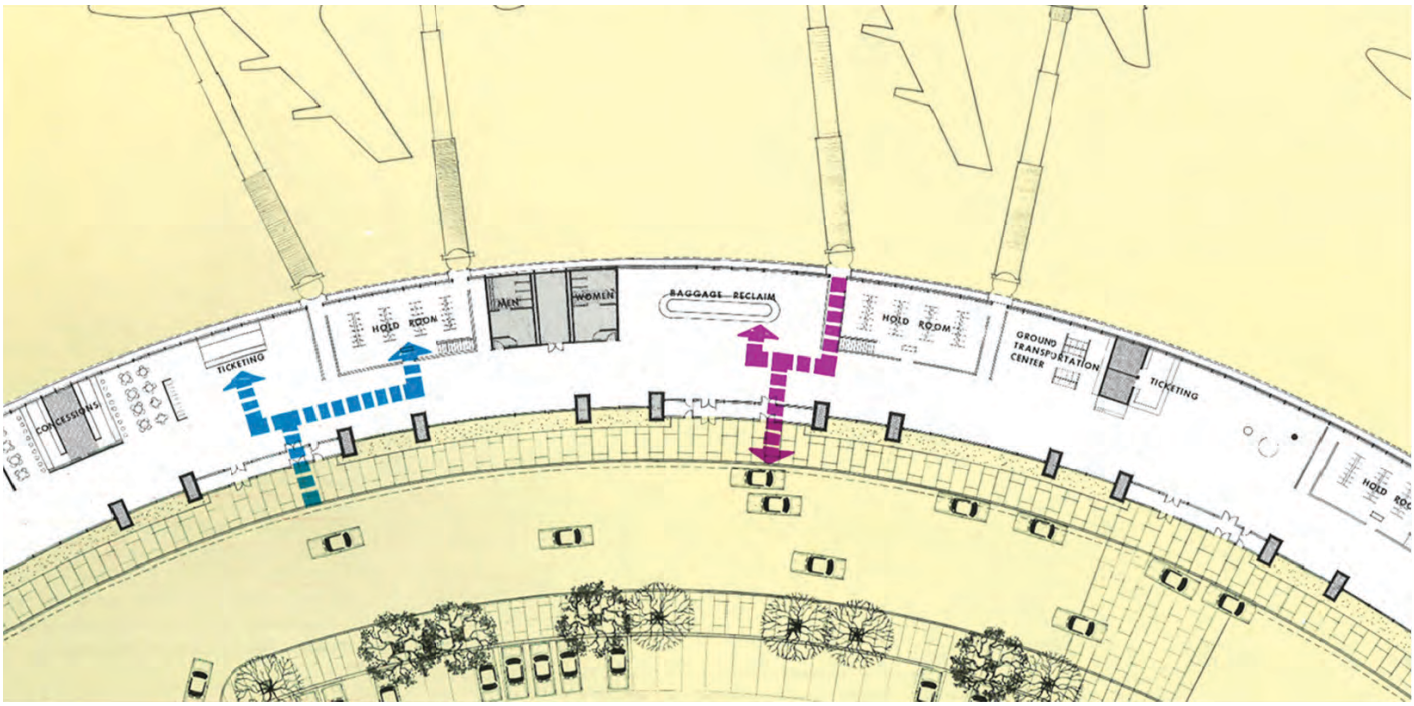


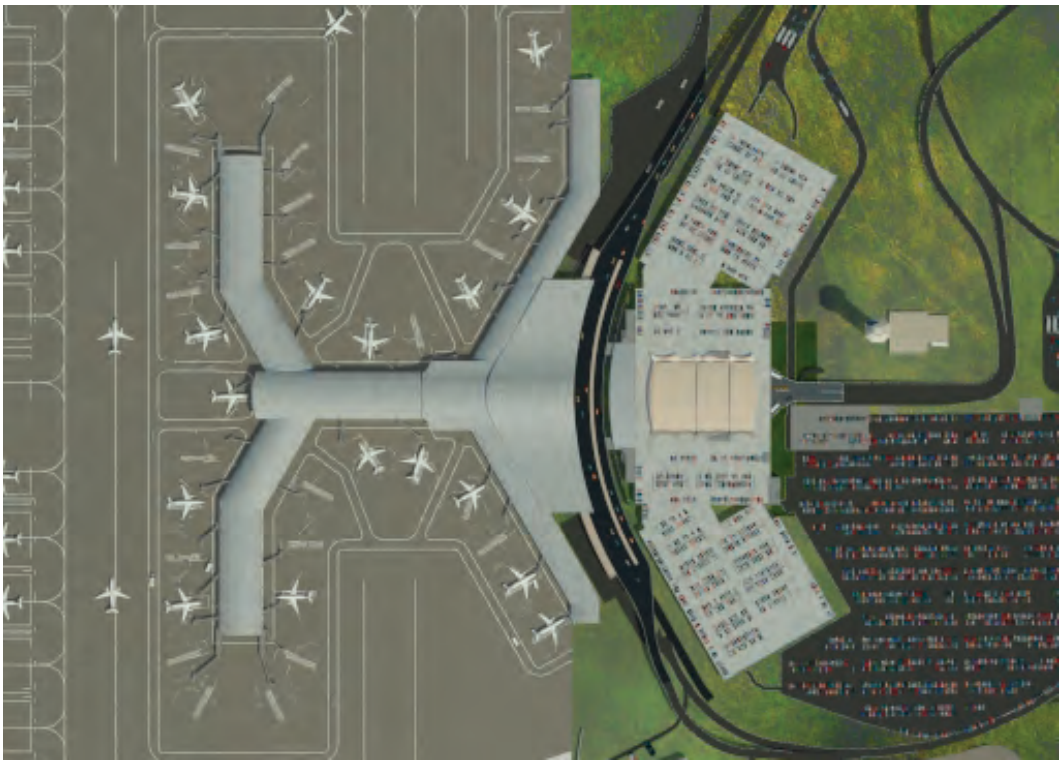
Source: Courtesy of Kansas City Aviation Department

Figure 3.15. Kansas City International Airport terminal floor plan.

as a replacement. A single unit terminal concept is being considered because it could help reduce airport operating costs, increase concessions revenues and enhance customer satisfaction by increasing the number of concession offerings to a larger, concentrated flow of passengers through a single, consolidated terminal facility. A recent industry planning study identified as a potential replacement a hybrid terminal concept consisting of a double-loaded pier configuration that mimics the "X" shape of PIT combined with a linear terminal with frontal gates. This hybrid, shown in

Source: Courtesy of Kansas City Aviation Department

Figure 3.16. Kansas City International Airport unit terminals and SSCP.



Source: Kansas City Aviation Department and Landrum & Brown

Figure 3.17. Proposed terminal for Kansas City International Airport.

Figure 3.17, would consolidate the passenger and aircraft operations from the existing three unit terminals into a single replacement terminal to be built on the current location of Terminal A.

3.4.4 Customer LOS Factors

The most critical LOS factors include passenger walking distance, number of level transitions, quality of wayfinding and navigation aids, and amount of wait times. The least important LOS factor is passenger density within the terminal. As discussed in Section 3.4.4.5, studies have shown that passengers rarely mention passenger density as a significant factor in overall LOS when compared to other critical LOS factors.

3.4.4.1 Walking Distances

Long walking distances are often a negative influence on passenger LOS. The relationship between long walking distances and poor LOS is due to passenger anxiety, fatigue, and wayfinding challenges. From passengers' perspective, as walking distances increase, there is an associated concern that they will not be able to find or reach their gate in time for their flight's departure. In addition, some passengers may find it too physically demanding to walk extended distances without assistance. Existing airports may install moving walks or APM systems to reduce the impact of long distances between passenger processing and aircraft gates.

APMs and moving walkways are used by airports to reduce passenger walking distances and to reduce overall transit times, typically between passenger security screening and aircraft holdrooms. When implementing these systems, it is important to understand how the location affects concession revenue. When positioning moving walkways, planners should ensure that concessions are strategically located in between the end of one moving walk and the beginning of the next moving walk. This configuration ensures that passengers have an opportunity to stop at concessions while

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fully utilizing the moving walkways. If concessions are placed adjacent to moving walkways, passengers may decide to bypass these concessions entirely, reducing concession sales and revenue.

APM systems typically link unit terminals or link a passenger headhouse to satellite concourses. Concession nodes can be strategically placed around the APM stations. This positioning allows concessions to capitalize on the concentrated passenger volumes entering and exiting the APM system. An example of this positioning is PIT, where a major concession node located within the center of the satellite concourse is positioned near the APM system that links the satellite concourse to the terminal headhouse.

3.4.4.2 Level Changes

One of the key factors in providing a higher overall LOS is the reduction in passengers' vertical transitions from one level to another. By minimizing the number of vertical transitions, passengers are relieved of having to walk up or down stairs or transition to and from an elevator or escalator. Minimizing vertical transitions also eliminates major wayfinding decision points about whether to change levels or not.

Minimizing vertical transitions is especially important when planning the placement of concessions. In some airports, due to constrained spaces, concessions are forced onto mezzanine levels above the regular passenger circulation level, requiring vertical circulation to access the concessions. Mezzanine-level concessions are less accessible and less visible to passengers, typically reducing potential sales when compared to concessions located on the same level as passenger circulation. The implication of this issue is demonstrated at one of the case study airports, BUD, where extra signage on the glass railings of the mezzanine levels is used in an attempt to entice passengers from the departures level to the upper-level food court.

3.4.4.3 Wayfinding and Navigation

Airport operators can reduce passenger stress levels by providing adequate wayfinding and navigation aids. This provision may include maps, help desks, adequate signage, and clearly marked gates and other passenger areas. Proper wayfinding allows passengers to reach their destination easily, resulting in an overall improvement in passenger mood and confidence. This improvement in passenger mood ultimately translates to a higher overall LOS when passengers are able to navigate through the terminal environment without worry of getting lost or missing their flight.

3.4.4.4 Wait Time

ACRP Report 55: Passenger Level of Service and Spatial Planning for Airport Terminals found that passenger LOS is most impacted by wait times, particularly in ticketing, security screening, and baggage claim. Wait times that were 25 minutes or less were generally accepted by passengers and did not necessarily have a major impact on their overall perception of LOS.

3.4.4.5 Passenger Density versus Other LOS Factors

The traditional approach to planning airport terminals revolves around the concept of LOS. LOS was originally derived from John J. Fruin, Ph.D., in his book *Pedestrian Planning and Design* (the revised edition published in 1987, and then adapted for use in terminal planning by the International Air Transport Association [IATA] in its *Airport Development Reference Manual*, the 9th Edition effective January 2004). LOS determines how much space is needed per passenger to achieve a perceived threshold of comfort based purely on the personal space remaining around a passenger under varying degrees of crowd density. The IATA LOS standards are broken down into multiple levels, A, B, C, D and E. In the majority of planning studies in the United States, a LOS of C as defined by IATA is generally the accepted minimum standard. While the use of

spatial LOS is generally a universally accepted standard for terminal design, IATA-based LOS has many limitations. It does *not* consider passenger wait time, passenger stress levels, amenities, or wayfinding. The main limitation of the spatial LOS measurement is that it only considers passenger density to determine passenger satisfaction or comfort. Due to this limitation, researchers have studied other ways by which to measure, improve, and plan for increasing passenger satisfaction for factors that are unrelated to density.

ACRP Report 55: Passenger Level of Service and Spatial Planning for Airport Terminals examines ways to measure LOS and to develop LOS guidelines based on real-world passenger experiences. The *ACRP Report 55* research team conducted passenger observations, surveys, and in-person interviews, which allowed them to determine specific passenger stress level and discomfort triggers.

ACRP Report 55 research found that passengers do not actually recognize density as a primary factor in their overall recognition of LOS. This finding contradicts the industry belief that there is a direct correlation between a passenger's perception of LOS and the physical space that the individual occupies. This perceived correlation has been the underpinnings of the IATA LOS methodology, which only uses a single factor—passenger density. *ACRP Report 55* research found that factors such as walking distance, signage/wayfinding, and flight information played a significant role in LOS. Terminal facilities with short walk times and better signage generally resulted in a higher LOS (*4*). *ACRP Report 55* found that other amenities were also important to passengers, such as Wi-Fi access, electrical outlets, and the availability of concessions.

Interviews helped determine an important finding in the study: passengers who feel more in control of their experience at the airport rate that experience as a higher LOS. This finding implies that if passengers are able to confidently predict wait times, walk times, and other passenger processes, then they are generally more comfortable and experience lower levels of stress. This result shows that minimizing passenger wait times and developing intuitive wayfinding signage results in a higher level of customer satisfaction, while simultaneously increasing the time available for passengers to engage in the concession program (*4*).

ACRP Report 55 is not the only evidence that space is not the primary driver of a passenger's LOS. In 1991, a study published by Seneviratne and Martel, titled "Variables Influencing Performance of Air Terminal Buildings," also determined that space was not the primary factor in passenger LOS. Based on passenger interviews and surveys, Seneviratne and Martel determined that information, number of available seats, and wait time were the most important factors affecting a passenger's LOS. This finding lends additional evidence that availability of space is not the sole determinate of LOS. In fact, overall spatial density was a factor for less than 10 percent of passengers (*5*).

ACRP Report 55 concludes that passenger density is *not* a primary factor in LOS and that designing beyond LOS C based on IATA standards is *not* as beneficial as previously considered by the industry at large. Planning and designing to reduce wait time, improve passenger awareness, better wayfinding, and providing amenities are the real keys to increase passenger LOS and hence overall passenger satisfaction.

3.5 Planning for Concessions in the Terminal Environment

As described in Section 3.4, Aircraft and Passenger Considerations, the primary drivers of the configuration for the terminal processor and concourses are a function of an efficient aircraft parking plan and convenient access to and from aircraft gates by passengers. It is so early in the planning phase of the aircraft and passenger framework that the concession program must be considered and integrated to maximize the opportunity to generate sales and revenue while simultaneously achieving a high level of passenger convenience and overall customer satisfaction.

This process of integrating the location and size of concession offerings into the passenger flow network is both science and art. As discussed in Chapter 4, Human Engineering Considerations,

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much of the science involved in integrating a concession program into the plan and architecture of the building focuses on the "consumption behavior" of the customer. In most cases, this focus is on the departing airport passengers and their movement through the spatial configuration of the terminal/concourse facilities.

3.5.1 Consumption Behavior

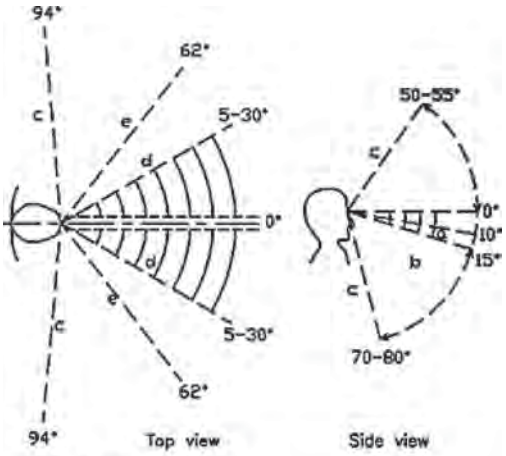
The fundamental factors leading up to the purchase of goods and services is known as "consumption behavior." S. Roland Hall first coined this term in 1920. Hall was an American economist who first described the five steps involved in consumption behavior: attention, interest, desire, memory, and action, also known by the acronym, AIDMA. First, consumers become aware of a product or service through advertisements or from other consumers (attention); depending on what they see, they may become interested (interest), then consumers decide if they need or want the service (desire). Next, consumers memorize the particular product or service (memory), and finally, they decide to purchase the good or service (action) (*6*).

AIDMA highlights the importance of marketing to consumers within the terminal environment. Without adequate and effective marketing, consumers either do not notice the goods or services for sale, or they forget about them entirely. As is often the case in an airport, passengers have many priorities more important than shopping. It is for this reason that effective marketing must be one of the top strategies for concession operators. For airport planners designing new terminals and concession spaces, there should be a focus on providing sufficient opportunities to place effective advertisements. Concessionaires within existing terminal facilities must find creative opportunities to communicate their products to consumers. These ideas and concepts are discussed in Section 3.7, Concession Needs.

3.5.2 Correlation between Passengers, Sales, and Line-of-Sight

Passengers using an airport terminal rely heavily on their field of vision to orient themselves, allowing them to move toward their desired destination inside the terminal. It can be assumed that a passenger's vision is typically accounting for over 80 percent of the knowledge being absorbed as compared to the passenger's other senses of hearing, touching, smelling and tasting (*7*). It is important when planning the location of concessions that a passenger's field of vision be taken into account. Figure 3.18 indicates the cone of vision associated in both the vertical and horizontal axes.

It is advantageous for a potential consumer of airport concession goods and services to make direct visual contact with the concession offering in order to gain an awareness of the product or service that can then potentially evoke the desire to purchase the concession offering. Therefore, it is a combination of a passenger's primary path of travel and field of vision that becomes paramount in determining what information a passenger takes in that can affect the passenger's mindset about a potential purchase. Clearly, other factors such as the time available before the departure of the passenger's flight and in-terminal advertising can and do affect a passenger's decision. First and foremost, however, it is a passenger's ability to see the concession offering that ranks as the highest consideration in the location of the concession. Therefore, passengers' ability to visually make contact with a particular concession offering is dependent upon their ability to have direct sight lines within the spatial context of the volume of space that is directly associated with their path of travel.



Source: *Accessibility for the Disabled: A Design Manual for a Barrier Free Environment,* Ministry of Social Affairs, National Committee for the Disabled; United Nations, Economic and Social Commission for Western Asia (2003).

Figure 3.18. Field of vision.

It is possible to determine from any given point within a specific volume of space what can be seen by the human eye. This single volume of space is defined as an isovist. By its very nature, an isovist is three-dimensional, but analysis is usually limited to only two dimensions due to the consistent elevation spacing of isovist subjects and field of vision. This principle can best be understood by visualizing the isovist as the area or volume of space illuminated by a single source of radiant light. For example, if this single point of radiant light is situated inside of a sphere, then the isovist is the same shape of the sphere from any single location within the sphere. Conversely, and as a two-dimensional example, if this single point is located at one end of an L-shaped room, then there will be multiple isovists, each with a plan volume limited to something less than the full area of the room. Analysis in plan view or as a vertical cross section is common (*8*). Figure 3.19 shows a two-dimensional example of this principle.

Source: Ben Doherty [CC-BY-SA-3.0 (http://creativecommons.org/licenses/by-sa/3.0)], via Wikimedia Commons

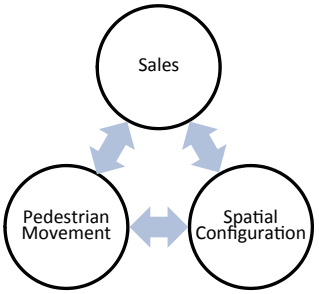
Figure 3.19. Example of a point isovist.

3.5.3 Correlation between Space, Passengers, and Sales

Industry research performed by Eun M. Kong and Young Ook Kim relative to the shopping mall industry, as recent as 2012, has indicated that there is a clear correlation between sales, pedestrian movement, and spatial configuration. Figure 3.20 diagrammatically illustrates this relationship.

In a short report prepared by Kong and Kim at Sejong University, Department of Architecture in the Republic of Korea, research indicates a high correlation factor between sales and pedestrian traffic, postulating that it is theoretically possible to forecast the value of a store location in a shopping mall based on pedestrian movements and spatial configuration. While the research conducted on airport concessions was not pointed at the revenue generation of a single location, drawing a parallel to airport concessions highlights the relationship between passengers and the spatial arrangement of concessions based on isovists from points along the path of the departing passenger. This is known as the theory of visual recognition hierarchy (*8*).

The theory of visual recognition hierarchy suggests there is a strong connection between concession sales, movement of passengers, and the configuration of concession spaces. This theory states that when the visibility of concession space improves, there is a resulting and measurable increase in sales. This principle applies to those passengers whose shopping tendencies are more impulsive rather than planned. Passengers who have already planned their purchases tend to seek those concession outlets they have already identified, regardless of visibility. This theory was developed with data collected from isovist spatial modeling. Isovist modeling utilizes spatial information from a floor plan or a built environment to develop line-of-sight projections based on predictions of passenger movements. These projections can help determine the potential value of a storefront by correlating line-of-sight information to real-world sales data. Information from the model has allowed researchers to estimate sales based on visibility and passenger movement. Figure 3.21 shows the output of an isovist model, and the shaded areas represent line-of-sight to the storefront identified in the model, while the colored areas in the background represent the most likely passenger movement areas. The outputs from the isovist model show how the configuration of visual obstacles and open space may have an impact on visibility and the propensity to shop.



Source: Kong and Kim (*8*).

Figure 3.20. Relation of sales, pedestrian movement, and spatial configuration.

The theory of visual recognition hierarchy may have direct applications to concession planning in the terminal environment. By modeling spaces using an isovist model, planners can adjust their designs to maximize visual connections to as many storefronts as possible. Additionally, the isovist model may assist in determining passenger flow patterns, allowing concession planners to strategically locate pop-up retail concessions or retail merchandising units. Pop-up retail refers to a short-term concession, typically with a six-month to one-year lease, that is often developed

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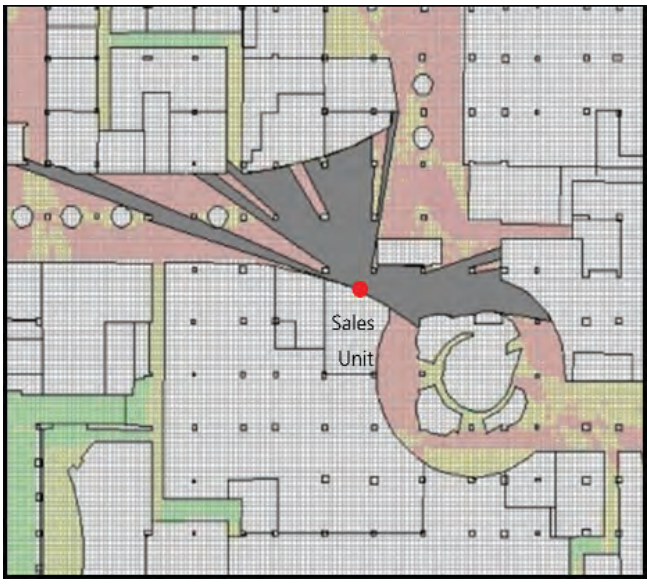

Source: Kong and Kim (*8*).

Figure 3.21. Example of an isovist model.

to fill a temporary unit, capture sales from an event (Olympics, Super Bowl, etc.), or generate seasonal sales. Designing concession spaces to maximize the visibility of storefronts and take advantage of areas with heavy passenger flow may result in an increase of spontaneous shoppers as well as increasing overall concession sales and revenue. This method strengthens the notion that concession planning should be involved from the very beginning of the terminal planning and design process. Applying isovist modeling in the initial phases of terminal design holds the potential to allow planners and designers to quantitatively maximize revenue generation from a terminal's concession program.

3.5.4 Casino Effect

All of the case study airports have central concession marketplaces. The majority of the designs for these marketplaces generally do not provide views to the airfield or outside. While there may be clerestories or skylights letting natural light into the space, as shown in Figure 3.22, the only windows tend to be remote from the shopping area (if at all)—in a common seating zone, for example. This lack of outside views creates a type of "casino effect" in the terminals. Rather than detracting from the customer experience, it actually seems to enhance it, as customers are highly satisfied at these airports and they are spending more in the concessions. As shown in Table 3.4, the case study airports that have a "casino effect" in their main concession area(s) perform well and maintain high satisfaction ratings.

Minimizing views to the airplanes and airfield may decrease the passengers' levels of anxiety, helping them to forget for a short while that they are at an airport. Instead, they are shopping, dining, and enjoying their experience as they would in any downtown or shopping center environment.

3.6 Trends in Passenger Processing

Technology continues to hold the promise of providing improvements to passenger processing, particularly its ability to empower passengers through self-check-in, self–bag tagging and self-boarding at their gates. Advances in remote check-in and the use of self-service kiosks are

John F. Kennedy International Airport, Terminal 5

Portland International Airport, Oregon Market

Source: AirProjects, Inc., 2013

Figure 3.22. Casino effect.

allowing passengers to avoid longer queue times associated with full-service ticket counters. Separate remote bag drops are also assisting passengers to reach SSCPs. Additionally, there are efforts being launched by the TSA to further advance the use of Pre✓™, which will assist in moving more passengers through the passenger and hand-carried bags screening process. All of these advancements have the potential of saving passengers time in the overall journey through airport terminals. These reductions in passenger processing times are viewed as a means to potentially increase passenger dwell times in the terminal, thereby increasing the opportunity for more concession sales. It is, however, unclear as to whether passengers will instead elect to simply show up later at the airport for their flights instead of spending this "found" time at the airport.

Table 3.4. Concession and satisfaction results at airports with a "casino effect."

Airport (Terminal)	Sales/ Enplanement	Sales/ Sq. Ft.	Customer Satisfaction
John F. Kennedy International Airport (Terminal 5)	$14.27	$1,527	Close to 60% of passengers are highly satisfied with the food service and retail concessions.
London Heathrow Airport (Terminal 5)	$16.56 (approx. concession revenue per enplanement-all terminals)	Not available	Skytrax: Best airport shopping worldwide—2010, 2011, 2012. Skytrax: Best airport terminal worldwide—T5, 2012. FAB awards: Best airport food & beverage worldwide (overall)—2012.
Minneapolis/St. Paul International Airport (Terminal 1)	$9.30 (not including Concourse G)	$938	Passenger ratings for food service and retail concessions averaged 4.1 on a scale of 1 to 5, where 4 equals very good and 5 equals excellent.
Pittsburgh International Airport	$12.02	$677	N.A.
Portland International Airport	$10.75	$923	Over 60% of the passengers are very satisfied with the food service and retail concessions.
Savannah International Airport	$9.72	$310	N.A.

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The following sections provide additional insights into each of these key passenger processing trends and their influence on concession revenue generation and customer satisfaction.

3.6.1 Check-in Trends

The process of passengers checking into an airport in order to obtain a boarding pass has changed significantly over the last several years, as new technologies have assisted in shortening the time passengers spend at check-in at an airport. Initial advances included the ability to check in remotely via computer and printing a boarding pass. This process was followed by technology that allows passengers to remotely obtain their boarding pass electronically on their handheld devices such as a cell phone or iPad that can then be scanned by document checkers prior to entering into the security screening queue. The following sections briefly review both the recent technological developments that have been widely implemented as well as the new trends in passenger check-in (some of which hold promise, but still need to be tested through widespread use in the airport environment in order to be accepted fully on a worldwide basis).

The industry has demonstrated that ticketing and check-in queues can be reduced by increasing the availability of self-service kiosks and self-service bag-drop systems. While self-service bag drops are new to the United States, they are already in full operation in numerous airports overseas. These automated functions reduce the reliance on staffed agent positions, allowing passengers to bypass the potentially long queues typically associated with the traditional agent-staffed ticket counters. Providing clear signage, instructions, and staff to assist self-service kiosks improves the effectiveness and efficiency of these facilities, further reducing passenger time in queue. However, encouraging passengers to obtain their boarding passes (either as a printed document or electronically on their handheld devices) online or at home is currently the optimal solution, allowing passengers to bypass the ticket counter or kiosk and proceed directly to a bag drop (if they have bags to check) or to proceed directly to security screening.

3.6.1.1 Near Field Communication and Touch Points

Near field communication (NFC) chip technologies are upcoming advancements in the check-in process that allow passengers with bags to use new self–bag-tagging kiosks, reducing time spent in passenger check-in queues.

As of the writing of this Handbook, Air New Zealand is the primary user of NFC technologies that are included in their passengers' check-in process. The NFC system integrates passenger information into smartphone devices and then wirelessly transmits this information to nearby airport devices. NFC allows passengers to "tap" their phone to access ticketing kiosks, airline lounges, and boarding gates. This system reduces the amount of time passengers spend entering in personal information, searching for membership cards, and interacting with agents. The future of NFC may be that smartphones continually feed passenger information into the airport system, allowing passengers to walk through ticketing, security, and airport boarding seamlessly.

3.6.1.2 Self–Bag-Tagging and Bag-Drop Systems

Self–bag tagging allows passengers to print bag tags and boarding passes in one location. This one-step process reduces demand on check-in agents compared to the existing two-step process. This system is currently in use at a number of overseas airports including Vienna, Munich, Paris–Charles de Gaulle, and London Heathrow and numerous Canadian airports including Edmonton, Calgary, Halifax, Montreal, Ottawa, Toronto Pearson, Vancouver, and Winnipeg. Currently, these systems still require passengers to drop off tagged bags at agent-staffed positions. Self–bag tagging has the added benefit of potentially allowing for remote bag drop and check-in in parking garages or transit stations.

Several equipment vendors are considering combining self–bag tagging with self-induction of the tagged bag into the baggage handling conveyor system. One such manufacturer is Bag-Drop Systems, which has developed a one-step check-in module that allows passengers to check in, print boarding passes, self–bag tag, and drop off checked baggage at a single module. Bag-Drop units are in use at Amsterdam's Schiphol Airport and Bologna Airport. Such systems reduce staffing needs, improve convenience, and potentially offer remote parking garage check-in and bag drop.

3.6.2 Security Screening Trends

The SSCP is another critical area where passenger queue times could be improved. Long queues at the SSCP are the result of either too few SSCP lanes or inadequate staffing of available SSCP lanes. One other factor includes the amount of carry-on baggage that must be screened. Additionally, airline checked baggage fees have resulted in an increase in carry-on items, further increasing SSCP wait times. Reducing the fees associated with checking baggage could potentially reduce SSCP screening requirements and improve passenger wait time. However, there are other more effective opportunities to improve wait times, such as Pre✓™ and technology enhancements to the SSCP equipment and processes (for example, IATA's Checkpoint of the Future).

3.6.2.1 Pre✓™ and the IATA Checkpoint of the Future

Pre✓™ is a TSA sponsored and operated program that allows passengers to sign up and become a known passenger. Available at just under 100 U.S. airports at the time of this research project, the Pre✓™ program allows enrolled passengers to enter a dedicated SSCP lane that has reduced screening requirements. According to the TSA, Pre✓™ passengers have wait times no greater than five minutes. Airports operating Pre✓™ lanes have the opportunity to greatly reduce time in queue for passengers.

Future SSCP innovations may greatly reduce passenger queuing and wait times. The Checkpoint of the Future, developed by the IATA, is envisioned to completely renovate the entire SSCP process. This new system will screen passengers based on risk level, rather than subjecting all passengers to the same level of scrutiny. Passengers will be categorized into three groups: known, normal, and elevated risk travelers. IATA anticipates that the Checkpoint of the Future will be fully functional sometime after 2020 with incremental steps in 2014 and 2017. As technology and processing functions improve, IATA will begin to implement various risk-based security screening solutions.

In place of traditional x-rays, magnetometers, and body scanners, the Checkpoint of the Future, sometime after 2020, will utilize technology with stand-off identity management, biometrics, and real-time risk score analysis embedded into the screening equipment, allowing passengers to move through with minimal interruption. Due to the enhanced technologies in passenger screening, the Checkpoint of the Future will not require the removal of shoes, clothing, or items from carry-on baggage.

With each stage of implementation and improvements in passenger risk assessment, it is anticipated that passenger queue lengths will become shorter and expedite the security screening process for the majority of passengers.

3.6.2.2 Facial Recognition Queue Measurement and Process Monitoring

Airport process monitoring systems that continually monitor passenger activity are gaining momentum among major international airports. This type of monitoring allows the airport to deploy staff before problems or congestion arises. One of these systems is facial recognition,

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which uses cameras to photograph and identify individuals in the queue, periodically recording their progress; this allows the system to predict anticipated time in the queue.

Other systems apply the same principal, using Bluetooth signals from passenger phones to determine location in the queue and then providing displays with an anticipated wait time. Other systems apply the same principle using different technology, such as thermal imaging counters, closed circuit television cameras, and infrared beam break. These real-time systems can then be accessed by a central system that monitors the entire airport. This real-time dashboard is currently in use at Dubai International Airport. This system notifies the controller when and where a problem is occurring.

These systems can improve an airport's ability to deploy staff, increasing staffing efficiency and passenger LOS. While these systems are currently focused on deploying airport staff, there may be potential for concessions to benefit. As these systems anticipate major passenger volumes entering or exiting the airport, concessions operators may be able to increase staffing levels and provide incoming passengers with a better LOS.

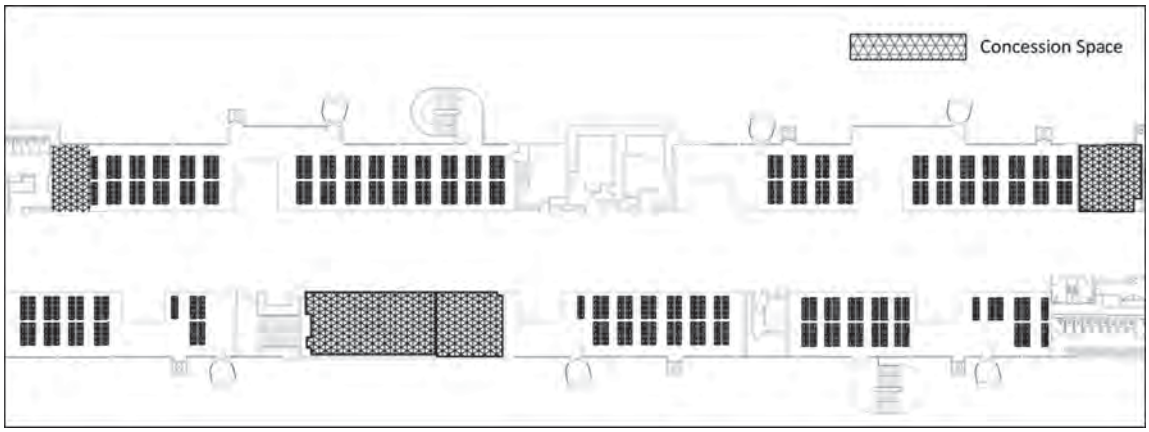
3.6.3 Holdrooms

Holdrooms, in their current form, are unique within the realm of transportation facilities. This is due to the function, size, and frequency of the mode of transportation they support. Holdrooms have evolved over the course of history in commercial aviation. In the beginning of large-scale commercial flight, whole terminals acted as the holdrooms for flights, much like the train stations they were fashioned after at the time. All functions were conglomerated into a single structure, allowing for dynamic use of these facilities. As commercial flight became more common, the train-like terminal design of these facilities became too chaotic to manage the passenger volume. Segmenting the facilities into more distinct parts permitted a more procedural flow through. This type of terminal scheme became more and more prevalent until the beginning of the jet age, becoming the de-facto standard for terminal design. The flow-through design allots each major task its own space, culminating the last steps of the process in the holdrooms and gates.

The holdroom is self-explanatory; it is a place to hold air travelers until their aircraft is ready to depart. This space in its purest form is a temporary holding pen and a place to pull passengers out of the way of the free flow of other processes. Concessions rely on the constant flow of passengers in front of and through their spaces. A boarding gate area, if not strategically designed to work in concert with concessions spaces, acts as an area where passengers remain rather than becoming potential concession customers.

3.6.3.1 Holdroom Types and Size

The current common design of holdrooms comprises dedicated space strictly used for passenger consolidation before departing flights, boarding/deplaning facilities, and some associated circulation and passenger services space. This area usually falls under exclusive or common-use lease agreements with airlines, thereby prohibiting using this space for other functions such as concessions. The size of a holdroom is typically determined by a LOS ratio based on the maximum size of aircraft associated with using the gate; spatial allowances for passengers waiting in the queue, sitting, and/or standing; and a boarding agent podium, which allows for little else to be contained in the space. These spaces are usually delineated by demising walls on three sides and lower ceilings to minimize costs. Some international departure lounges may have two levels for jet bridges and/or sterile boundaries for limited access. Visual perspectives and passenger movement within both domestic and international holdrooms are limited by such barriers, inhibiting visual coordination with surrounding service and concession spaces. Figure 3.23 is a layout of Chicago O'Hare's Concourse H, typical of this type of holdroom design.



Source: Chicago Department of Aviation

Figure 3.23. Typical holdroom configuration, Chicago O'Hare International Airport, Concourse H.

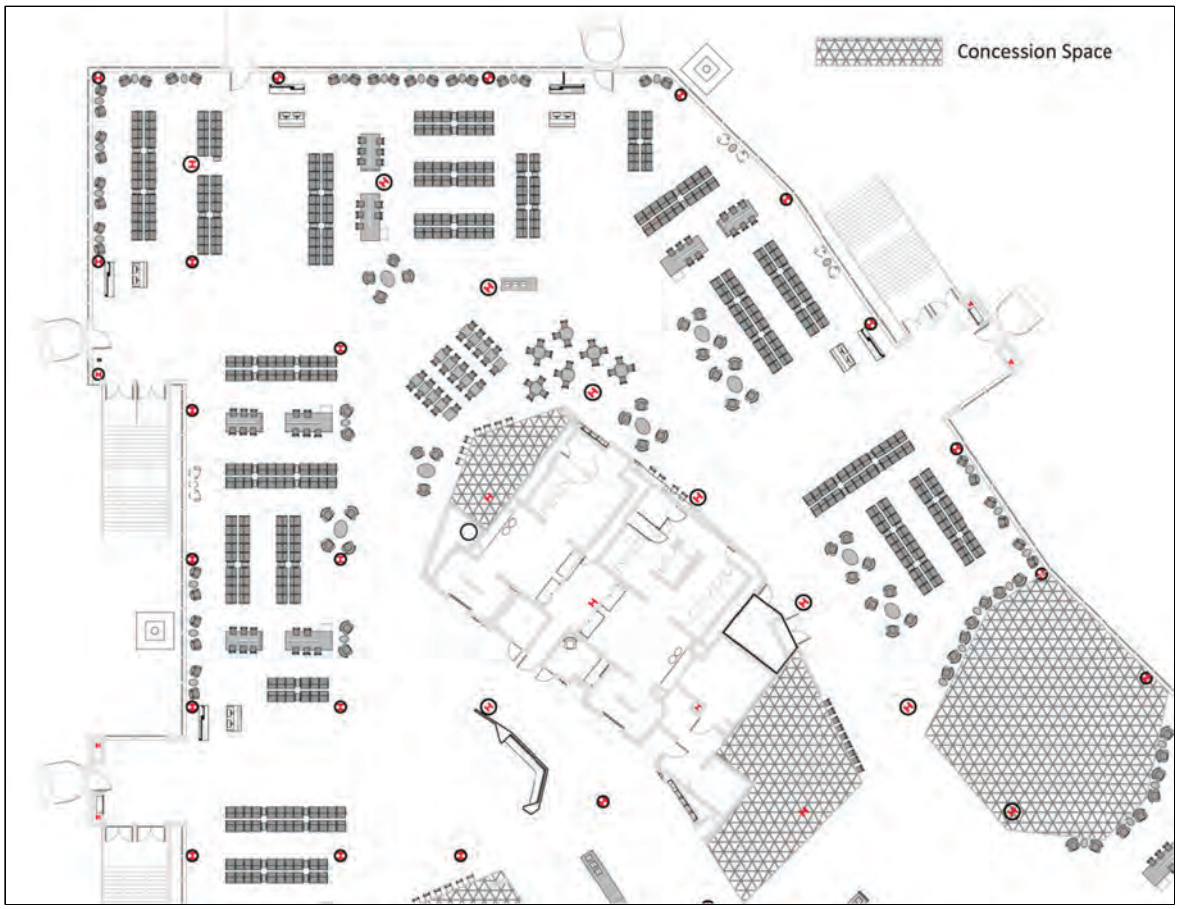
More recently, there has been an effort to maximize the use of expensive terminal and concourse space by allowing for multiple uses throughout the passenger journey. To justify the high cost of conditioned holdroom space, their utilization capabilities need to be maximized. Holdrooms for shared and multiple aircraft ramp system (MARS) gates are becoming more prevalent at overseas airports. Many of the traditional processes have been modified or usurped by distributed technologies, such as remote check-in, location-based services, and other web-based services, allowing for these traditional functional spaces to be cross-utilized. The "open holdroom" design follows this methodology by marrying several functions within a combined space. Open holdrooms have several functions that would traditionally adjoin the holdroom area such as circulation, passenger services, concessions, etc. and combines them into one larger open space. By minimizing the boundaries between holdrooms and concessions, higher passenger exposure to concessions can be reached. Sizing these holdrooms still follows a LOS ratio but combines several distinct processes and intermingles their programmed space. As seen in Figure 3.24, San Francisco International Airport, Terminal 2, has followed these principals for the open holdroom design.

The open holdroom design is as much evolution of the passenger space as it is a conscious design form. Between the increased separation of secure/non-secure areas and increased frequency of airline operations, traditional holdrooms have become destination points as well as areas of movement.

Major changes in the profile of passengers have forced airports to adapt. With the advent of low-cost carriers, turnover rates at contact gates can be as fast as 25 minutes per flight and can result in shorter dwell time for transfer passengers, particularly for intraline connections. Conversely, post–9/11 security measures have forced passengers to arrive earlier, increasing terminal dwell time for originating passengers. The dichotomy of the originating versus connecting passenger profiles has widened to the point that the traditional holdroom space tends to inhibit the effective buying potential of both groups. Freer flow with less visual/physical impediments and different options for rest points within the open holdroom design keep the short- and long-dwell passengers engaged with the space. Integration of concession options is critical to that interaction, allowing for greater choice and novel engagement of the passenger population.

3.6.3.2 Holdroom Operations

Integration of concession space with holdroom processes is another means for the airport operator to maximize passenger exposure and experience, as well as maximizing revenue and



Source: Courtesy Gensler Architects

Figure 3.24. Open holdroom configuration, San Francisco International Airport, Terminal 2.

sales potential. Dedicated spaces need to work in conjunction to enhance the passenger experience as well as not hinder the spaces' main functions: stationary holding (sitting, standing), movement holding (browsing, queuing, use of nearby holding spaces), and movement (ingress, egress, process shifting). Better integration of concession spaces with holdroom operations must involve more than just strictly adjacency; spaces need to be an integral part of the plan. The primary role of the holdroom is to give space for passengers to wait or rest before or after a flight while allowing for other adjacent functions to move smoothly without undue hindrances. Figure 3.24 shows the mixture of holding areas and concessions, such that seating is clustered around gating areas and concessions as required, but easily flow from one process to the next. Seating areas act as boundaries for the main corridors to and from the gates with discernible ingress/egress flows without the visual obstacles of demising walls. Furniture, signage, and contiguous obstacle-free zones define wayfinding.

As the passenger goes to or from the gate, they pass through an open area sidelined with the standard options available for the traveling passenger: seating space, passenger services desks, restrooms, and concessions. There are some non-standard alternatives as well: standing tables and counter-height stools, coffee table group seating, and grouped lounge style chairs. The choice of any holding arrangement throughout the boarding areas, as well as concession spaces, allows passengers to visually access and interact with the concession spaces. The obstacle-free areas still allow for the passenger to flow freely without the chaos of random seating arrangements.

3.6.3.3 Call-to-Gate Holdroom Procedures

Another style of boarding procedure and holdroom configuration that has seen increased popularity at European airports is call-to-gate. In this operational concept, a large area of common public seating and the overall concessions areas of retail and food and beverage act as a common space for holding passengers until they are called to their gate. From a terminal planning standpoint, facility requirements are somewhat lower due to the higher utilization factors of holding areas, common-use gates, and non-exclusive–use facilities. Since this operating procedure concentrates holding areas into one contiguous area, there is typically little to no dedicated seating needed adjacent to the gate. From a concessions viewpoint, the entire passenger population is somewhat captured for interaction with the concession offerings.

The Budapest Ferenc Liszt International Airport utilizes the call-to-gate procedures combined with a strong concession-centric layout. Schengen and non-Schengen passengers flow from ticketing, through security, and into the central mall, an open space lined with shops and services. All departing passengers flow through this center Skycourt, capturing all prospective customers first before they head to their respective holding areas. From the Skycourt, departing passengers flow into one of two "central" hold spaces known as Terminal 2A and 2B. The terminal is split to allow processing of non-Schengen international arrival passengers in 2A, while Schengen and domestic arrivals that do not need security processing flow into the gate level in 2B. The centrally located Skycourt between the two holding areas is the focal point for passenger wayfinding and has visual sight lines to the majority of the concessions program. This arrangement is illustrated in Figure 3.25.

Holdrooms, within this context, are still passenger holding areas, yet they allow maximum potential for concessions under the constraints of multi-level passenger travel. No walls, other than building edge and security, disrupt interaction of holding passengers and concession spaces. While passengers are not physically constrained from proceeding to their gates, they are not informed of the specific location of their departing flight until typically between 40 and 50 minutes prior to departure. Passengers are "called" with visual and verbal cues for the correct gate and proper loading time. An example of the visual cues relating to the call-to-gate procedure is illustrated by the FIDS in Figure 3.26 at BUD.

The call-to-gate procedure tends to control the movement of passengers to have them remain in closer proximity to concession offerings for longer periods of time. There is evidence from the BUD case study that the call-to-gate procedure does have a positive impact to concession sales and revenue for the airport operator. Initially BUD operated as airports typically operate in the

Source: Budapest Ferenc Liszt International Airport

Figure 3.25. Skycourt and call-to-gate configuration, Budapest Ferenc Liszt International Airport.

Source: Budapest Ferenc Liszt International Airport

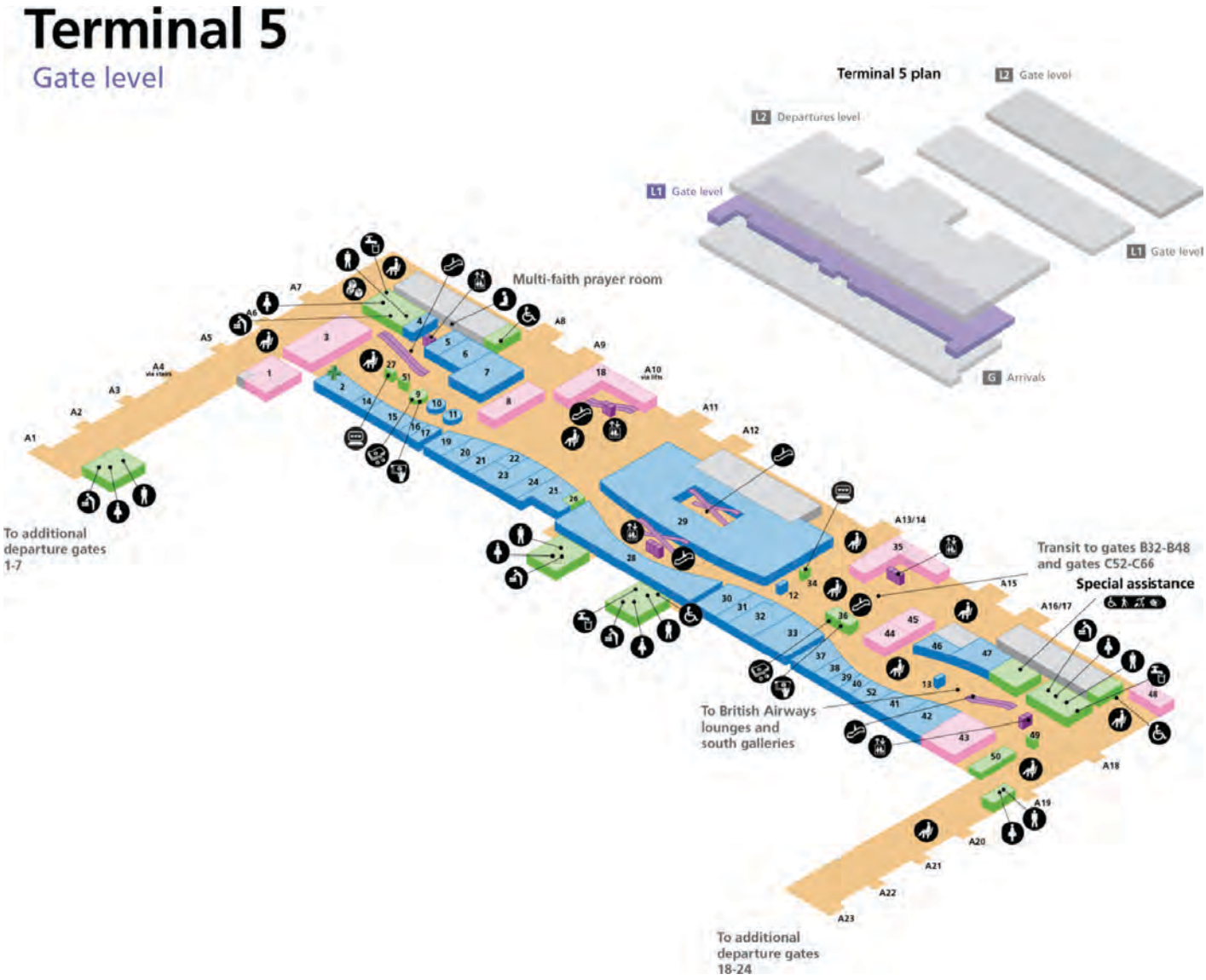
Figure 3.26. Call-to-gate FIDS at the Budapest Ferenc Liszt International Airport.

United States, with passengers being informed about what gate number their aircraft is departing from many hours before departure. Once management moved to late gate announcements of just 40 to 50 minutes prior to flight departure, the airport's mezzanine-level food and beverage sales improved some 5 to 10 percent.

London Heathrow Airport's Terminal 5, shown in Figure 3.27, also utilizes similar call-to-gate holdroom procedures. Heathrow is designed to be as free flowing and open as possible within the constraints of today's air travel security demands. Departure passengers flow from a combined upper ticketing and security area to an open gating level. Domestic transfer passengers also move from the contact gates into the holding room at this level. Non-domestic–origin international transfer passengers must proceed through the lower level, pass through security and customs, and elevate to the open gating level with the other waiting travelers. Most major services for the terminal are in the terminal's gating level, which consists of circulation to/from gates and satellites, passenger services, passenger-related spaces, holding areas, and concessions. Concessions and services line the edges of the seating space that is also open to a balcony lined with various goods and services—all visible from the combined holdroom area. In large facilities such as Heathrow, a single focus point is an excellent way to minimize wayfinding problems inherent in international terminals.

3.6.3.4 Self-Boarding

Self-boarding systems, currently under testing at some U.S. airports, are in use at Vienna International Airport. Passengers self-board by utilizing new electronic self-scanning systems. With this system, Vienna International Airport no longer requires an agent to scan each individual passenger. Self-boarding systems allow agents to focus on other passenger needs, ultimately providing a better LOS.



Source: London Heathrow Airport

Figure 3.27. Call-to-gate seating arrangement with movement areas and circulation, London Heathrow Airport.

3.7 Concession Needs

The need for concession space at an airport is paramount as airport operators continue to focus on non-aeronautical revenue generation. Determining the appropriate amount and proper placement of such concession space requires specific and careful planning to deliver the maximum revenue and customer satisfaction. This section discusses the research findings from the airport case studies regarding types of concessions, adjacency considerations, and methods to determine the appropriate amount of concession space, optimal locations for different types of concessions, signage, and sustainability efforts.

3.7.1 Types of Concessions Required

There are different types of airport concessions. Some are designed to provide food service to passengers, while others are tailored to provide retail merchandise or consumer services.

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Within the broad food service and retail categories are subcategories that further delineate the type of product being sold or the manner in which it is sold (i.e., duty-free retail, specialty retail, convenience retail). *ACRP Report 54: Resource Manual for In-Terminal Concessions* provides an overview of the most common classifications used for airport concessions.

It should be noted that at most of the case study airports, international passengers account for a very small percentage of total passengers. As a result, duty-free concessions account for a smaller percentage of the concession programs at most of the case study airports (excluding London Heathrow Airport and Budapest Ferenc Liszt International Airport). In cases where international passengers account for a larger portion of the passenger base, a greater proportion of concession space is typically allocated to duty-free concessions.

The case study airports had many common characteristics among the concessions classifications. All of the case study airports differentiated food service concessions from retail concessions on their websites and/or survey responses. Table 3.5 presents the general breakdown of total concession program size for each of the case study airports by food service and retail concessions. On average, 54 percent of concession space was allocated to food service, 36 percent was allocated to non–duty-free retail, and 10 percent was allocated to duty-free retail. Four of the seven airports had more concession space allocated to food service rather than retail concessions, with PIT, BUD, and LHR's Terminal 5 serving as the exceptions to this practice.

All of the case study airports further diversified their food service programs through classifications that describe the manner in which the food is served. The most common food service classifications used among the case study airports are as follows:

- Quick service
- Coffee
- Bar (with food)
- Casual/sit-down restaurant

A brief discussion regarding these four main classifications of food service concessions is provided in the following paragraphs. Additional detail can be found in *ACRP Report 54.*

Quick-service concessions primarily serve food over a counter, with customers ordering and waiting for their food at the counter. The food can be made-to-order or pre-made. This category of food service may also include concessions where orders are taken at a counter and then the food is delivered to tables by concession staff (also referred to as "fast casual"). Quick-service concessions often include "grab and go" options for customers who are in an even greater hurry. The quick-service category includes a variety of concession types that may encompass traditional "fast-food" food court units (e.g., hamburgers, chicken, pizza, Mexican, Asian) as well as inline units with or without seating. Examples of quick-service concessions from the case study airports are provided in Figure 3.28.

Table 3.5. Concessions by type, as percentage of total program size.

Concession Type	JFK T5	MSP T1	PDX	PIT	SAV	BUD	LHR T5	Average
Food Service	73%	66%	64%	42%	61%	36%	33%	54%
Retail (Non–Duty-Free)	25%	32%	36%	58%	39%	19%	44%	36%
Duty Free	2%	2%	0%	0%	0%	45%	23%	10%

Compiled by AirProjects, Inc., 2013

(a) (b)

Source: AirProjects, Inc., 2013

Figure 3.28. Quick-service concessions: (a) Flying Elephants Deli, Portland International Airport; (b) Panopolis, Budapest Liszt Ferenc International Airport.

Coffee concession operators focus on providing premium, freshly brewed coffee and espresso-based drinks. Their menu often includes teas, juices, pastries, and pre-packaged salads, sandwiches, and snacks. Figure 3.29 presents an example of a coffee concession from one of the case study airports.

The operators of bars with food primarily focus on providing beverages, both alcoholic and non-alcoholic. They often feature a limited food menu to complement the beverages offered. Bars in airports are often operated under proprietary names or may be themed for local landmarks or other local symbols, such as sports teams. Additionally, wine bars that specialize or solely focus on wines and complementary food are gaining in popularity. Figure 3.30 presents examples of bars with food at two of the case study airports.

Casual/sit-down restaurants have menus offering made-to-order meals, snacks, and full bar service within a table-service environment. Meals are typically consumed in the restaurant (rather than taken to go), and the average transactions at these restaurants tend to be the highest among all food service categories as a result of the alcohol sales and generally higher price points for full-service hospitality and more extensive menu offerings. Casual dining restaurants also tend

Source: AirProjects, Inc., 2013

Figure 3.29. Caribou Coffee, Minneapolis–St. Paul International Airport.

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(a) (b)

Source: AirProjects, Inc., 2013

Figure 3.30. Bars with food: (a) Leroy Bistro, Budapest Liszt Ferenc International Airport; (b) Dewar's Clubhouse, Savannah/Hilton Head International Airport.

to occupy the largest amount of concession space among the food service operations and require full kitchens and larger seating areas. Figure 3.31 presents two U.S. airport casual dining restaurants.

The case study airports not only used similar food service classifications/naming nomenclature, but also had similar unit allocations to the food service categories. Table 3.6 provides the allocation of food service concession units by type as a percentage of total food service units. Generally all of the case study airports had approximately one-half of their food service units allocated to the quick-service subcategory. This heavy focus on quick food service caters to the limited amount of time that many passengers have to dine while in an airport.

The second highest space allocations were for casual dining and coffee units that each averaged 19 percent of the total food service units among the case study airports. While coffee units fulfill a necessary need within the airport market, a significant portion of their business tends to focus on the morning departures.

Bars with food averaged 14 percent of the total food service units among the case study airports.

The case study airports differed somewhat in the amount of space (measured by square footage) allocated to the different types of food service. Among the case study airports, an average of 43 percent of the total food service space was allocated to casual dining, as seen in

(a) (b)

Source: AirProjects, Inc., 2013

Figure 3.31. Casual dining restaurants: (a) Aeronuova/5ive Steak/Piquillo, John F. Kennedy International Airport, Terminal 5; (b) Mill City Tavern, Minneapolis–St. Paul International Airport.

Table 3.6. Allocation of food service concessions, as a percentage of total of food service units.

Concession Type	JFK T5	MSP T1	PDX	PIT	SAV	BUD	LHR T5	Average
Quick Service	47%	55%	47%	61%	45%	53%	33%	48%
Coffee	13%	16%	28%	9%	22%	23%	24%	19%
Bar with Food	20%	5%	n/a	13%	22%	6%	19%	14%
Casual Dining	20%	24%	25%	17%	11%	18%	24%	19%

Compiled by AirProjects, Inc., 2013

Table 3.7. This higher space allocation is required to accommodate the larger footprints that casual dining restaurants need for kitchens, seating, and bars. The second largest allocation of space was to quick service, which averaged 34 percent of the food service space among the case study airports.

All of the case study airports diversified their retail programs through classifications that describe the type of merchandise sold. The most common retail classifications used among the case study airports are the following:

- Specialty
- Convenience
- Duty Free

A brief discussion regarding these three main classifications of retail concessions is provided in the following paragraphs. Additional detail can be found in *ACRP Report 54*.

Specialty retail concessions offer targeted lines of merchandise such as jewelry, leather goods, electronics, personal care products, apparel, toys, and souvenirs. Many specialty retail concessions are branded through local, national, or international brands.

Specialty retail concessions are considered to fulfill passengers "wants" rather than "needs" in many cases. Many specialty retail locations are intended to stimulate impulse purchases. For this reason, specialty retail positioning, storefronts, and displays are extremely important since they must attract customers and draw them into the shop to purchase merchandise they may not have planned to purchase. Examples of specialty retail concessions from the case study airports are provided in Figure 3.32.

Specialty retail can also include automated retail machines that sell a targeted variety of merchandise. Figure 3.33 shows an automated retail machine at Minneapolis–St. Paul International Airport that features electronics and gadgets.

Convenience retail concessions traditionally provide merchandise that is in high demand by the traveling public. The product mix typically includes reading materials (newspapers, periodicals, and books), candy and mints, pre-packaged snacks, health and beauty aids, and often local souvenirs. With passenger demand, behavior, and time constraints evolving,

Table 3.7. Allocation of food service concession space, as a percentage of total food service square feet.

Concession Type	JFK T5	MSP T1	PDX	PIT	SAV	BUD	LHR T5	Average
Quick Service	42%	36%	29%	44%	n/a	n/a	19%	34%
Coffee	6%	5%	13%	4%	n/a	n/a	23%	10%
Bar with Food	9%	3%	0%	15%	n/a	n/a	13%	8%
Casual Dining	36%	43%	58%	32%	n/a	n/a	44%	43%

Compiled by AirProjects, Inc., 2013

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(a)

(b)

(c)

Source: (a) AirProjects, Inc., 2013; (b, c) Landrum & Brown, Inc. 2013.

Figure 3.32. Specialty retail: (a) Nike, Portland International Airport; (b) Tiffany & Co., London Heathrow Airport, Terminal 5; (c) Swarovski, Budapest Liszt Ferenc International Airport.

convenience retail concessions may also now incorporate a limited amount of food service, such as freshly brewed coffee, pre-packaged sandwiches and salads, and snacks. Figure 3.34 presents examples of convenience retail concessions from the case study airports.

Duty-free retail concessions offer merchandise for passengers traveling outside of their departure country that is free from certain taxes or "duties." Typical merchandise sold in duty-free concessions includes liquor, fragrances, cosmetics, jewelry, accessories, and tobacco products. Due to the reduced prices, passengers are generally highly motivated to seek out duty-free shopping opportunities. Figure 3.35 shows the interior of a duty-free retail concession at one of the case study airports.

The allocation of total retail space at the case study airports was fairly similar. Five of the case study airports had over 50 percent of total retail space allocated to specialty retail and approximately 13 percent to 31 percent of total retail space allocated to convenience retail. The airports located outside of the United States that had a significantly higher percentage of international passengers had a higher allocation of duty-free retail, with BUD having 71 percent of total retail space allocated to duty free and LHR's Terminal 5 having 36 percent of its retail space allocated to duty-free retail. This data is summarized in Table 3.8.

3.7.2 Concession Branding

The type and mix of concession brands selected for a concession program play a critical role in customer satisfaction and overall program performance. This section investigates common characteristics observed in the case study airports related to concession branding.

To achieve maximum customer satisfaction and revenue performance, it is important to include a mix of food service brands in the concession program. Ideally, there should be a variety of national brands instantly recognizable to a majority of passengers from all over the country and ideally the world, coupled with local and regional brands that showcase the popular food offerings of the surrounding community. Many concessionaires have also developed proprietary brands that are common in their portfolio of concession offerings throughout numerous airports, but can only be found in airports.

Food service branding was analyzed among the case study airports. The results of this analysis are presented in Figure 3.36. Among the case study airports, on average, 58 percent of the food service units were attributable to national/international brands, 24 percent to proprietary brands, and 18 percent to local/regional brands. The highest sales per enplanements were realized at airports that have a mix of brands rather than strictly national brands. (Note: Food service sales per enplanement data were

Source: AirProjects, Inc., 2013

Figure 3.33. Automated Retail, Minneapolis–St. Paul International Airport.

unavailable for the case study airports outside of North America.) The top-performing food service program, as measured by food service sales per enplanement, was JFK's Terminal 5, which generated over $8.40 per enplanement and had 74 percent of the food service concessions allocated to proprietary brands and 26 percent allocated to national brands. However, the proprietary brands in Terminal 5 were developed in conjunction with local New York chefs and restaurateurs even though their name brands do not appear on the restaurants at the airport.

(a)

(b)

Source: (a) Landrum & Brown, Inc., 2013; (b) AirProjects, Inc., 2013

Figure 3.34. Convenience retail: (a) Hilton Head Marketplace, Savannah/Hilton Head International Airport; (b) CNBC News New York, John F. Kennedy International Airport, Terminal 5.

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Source: Landrum & Brown, Inc., 2013

Figure 3.35. Duty-free retail, Budapest Liszt Ferenc International Airport.

The branding among specialty retail programs was also analyzed among the case study airports. The results of this analysis are presented in Figure 3.37. Among the case study airports, on average, 49 percent of specialty retail units were attributable to national/international brands, 32 percent to proprietary brands, and 19 percent to local/regional brands. (Note: Specialty retail sales per enplanement data were unavailable for the case study airports outside of North America.) The highest specialty retail sales per enplanement were observed at PIT, a program that consists of 55 percent national/international brands, 42 percent proprietary brands, and 3 percent local brands. The other top-performing specialty retail programs in the sample had between 29 percent and 55 percent of national brands in their mix. PDX was an anomaly, with 52 percent of the specialty retail attributable to local brands.

3.7.3 Variety of Concessions

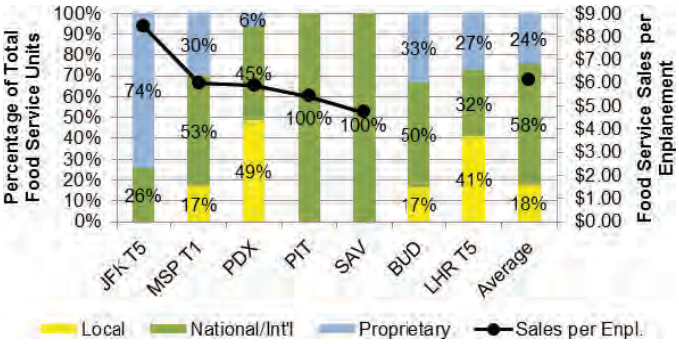
This section investigates common characteristics observed in the case study airports related to concession variety and availability as measured by passenger satisfaction.

One way to measure passenger satisfaction with the variety and availability of concessions is to use passenger survey data coupled with the number of concepts in a concession program and the amount of concession space relative to the number of enplanements. Figure 3.38 summarizes the variety and availability of concessions compared to passenger satisfaction with the food service offerings at the case study airports. Summaries of passenger survey data regarding this topic were available for three of the case study airports. All three of the case study airports had similar allocations of food service space per 1,000 enplanements, ranging from 6.4 to 7.4 square feet per 1,000 enplanements. Among the case study airport passengers, those at Minneapolis–St. Paul

Table 3.8. Allocation of retail as a percentage of total of retail square feet.

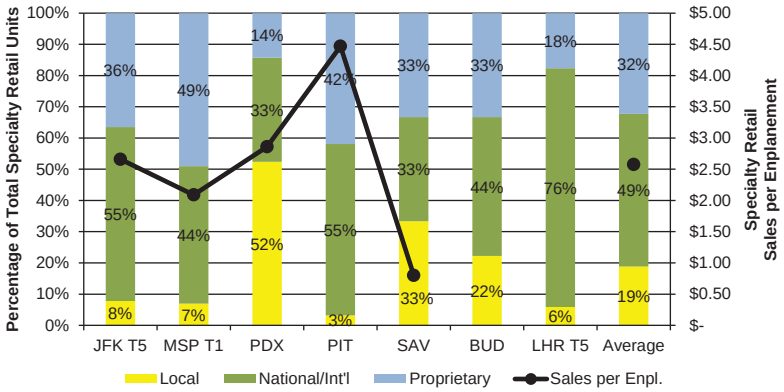
Concession Type	JFK T5	MSP T1	PDX	PIT	SAV	BUD	LHR T5	Average
Specialty Retail	64%	63%	72%	77%	34%	29%	51%	60%
Convenience Retail	30%	31%	28%	23%	66%		13%	32%
Duty-Free Retail	6%	6%	0%	0%	0%	71%	36%	30%

Compiled by AirProjects, Inc., 2013
Note: The specialty retail/convenience retail breakdown was not available from BUD and it was excluded from the calculation of average percentages.



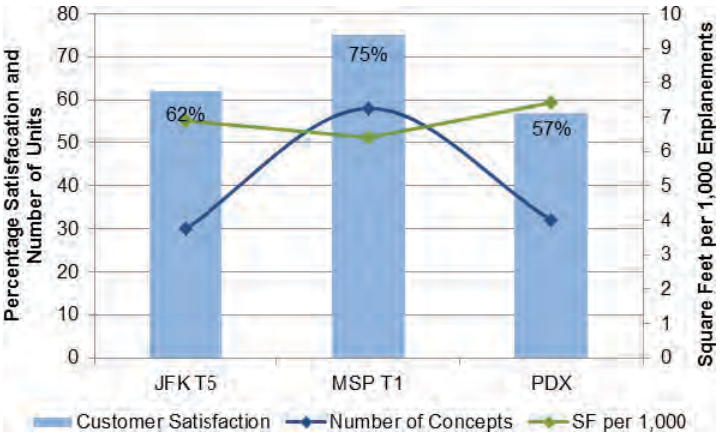
Compiled by AirProjects, Inc., 2013

Figure 3.36. Food service brands among case study airports.



Note: Numbers may not sum to 100 percent due to rounding.

Figure 3.37. Specialty retail brands among case study airports.



Compiled by AirProjects, Inc., 2013

Figure 3.38. Availability and variety of food service concessions within case study airports.

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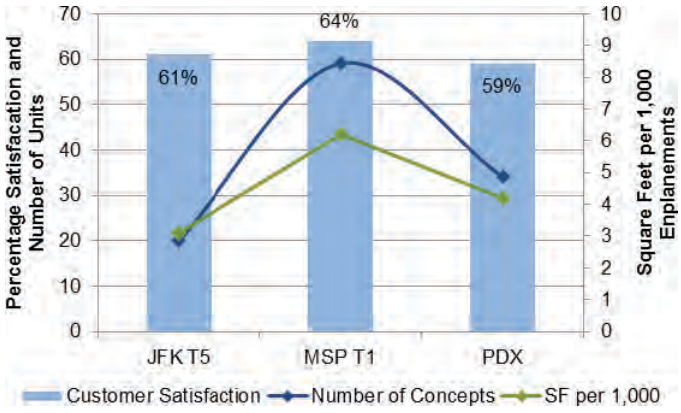

Compiled by AirProjects, Inc., 2013
Note: Duty-free concessions were included in retail figures where applicable.

Figure 3.39. Availability and variety of retail concessions at case study airports.

International Airport were the most satisfied with the variety of the food service concessions based on a recent passenger survey. There are also significantly more food service concepts at MSP compared to the other case study airports. PDX and JFK's Terminal 5 had similar quantities of food service concepts and similar passenger satisfaction levels. This finding suggests that there is a relationship between customer satisfaction and the number and variety of food service concepts available in the program.

The retail concession programs were also analyzed to determine if variety and availability of retail concessions affect passenger satisfaction. The results of the analysis are summarized in Figure 3.39. All three airports had similar passenger satisfaction levels, ranging from 59 percent to 64 percent. However, MSP had the largest quantity of retail concepts and significantly more retail space per thousand enplanements (6.2 square feet per 1,000 enplanements) than the other airports (JFK's Terminal 5 had 3.1 square feet per 1,000 enplanements and PDX had 4.2 square feet per 1,000 enplanements).

3.7.4 Adjacency Considerations

The placement of airport concessions in relation to other concessions and airport functions can have a substantial impact on their performance. This section discusses adjacency planning considerations to maximize concession revenue and customer service.

3.7.4.1 Concession to Concession

Concession planners often intentionally locate concession units near each other to create a "synergy" among the concession units. This synergy often results in customers browsing multiple shops due to their proximity. Creating synergy between concessions can have a substantial impact on sales. For this reason, many concessions are located in "nodes" and grouped together in a section of a concourse or terminal to maximize synergy between them.

As a general rule of thumb, placing specialty retail concessions within view of food service concessions' seating areas typically enhances the performance of the specialty retail. Customers often scan the specialty retail shops while they dine, increasing their chances of making an impulse purchase after they finish their meal. Specialty retail concessions may also benefit from placement near convenience retail concessions due to the passenger draw to the convenience retail concessions.

Similarly, clustering food service concessions typically offers multiple benefits to the airport operator and customers alike. If the food service concessions are operated by different concessionaires, clustering promotes competition, which tends to improve customer service, influence pricing, and generally encourage optimal performance. From a customer's perspective, such adjacencies create opportunities for choice and variety.

Two examples of airports that have successful concession nodes that maximize synergy between concessions and the overall performance of the concessions are JFK's Terminal 5 and PIT. The layouts of and photographs from these two airports are provided in Figures 3.40 and 3.41.

JFK's Terminal 5 has a central concession marketplace located immediately after the single SSCP. All departing passengers must pass through this central marketplace area, where numerous specialty retail shops are located in proximity to casual dining and quick-service food service restaurants and their seating areas. The central marketplace was specifically designed to capture the attention of all passengers emerging from the SSCP.

Pittsburgh International Airport also has a central concession area, as shown in Figure 3.41. The concession program is branded as an "airmall" and focuses a majority of the concessions in the central open space, with specialty retail located primarily along the exterior of the core. This layout allows passengers to browse numerous concessions in a short amount of time and maximizes their exposure. Many of the food service units are grouped together to provide a variety of alternatives.

Source: John F. Kennedy International Airport, Terminal 5; AirProjects, Inc., 2013

Figure 3.40. John F. Kennedy International Airport, Terminal 5, central concession marketplace.

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Source: Pittsburgh International Airport

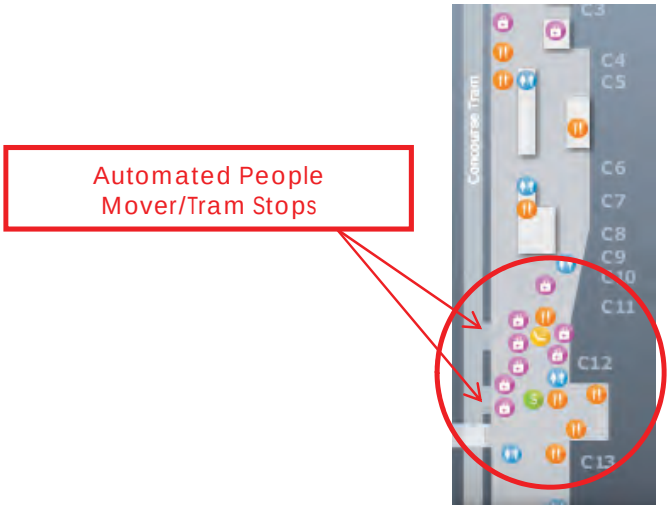
Figure 3.41. Pittsburgh International Airport, central concession core layout.

3.7.4.2 Concessions to Airport Functions

Concession performance can also benefit from locations proximate to certain airport functions. Adjacency to functions such as APMs, holdrooms, and FIDSs can benefit concessions. All of these airport functions are discussed in further detail in the following paragraphs.

Grouping concessions near APM stops can offer enhanced exposure to concessions. MSP's Concourse C is one example where multiple food service concessions (indicated by the knife and fork in an orange circle in Figure 3.42) and retail concessions (indicated by a shopping bag in a purple circle in Figure 3.42) are concentrated near APM stops.

Locating concessions near holdrooms can also maximize concession exposure. In general, concessions located adjacent to holdrooms tend to perform well because the location allows passengers to shop or dine within eyesight and earshot of their holdrooms, which eliminates anxiety about missing flights. More recently, some concessionaires have blurred the lease lines between concessions and holdrooms by allowing customers to order food and beverages from their holdrooms and have meals delivered directly to the holdroom. One airport where this service is offered is JFK's Terminal 5. The ordering stations in Terminal 5 are shown in Figure 3.43. Holdroom ordering may have implications for the concession queuing and/or seating space that is typically required in a concession program. There may be some direct growth in sales as a result of having concessions directly in or proximate to holdrooms and capturing passengers that would not otherwise move from their holdrooms. However, there may also be shifts in sales or cannibalization as purchases normally made at a centrally located concession unit may shift to the holdroom concessions. This type of sales shift could also reduce impulse purchases since passengers would no longer be exposed to other concessions while they are dining in their holdrooms. Regardless, if a holdroom ordering system is put into place at an airport, effective and efficient merchandise transportation plans are necessary. There may also be future planning implications for holdroom sizing should this trend continue.



Source: Minneapolis–St. Paul International Airport

Figure 3.42. Minneapolis–St. Paul International Airport, Concourse C, tram stops.

FIDS monitors are another core airport function that often becomes a destination for passengers. Since passengers are drawn to FIDS monitors for information, they tend to create a natural congregation point for passengers. Sometimes, passengers choose to stay near a FIDS monitor to track the status of their departing flights. Other times, passengers refer to the FIDS monitor and then head directly to their gates. BUD is one example of an airport where FIDS monitors have been effectively used to attract passengers to areas where concessions are located, as shown in Figure 3.44. The image shows the placement of the FIDS monitors directly above the convenience retail storefront, thus drawing passenger traffic to the concession unit.

3.7.5 Methods to Determine Amount of Space

The amount of concession space needed at a particular airport is dependent on a number of factors, including traffic volume, passenger demographics and characteristics, passenger flows,

Source: AirProjects, Inc., 2013

Figure 3.43. Holdroom ordering system, John F. Kennedy International Airport, Terminal 5.

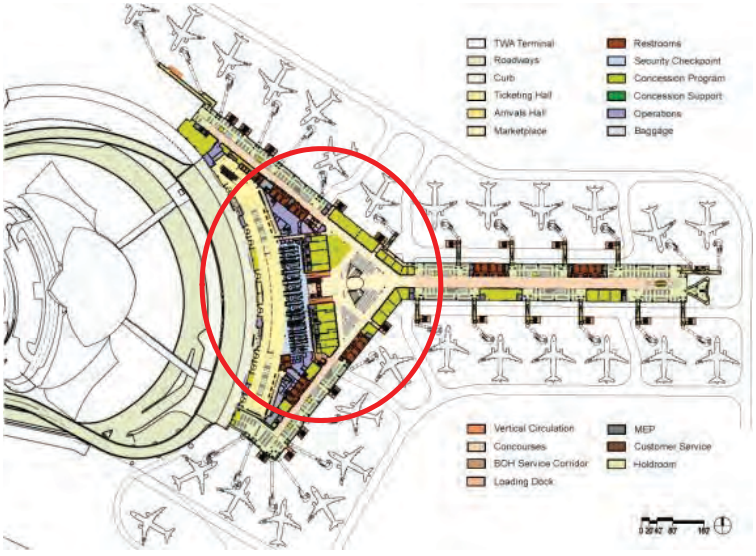
Source: Landrum & Brown Inc., 2013

Figure 3.44. FIDS monitors, Budapest Liszt Ferenc International Airport.

terminal/concourse configuration, and anticipated sales per square foot and sales per enplaned passenger. Chapter 5 of *ACRP Report 54* presents an in-depth review of this topic. This section relates the guidelines provided in *ACRP Report 54* directly to the case study airports.

3.7.5.1 Impact of Configuration on Demand for Space

The configuration of a terminal plays a major role in where concessions are placed. Likewise, the proper placement of concessions should help to drive the configuration for new terminals. However, there are no specific rules of thumb that dictate where concessions should be placed for specific terminal configuration. Rather, there are common planning principles that can be incorporated into various types of configurations. While all of the case study airports had different terminal configurations, all of their configurations yielded a central concession core. Regardless of whether it was a "Y" configuration, an "H" configuration, or an "X" configuration, all of the case study airports concentrated the majority of their concession programs into one central area. These core areas are identified in Figures 3.45 through 3.51.

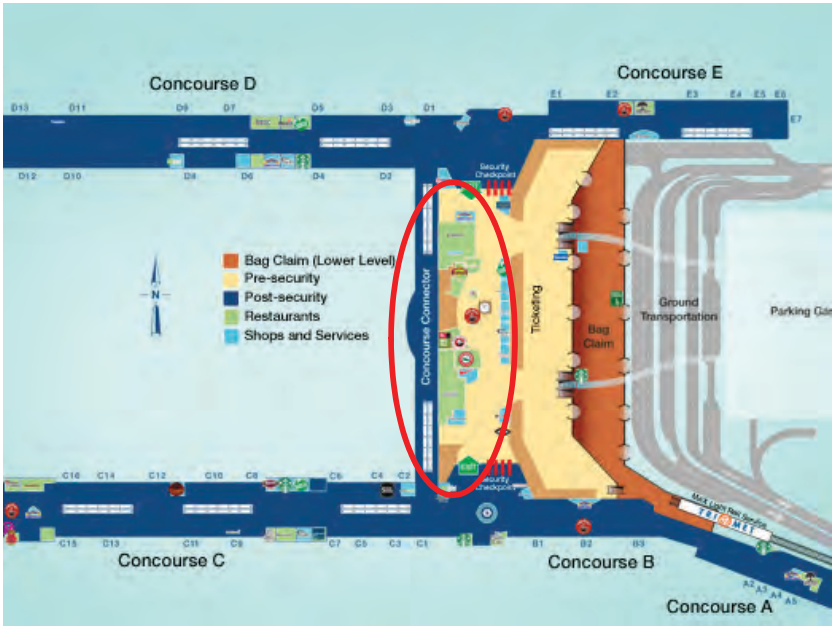


Source: Port Authority of New York New Jersey

Figure 3.45. John F. Kennedy International Airport, Terminal 5, central core.

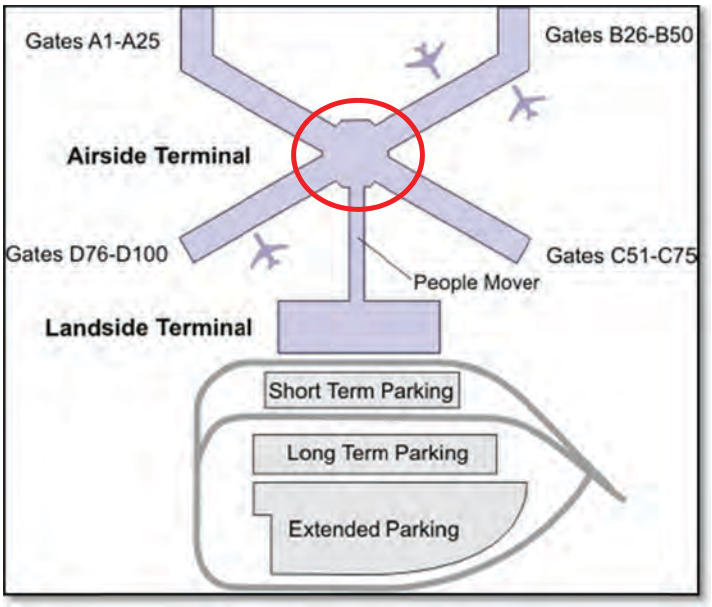
Source: Minneapolis–St. Paul International Airport

Figure 3.46. Minneapolis–St. Paul International Airport, Terminal 1, central core.



Source: Portland International Airport

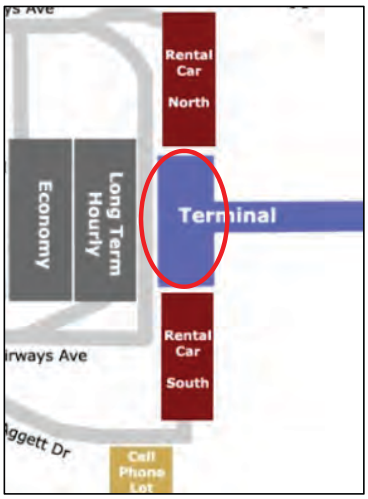
Figure 3.47. Portland International Airport central core.



Source: Pittsburgh International Airport

Figure 3.48. Pittsburgh International Airport central core.

An analysis was conducted to determine if a particular terminal configuration yielded higher concession performance. The results of the analysis are summarized in Figure 3.52. JFK's Terminal 5, which has an inverted Y-shaped configuration, had the highest total concession sales per square foot at over $1,500. MSP 1 and PDX both have H-shaped configurations and yielded similar sales of approximately $940 and $920 per square foot, respectively. The program at BUD, where call-to-gate procedures are used, generated sales of just under $800 per square foot. PIT, which has an X-shaped configuration, had total concession sales per square foot of just under $700. Finally, the concession program at SAV, which has a single-pier configuration, yielded approximately $300 per square foot.



Source: Savannah-Hilton Head International Airport

Figure 3.49. Savannah/ Hilton Head International Airport.

Note that sales per square foot also reflect the amount of concession space allocated. For example, the concession program at SAV generated the lowest sales per square foot among the case study airports, but had the most concession space relative to the number of passengers, at approximately 31 square feet per thousand enplanements. This allocation is more than three times as much concession space per passenger as that allocated at JFK's Terminal 5, where there are approximately 9.3 square feet per thousand enplanements.

For this analysis, the location of a concession program in relation to security screening was also considered. Previously, *ACRP Report 54* found that among the airports surveyed, 31 percent of the concession space was located in a pre-security environment, while 69 percent was located in a post-security environment (*9*). For the case study airports analyzed for this Handbook, similar results were found as approximately 21 percent of the concession space among these airports was located in a pre-security environment, and 79 percent was located in a post-security environment, as presented in Table 3.9.

3.7.5.2 Impact of Concession Operational Procedures on Space Needs

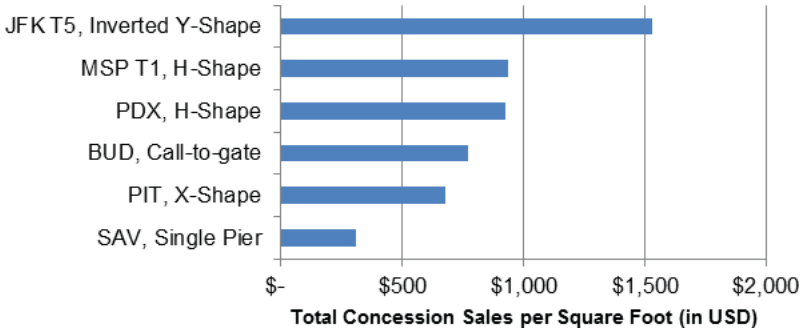
Some procedures implemented at airports by concessionaires have either a direct or indirect impact on the amount and/or type of space needed for concession operations. This section discusses some of these procedures and their impacts.

Source: Budapest Liszt Ferenc International Airport

Figure 3.50. Budapest Liszt Ferenc International Airport central core.

Source: London Heathrow Airport

Figure 3.51. London Heathrow Airport, Terminal 5, central core.



Compiled by AirProjects, Inc. 2013

Figure 3.52. Total sales per square foot by terminal configuration.

In the past, when there was often a single food service concessionaire operating in an airport, there would be a centralized food preparation kitchen (a commissary) where food would be prepared and packaged or prepped so that it could be quickly finished in the concession units in the concourses. The use of commissaries for food preparation, especially at medium and large hub airports has greatly diminished, as the majority of food preparation at airports now occurs in individual concession units due to leases with branded restaurants and a greater emphasis on fresh products and visible food preparation. As a result, many commissary spaces have been converted to storage and office space for the concessionaires. However, in certain situations, the availability of such centralized facilities may reduce the need for valuable airside space for back-of-house operations.

Due to CBP regulations, virtually all duty-free alcohol and tobacco products purchased by customers at U.S. airports must be delivered to the customers as they enter the passenger loading bridge just prior to boarding their international flight. From a staffing standpoint, this procedure is highly inefficient, as it requires one or more concession staff to deliver packages outside of the store on a time-specific basis. From a space perspective, this procedure for purchase delivery may offer some benefits. Because orders do not necessarily have to be filled from the store itself, it may not be necessary for large amounts of inventory to be maintained in the stores. This procedure allows the operator to display smaller quantities of a larger variety of products in the store or, alternatively, operate a smaller store. Since U.S. international passengers are accustomed to walking away from the stores without their products, gate-delivered duty-free sales also work well with a product wall where customers can order merchandise either on their smart phones or from a sales assistant for delivery to their gate. If orders are filled from a warehouse or other remote location, this secondary location should be convenient to as many of the aircraft departure gates as possible and must have sufficient nearby vertical circulation if the order-fulfillment center is located on a different level of the airport from the departure gates. An effective communication system is also necessary to ensure that customers receive their purchases before their flight departs.

Table 3.9. Allocation of concessions, pre-security versus post-security.

Location	JFK T5	MSP T1	PDX	PIT	SAV	BUD	LHR T5	Average
Pre-Security	7%	6%	48%	10%	41%	12%	24%	21%
Post-Security	93%	94%	52%	90%	59%	88%	76%	79%

Compiled by AirProjects, Inc. 2013

3.7.5.3 Impact of Airport Operational Procedures on Space Needs

Airports with call-to-gate boarding operations maintain a large, central public holding area for passengers waiting to board their flights rather than individual holdrooms. Passengers from all departing flights remain in the central area until their flights are ready for boarding. Call-to-gate procedures are commonly found outside of North America. Both of the case study airports located outside of North America, BUD and LHR Terminal 5, have call-to-gate boarding operations. The implications of call-to-gate procedures on concession productivity can be substantial given the increased concession exposure and dwell time in a central area that it creates. Airports that have this type of boarding operation typically create a central concession marketplace within and surrounding the common holding area and close to the boarding gates. This situation creates a central concession marketplace that has exposure to the vast majority of the passenger population, creating enhanced opportunities for impulse purchases and joint-marketing of the concessions.

If an airport does not have call-to-gate boarding operations (as is the case with all of the North American case study airports), the way that airline departures are distributed among the gates can pose significant impacts on the concession program.

In general, gate assignments are conducted in three ways:

- By the airport operator (i.e., in a shared-facility/common-use environment)
- By both the airport operator and the airline (i.e., in cases where there are preferential-use holdrooms/gates, the airlines determine how to allocate their assigned gates to their departing and arriving flights)
- By the airline only (i.e., when the airline owns, operates, and/or leases one or more terminals at an airport)

In a shared-facility/common-use environment, the airport operator can place flight arrivals and departures at any available gates. This procedure creates an opportunity for an airport operator to strategically allocate gate assignments to ensure that significant passenger traffic flows past the concessions.

In a preferential-use environment, the number and nature of flights (i.e., long-haul versus short-haul, domestic versus international, etc.) as well as the characteristics of the airlines are often considered when planning concessions for a specific location within a terminal.

In an airline-controlled environment, the airline also may control the concession leases and receive some or all of the rent from the concessionaires. If there is a revenue-sharing agreement between the airline and the airport operator, the airport operator likely receives a lesser revenue stream than if it directly controlled and managed the concession program. In these cases, the airline often strategically allocates its flights to specific gates in order to maximize the value of the concessions in its terminal.

3.7.6 Locating Concessions by Type

Each type of concession has characteristics that dictate its ideal placement for optimal performance. This section provides an overview of the findings from the case study airports regarding the placement of various types of concessions in the terminals.

3.7.6.1 Food Service

Food service concessions generally can thrive in a number of different locations, depending on the type of operation. Total food service sales per square foot were calculated for each of

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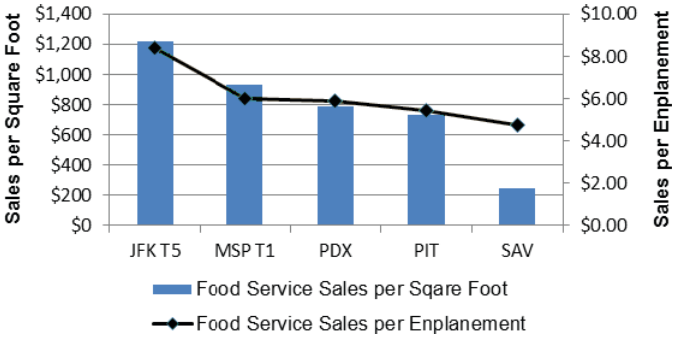


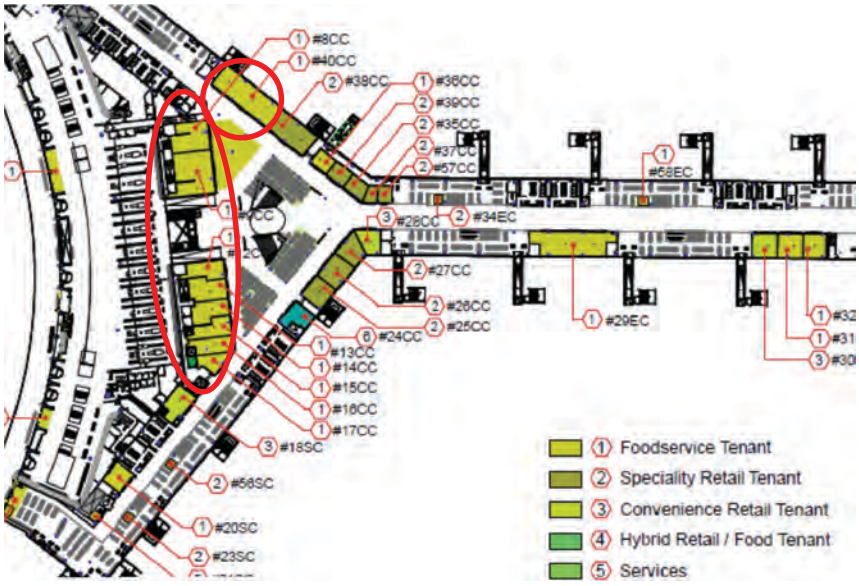
Compiled by AirProjects, Inc. 2013

Figure 3.53. Food service productivity metrics.

the case study airports for which food service sales were reported. The results are summarized in Figure 3.53.

JFK's Terminal 5 had the strongest productivity metrics, with sales per enplanement at just under $8.50, and sales per square foot just over $1,220. As shown in Figure 3.54 the majority of the food service in JFK's Terminal 5 is located in the central marketplace where there is common seating and a clear line-of-sight to the majority of the specialty retail concessions. This central area includes casual dining and quick-service concessions.

The second highest food service productivity level was generated by the food service concessions at MSP's Terminal 1, which yielded sales of over $930 per square foot and $6.00 per enplanement. A significant portion of the food service concessions at MSP's Terminal 1 is located in clusters at strategic intersections or decision points within the main terminal core adjacent to and across from specialty retail concessions, as indicated in Figure 3.55.



Source: Port Authority of New York New Jersey

Figure 3.54. Location of central marketplace food service at John F. Kennedy International Airport, Terminal 5.

Source: Minneapolis–St. Paul International Airport

Figure 3.55. Location of central food service concessions at Minneapolis–St. Paul International Airport, Terminal 1.

The food service concessions at PDX yielded the third highest food service productivity levels with sales of $5.90 per enplanement (similar to MSP's Terminal 1) and just under $800 per square foot. As shown in Figure 3.56, a large portion of its food service program is concentrated in the pre-security area and includes casual dining restaurants, quick-service units, and a food court that are within eyesight of many specialty retail concessions.

Successful food service programs have high productivity metrics as measured by both food service sales per square foot and food service sales per enplanement. The successful food service programs were also located in clusters in concentrated concession areas that included specialty retail.

3.7.6.2 Specialty Retail

Specialty retail concessions require high visibility in order to succeed. Customers rarely plan to make specialty retail purchases at airports. As a result, specialty retail concessions should be in the direct circulation path of and easily visible to passengers since the passengers are not likely to seek them out. Specialty retail concessions benefit significantly from exposure to enplaning passengers and from a terminal configuration that provides substantial passenger exposure to concessions. This conclusion is supported by the data obtained from the case study airports, as presented in Figure 3.57.

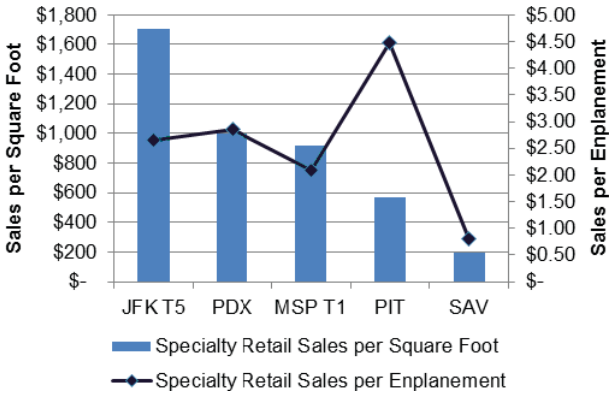
The graph in Figure 3.57 showing the specialty retail productivity metrics is not as linear as the one provided for food service. This result demonstrates that many factors affect specialty retail purchases and relying on just one metric can create misleading information. For example, the specialty retail concessions at PIT had the highest sales per enplanement at just under $4.50, yet a lower productivity with sales per square foot at just under $600 (significantly lower than three other case study airports). Likewise, the specialty retail concessions at JFK's Terminal 5 generated

Source: Portland International Airport

Figure 3.56. Location of central food service concessions at Portland International Airport.

sales just under $2.70 per enplanement, yet these concessions yielded over $1,700 per square foot. The reasons for these variances are discussed in the following paragraphs.

PIT's specialty retail program likely benefits from the terminal's "X" configuration that requires all passengers to pass through the central mall area. This configuration and the central concession mall provide virtually 100 percent exposure to the concentration of specialty retail within the central core of the terminal. In addition, passenger dwell times in the central core are likely substantial because all of the concourses directly connect to the "X" and none are extremely long. This creates a situation in which many passengers would be willing to venture back to the central mall after they have located their departure gate. The low sales per square foot and the high sales per enplanement in this terminal generally stem from the same reason.



Compiled by AirProjects, Inc. 2013

Figure 3.57. Specialty retail productivity metrics.

Table 3.10. Specialty retail program sizes of the case study airports.

Airport	Size of Specialty Retail Program (square feet)
JFK T5	8,900
PDX	19,500
MSP T1	34,200
PIT	32,800
SAV	3,300

Compiled by AirProjects, Inc., 2013

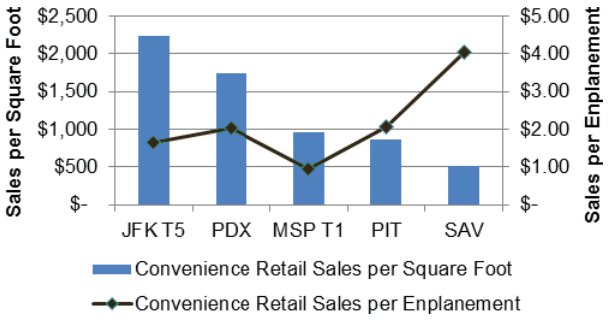
There is a high allocation of specialty retail at this airport. This high allocation contributes to the higher sales per enplanement since there is a good variety of specialty concepts available, increasing the likelihood that passengers will be enticed to make a purchase. Conversely, this high allocation also thins out the concentration of sales per square foot of space allocated for specialty retail. The high sales per square foot figure at JFK's Terminal 5 is the result of significant sales per enplanement occurring within a small allocation of specialty retail stores. Table 3.10 summarizes the size of the specialty retail programs for the case study airports that provided data.

The most successful specialty retail programs should have high productivity metrics as measured by both specialty retail sales per square foot and specialty retail sales per enplanement. When there is not a strong correlation between these two metrics, further investigation is necessary to check for a misallocation of space, errors in concept and merchandising, or issues with the concession locations or customer service. There is typically a balance of contributing factors including exposure, terminal configuration, concepts, and passenger mix that affect specialty retail performance.

3.7.6.3 Convenience Retail

Convenience retail concessions generally fill passenger needs, and for the most part, passengers seek out convenience retail. As such, convenience retail units are often strategically placed near specialty retail units to help draw passengers and increase exposure to the specialty retail. Convenience retail is also frequented by arriving passengers in addition to departing passengers. Average sales per transaction tend to be lower than those at specialty retail units, but the volume of transactions is typically significantly higher.

Figure 3.58 summarizes the productivity metrics for the convenience retail programs at the case study airports that provided such data.



Compiled by AirProjects, Inc., 2013

Figure 3.58. Convenience retail productivity metrics.

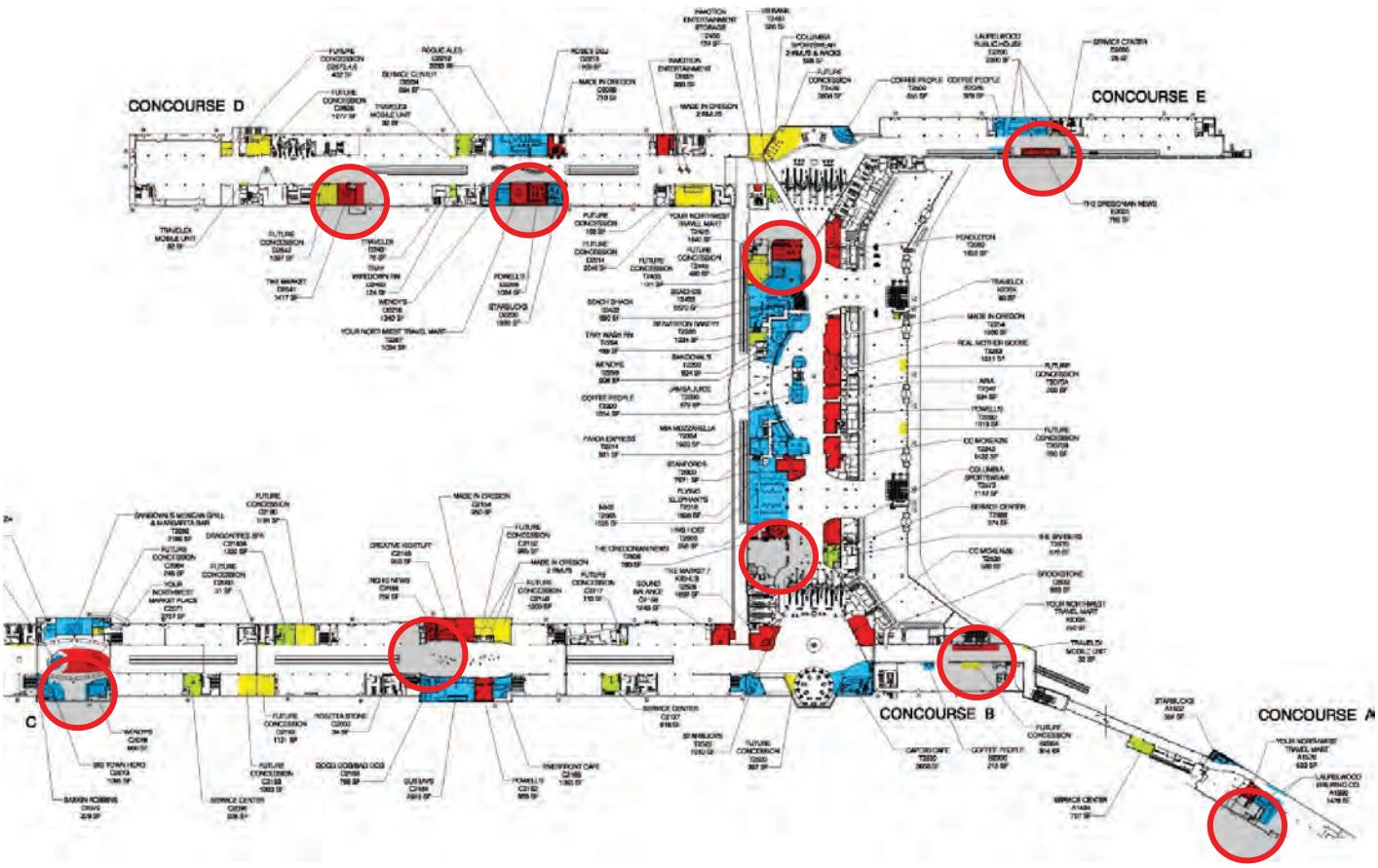
The productivity metrics show that the convenience retail at SAV yielded the highest sales per enplanement at just over $4.00 and that JFK's Terminal 5 yielded the highest convenience retail sales per square foot at just over $2,200.

Figure 3.59 shows the concession plan for PDX and identifies each of the convenience retail locations. The plan demonstrates a traditional approach to convenience retail placement, as it shows the convenience retail units distributed throughout the terminal, accessible to both departing and arriving passengers, and in many instances proximate or adjacent to specialty retail and/or food service concessions.

The most successful convenience retail programs should have numerous units strategically located throughout the main areas of the terminal to serve both departing and arriving passengers. In addition, convenience retail co-located with or proximate to specialty retail can increase the passenger exposure for specialty retail.

3.7.6.4 Duty-Free Retail

Passengers are often highly motivated to seek out duty-free shopping opportunities. As such, duty-free concessions can often be used as anchors for a terminal retail program to attract passengers past other concessions. However, in other situations, duty-free operations are integrated with or along the main passenger circulation routes. One such example within the case study airports is the duty-free location at BUD, shown in Figure 3.60, where over 46,000 square feet of space is allocated to duty-free concessions. Passengers immediately enter the flow-through



Source: Portland International Airport

Figure 3.59. Convenience retail locations, Portland International Airport.

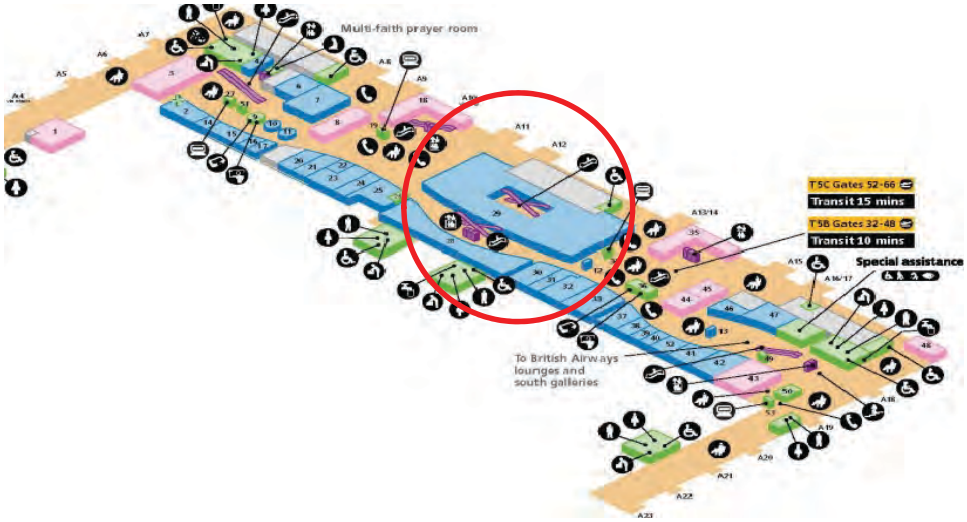
Source: Budapest Ferenc Liszt International Airport

Figure 3.60. Duty-free concession, Budapest Ferenc Liszt International Airport.

duty-free store after exiting each of the SSCPs. They are not given the option to bypass the duty-free concession, but must walk through the store in order to enter the Skycourt that contains other retail and food service.

LHR's Terminal 5 has a significant amount of prominent space allocated to duty free—approximately 47,400 square feet. In this regard, the duty-free units serve as anchors to generate additional exposure to other concessions, as shown in Figure 3.61.

Duty-free concessions can generate significant revenue and serve as anchor tenants for a concession program. Exposure to all departing international passengers is created through



Source: London Heathrow Airport

Figure 3.61. Duty-free concessions, London Heathrow Airport, Terminal 5.

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flow-through duty-free stores that require customers to walk through the duty-free unit to access their final destination point within the terminal.

3.7.7 Concession Signage

The key to the identity of each concession location is the signage that is used at the entry to the store. Such signage calls attention to the location and informs potential customers of the brand and/or products sold. It is important that signage complement the terminal architecture and the overall theme of the concession program (if there is a theme for the program), while creating a distinct, welcoming, and visible portal to its offerings. Signage is important to providing customer service and increasing concession revenue by ensuring that passengers can find the products they are seeking and identify the brands with which they are familiar.

Generally, airport operators allow a single store identity sign on the storefront; if a store wraps around a corner and has two openings, then the concessionaire is typically permitted two storefront signs. The form and format of these signs vary and include large, three-dimensional signage and backlit letters cut into the fascia, among others. Figure 3.62 shows some of the different types of signage at the case study airports.

Directories and directional signage in terminals, shown in Figure 3.63, can significantly affect concession performance. Frequent fliers may be familiar with terminal layouts, but many passengers still rely on in-terminal directories and signage to find their gates and learn about available concessions and amenities.

Increasingly, airport operators are adopting new technologies to enhance wayfinding. Static directories are being replaced by digital displays that passengers can use to help find their departure gates, concessions, and airport amenities. Some of the new technologies also provide additional opportunities for advertising and promotions.

Table 3.11 summarizes the different types of storefront and wayfinding signage that have been implemented at the case study airports.

Signage and wayfinding can affect customer satisfaction. JFK's Terminal 5 received strong customer satisfaction ratings for the availability of concessions. For the food service concessions, 62 percent of passengers were highly satisfied with the availability of pre-security concessions, and 56 percent were highly satisfied with the availability of post-security concessions. These figures were higher for retail, where 77 percent of passengers were highly satisfied with the availability of concessions in the pre-security area and 64 percent were highly satisfied with the availability

(a) Static (b) Three-dimensional (c) Blade

Source: AirProjects, Inc., 2013

Figure 3.62. Signage at (a) John F. Kennedy International Airport, Terminal 5; (b) Minneapolis–St. Paul International Airport, Terminal 1; and (c) Portland International Airport.

(a) Static (b) Digital

Source: AirProjects, Inc., 2013

Figure 3.63. Wayfinding at (a) Budapest Liszt Ferenc International Airport and (b) Minneapolis–St. Paul International Airport, Terminal 1.

Table 3.11. Storefront and wayfinding signage at case study airports.

Airport	Storefront Signage	Wayfinding Signage
John F. Kennedy International Airport, Terminal 5	Static	Static
Minneapolis-St. Paul International Airport, Terminal 1	Digital, static, and blade signs with logos	Digital directories with walking time to gates
Portland International Airport	Digital, static, and blade signs with logos	Digital and display windows
Pittsburgh International Airport	Digital and static signs	Digital and static
Savannah-Hilton Head Island International	N/A	Digital and static
Budapest Ferenc Listz International Airport	Digital and static signs	Digital and static
London Heathrow Airport, Terminal 5	Digital and static signs	Digital and static

Compiled by AirProjects, Inc. 2013

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of concessions in the post-security area. A correlation between signage and customer satisfaction with the availability of concessions could not be determined at other case study airports, as survey data was not available.

For additional guidance on airport signage and wayfinding, consult *ACRP Report 52: Wayfinding and Signing Guidelines for Airport Terminals and Landside.*

3.7.8 Pricing

Airport operators typically define a pricing policy for concessions in their leases to concessionaires. This policy is set to ensure reasonable pricing and combat the perception that products and services offered in airports are priced significantly higher than those offered at comparable facilities in shopping malls. The street pricing structure has been implemented at many airports, including several of the case study airports, as presented in Table 3.12. The most common pricing policy was straight street pricing, which prevents concessionaires from marking up prices above levels at comparable street locations. At one case study airport, concessionaires were allowed to add a 10 percent premium to street prices.

When available, passenger survey data from the case study airports was reviewed to determine the passengers' perceptions of the pricing and value of the concessions at each of the case study airports. Table 3.13 summarizes the results at each of the airports.

Among the four case study airports for which both pricing policy and passenger survey results were available, a connection between customer satisfaction and pricing policy could not be determined. JFK's Terminal 5 and PDX have a street pricing policy, while MSP's Terminal 1 has a street pricing plus 10 percent policy. Yet passengers at MSP are slightly more satisfied than passengers at JFK's Terminal 5, and significantly more satisfied than passengers at PDX. As such, it is possible that the concepts and variety of a food service and retail program can help to offset the increased prices and/or a 10 percent increase in pricing above the street level is not significant enough of an increase to negatively affect passenger satisfaction.

3.7.9 Sustainability Considerations

Airport operators around the world are increasing their commitment to developing sustainable business practices. Concession program managers and operators have been relatively quick to adapt and develop new ways to mitigate an airport's impact on the environment. Concessionaires and passengers have worked to adopt the new practices.

A summary of some of the environmental practices currently in place at the case study airports that specifically affect concession programs is provided in Table 3.14.

Table 3.12. Pricing policy at case study airports.

Airport	Pricing Policy
John F. Kennedy International Airport, Terminal 5	Street pricing
Minneapolis–St. Paul International Airport, Terminal 1	Street pricing plus 10%
Portland International Airport	Street pricing
Pittsburgh International Airport	Street pricing
London Heathrow Airport, Terminal 5	High Street
Budapest Ferenc Listz International Airport	Data not available
Savannah/Hilton Head International Airport	Data not available

Compiled by AirProjects, Inc., 2013

Table 3.13. Customer perceptions of pricing/value at case study airports.

Airport	Survey Summary
John F. Kennedy International Airport, Terminal 5	44% were highly satisfied with food service, 50% were highly satisfied with merchandise (ranked 8 or higher on 10-point scale)
Minneapolis–St. Paul International Airport, Terminal 1	49% were highly satisfied with food service, 44% were highly satisfied with merchandise (ranked 4 or higher on 5-point scale)
Portland International Airport	35% were highly satisfied with food service, 32% were highly satisfied with merchandise (ranked 8 or higher on 10-point scale)
Pittsburgh International Airport	No survey data available
London Heathrow Airport, Terminal 5	No survey data available
Budapest Ferenc Listz International Airport	2.98 score for food service, 3.01 score for retail (mean score on 5-point scale)
Savannah/Hilton Head International Airport	No survey data available

Compiled by AirProjects, Inc. 2013

In addition to the sustainability criteria from the case studies airports, airports such as Chicago O'Hare International Airport have developed indoor vegetable gardens. These gardens grow herbs and vegetables that are used in airport restaurants. Airport operators and concessionaires are also encouraging the use of recycled or sustainable materials in the build-outs, such as reclaimed wood and bamboo. Use of LED lighting and eco-friendly paint also help to offset energy consumption and harmful chemicals, such as mercury and volatile organic compounds found in fluorescent lighting and paint (*10*).

Additional information on sustainability as it relates to the airport environment can be found in *ACRP Report 80: Guidebook for Incorporating Sustainability into Traditional Airport Projects*.

3.7.10 Concession Trends

Airport concessionaires are implementing new technologies and marketing strategies to enhance the passenger experience and create revenue opportunities; these strategies cater to the growing number of passengers using smart phones, tablet computers, and other personal computing devices. The impact of these advancements on customer satisfaction and concession revenue is not yet fully recognized since this technology is still evolving.

Table 3.14. Sustainability practices at case study airports.

Practice	JFK T5	MSP T1	PDX	PIT	SAV	BUD	LHR T5
Recycle Cooking Oil	●	●	●		●		
Recycling Program for Concessionaires and/or Passengers	●	●	●	●	●	●	●
Organic Waste Composting Program		●	●				
Liquid and Ice Separation Program at Checkpoints			●				
Water Refill Stations			●				
Program to Reduce Water Consumption							●

Compiled by AirProjects, Inc., 2013

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3.7.10.1 Self-Service Trends

While it is generally accepted that passenger self-service is a rising trend in the airport check-in process, F&B concessionaires are only beginning to recognize the potential benefits. These benefits include enhanced user control, reduced queue times, and cashless payment systems. Self-service kiosks, phone applications, and tablet interfaces are being developed in the F&B sector, allowing passengers to place orders through their smart phones and self-service kiosks without the assistance of wait staff. These technologies can enhance user control by allowing passengers to make ordering decisions remotely, effectively removing them from traditional processes.

One of the key features in self-service concessions is the ability to make cashless payments, which utilizes NFC technology. The NFC chip, which is present in some smartphones and other devices, uses proximity-based radio signals that allow users to "tap and pay" through their phones. Additionally, NFC may allow passengers to interact with concessionaire advertisements, delivering information directly to their wireless devices.

Concessionaires in the industry have announced that they plan on offering more self-service F&B ordering options to passengers. Currently, an established concessionaire utilizes a mobile application (app) that allows users to order food directly from their phones and have it delivered to pre-designated locations (*11*).

3.7.10.2 Marketing Trends

Airports are also experiencing an increase in demand for specialty F&B choices, such as gluten-free, organic, and sustainably produced foods. Consumers are also demanding more healthy food choices. In the airport environment, it is often difficult to find healthy food due to the limited concession options (*10*).

Other marketing trends focus on providing concession information to passengers throughout their entire journey through the airport. A good example of this is the marketing campaign at Port Columbus International Airport (CMH). CMH placed digital ads adjacent to FIDSs, floor decal advertisements, column wrap advertisements, and informational displays in the parking garage and the departures level entrances. In addition to its marketing campaign, CMH focused on the placement of concession kiosks and vending machines in areas where passenger needs had not been previously met. By placing concession kiosks and vending machines inside or near holdrooms, CMH was able to satisfy passengers that typically stay near or inside the holdroom following security screening. Ultimately, the success of CMH's marketing program can be attributed to its development of signage and advertisements that clearly, thoroughly, and continually communicate to passengers throughout their experience in the airport (*12*).

Bristol Airport in England has taken the relay of concession information to the next level. This relay of information has been accomplished by utilizing "smart" and interactive marketing displays. A centralized digital tower outfitted with LCD screens delivers advertising information to passengers based on the time of day, flight, and other available information. This strategy allows the airport to hone in on the advertisements most likely to result in concession sales. To enhance the effectiveness of the target digital market, Bristol Airport has also included walk-through retail, interactive displays, and product sampling (*13*).

Airports are also increasingly recognizing the importance of developing concessions with airport employees in mind. Dallas/Fort Worth International and Los Angeles International airports plan on opening a well-known convenience store within their terminals. The aim is to better serve and provide services to airport workers by providing the convenience items they often purchase in their off-airport communities (*10*).

These trends in airport concessions focus on two fundamental concepts, communication and convenience. With these two concepts, passengers' needs are understood and evaluated.

By evaluating how passengers interact with their environment, airports operators can respond by developing strategies that increase revenue as well as customer satisfaction. By effectively communicating through signage, advertisements, and mobile applications, passengers are quickly able to understand how, when, and where to meet their needs. The overall passenger experience is improved when these processes become faster, easier, and more convenient through the use of mobile and kiosk-based self-service concessions.

3.7.10.3 Concession Placement Trends

Other trends geared toward increasing revenue relate directly to the placement of small-scale targeted concessions. In 2011, McCarran International Airport in Las Vegas, Nevada, made 13 percent of its total concession revenue from free-standing retail merchandising units (RMUs), self-service vending machines, and wall-mounted concession kiosks. This strategy of using low-impact, non-fixed concession units allows smaller local companies to gain exposure in the airport at a relatively low cost and with short and flexible lease periods.

This approach to enhancing the concession program, which has been successful at McCarran, could be applied at other airports that have additional space for small-scale concessions. RMUs can be strategically placed to provide impulse or grab-and-go items. These types of concessions have the potential to generate additional sales and concession revenue with minimal impacts on airport infrastructure and the existing concession programs. In addition, this strategy also allows the airport operator to conduct short test periods with concessionaires, rather than entering into three- to seven-year leases for a product line that may or may not work at the airport. This test period enables the airport to test product lines and concepts to determine those that will be the most successful and best satisfy its customers (*14*).

While some of these trends are related to changes in technology or consumer trends, another way in which airports are changing is by repurposing unused or underutilized spaces. Airport operators are recognizing that new concession square footage can be added by creatively adapting existing spaces, potentially increasing overall concession sales and revenue (*10*).

CHAPTER 4

Human Engineering Considerations

This chapter discusses the human engineering factors that encompass human behaviors and the emotional processes behind them as pertaining to passenger purchases at airport terminals. Analyzing these human engineering factors has revealed a distinct set of needs and priorities for airport customers based on changing needs at various times during their visits.

4.1 Human Engineering Concepts

To the airport customer, the different needs can be divided into two distinct and often very different experiences: landside (all actions taken before completing security screening) and airside (post-security screening).

Landside, customers' behavior and mindsets are focused on accomplishing two tasks: check-in and security. Airside, behavior varies according to individual needs and preferences, frequency of travel, and trip type (business or leisure). Airport owners and operators can increase customer satisfaction both landside and airside. Improving sales performance presents primarily airside opportunities.

While human factors and preferences are universal throughout all commercial and public spaces (such as the need for clear navigational signage), airports present two unique challenges. The first challenge is to alleviate stress and anxiety, as well as cater to basic customer needs. Airport customers enter the space with a heightened need state, increased stress levels, and, depending on their frequency of travel and familiarity with the airport, anxiety about the airport visit process.

The second challenge is to accommodate the need to increase physical space and comfort. Airport passengers have a bigger "body bubble" than they normally would because they are navigating spaces while strapped with backpacks and pulling rolling luggage. Passengers desire to speed up their check-in processes and avoid ever-growing airline check-in luggage fees. Accommodating these mental and physical needs and providing needed/wanted customer products and services to improve the customers' experiences are the key challenges of the airport operator.

4.1.1 Airport Customers

The traditional business and leisure traveler split has continued to be supported by studies as two clear groups with distinct needs and behaviors. Though most airport customers fall into these two major behavior patterns, the landside airport environment also encompasses a third user: those accompanying departing passengers or waiting for arriving passengers. These customers are a key demographic for retail and food concession operators.

4.1.1.1 Business Travelers

Business travelers plan the least amount of time for their airport visit and are most familiar with the offerings available at the airport. As such, they will explore the airport less, and their retail and food spending is commonly planned (if not outright restricted by per-diem and receipt-keeping restraints). For these customers, increasing satisfaction often means increasing efficiency and minimizing delays. The vast majority of business travelers are alone, with only a fraction traveling with colleagues and even fewer with friends or family. Additionally, they travel light, move fast, and exhibit predictable and consistent airport behaviors.

4.1.1.2 Leisure Travelers

In contrast, leisure travelers plan the most time for their airport visit, arriving far earlier than business travelers, and are more interested in shopping retail and food concessions. These segments offer a better opportunity to improve revenue performance at the airport as their increased time at the airport and interest in concessions can result in higher sales. When considering human factors related to leisure travelers, a key difference is that the leisure travelers are most likely to be traveling with others, with the majority traveling with friends or family. Group travelers move more slowly and crowd tight spaces inadvertently; this is a consideration that should be taken into account when designing spaces for these travelers.

4.1.1.3 Landside Guests

These non-travelers were the *most* likely to plan to visit food and retail options at the airport. They were also the most likely to state that "sitting and relaxing" was a part of their plan for their airport visit. Although non-travelers compose a small portion of the total airport customer base, airport design should still consider this group by offering lounges or comfortable seating areas, adjacent casual shopping, and food and beverage concessions.

4.1.2 Landside Behavior

Landside behavior is largely procedural with an emphasis on completing check-in and security. Landside behavior showed little opportunity to increase concession sales and airport revenue from customers visiting the airport for departing flights; in surveys, passengers responded that they preferred to wait until after security to visit any retail or food concessions. Departing passengers cited the most stressful parts of the airport experience as check-in and security. Therefore, by minimizing the anxiety of these two processes, the landside does offer an opportunity to improve overall customer satisfaction.

4.1.2.1 Check-in

Of all the activities that add stress to the airport experience, check-in was cited by respondents as the most stressful. Unsurprisingly, check-in counters and kiosks were the first destination of nearly every departing passenger; this process was the sole task that passengers felt needed to be completed landside.

As airlines increasingly require passengers to complete more of this process themselves, with kiosks for check-in and drop-off points for baggage, check-in has become a larger source of anxiety. Especially for the inexperienced traveler, the check-in process can be intimidating and require assistance from airport personnel.

To reduce anxiety, airport terminal planning and design should focus on wide areas for self-check kiosks that accommodate baggage and groups. Long rows of check-in desks should also feature easy-to-spot signage that clearly calls out the airline operators and is visible from afar.

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Open sightlines to baggage drop and clear signage to security also alleviates these top sources of anxiety.

Landside, passengers spend the majority of their time at check-in. In an observational study, few passengers visited any retail or food concessions, and surveyed passengers showed little interest in offerings here (*15*). When asked why they choose not to purchase food or retail landside, most passengers responded that they preferred instead to complete the next big obstacle: getting through security.

In planning for retail and food offerings landside, the design should primarily focus on the small number of non-traveling airport customers who are waiting for arriving guests. As non-travelers are the most likely users of these services, these spaces should offer relaxing places to wait (in view of an arrivals/departures FIDS), and include snack and beverage products, rather than full-service meals.

4.1.2.2 Security

Following the first destination of check-in, two-thirds of airport customers typically head directly to security (*15*). In fact, few customers visited *any* landside area other than check-in and security.

With customers' tunnel-vision toward completing their primary tasks of check-in and security, there is little opportunity for the airport to increase revenue. However, by focusing on their immediate needs, proper airport design and signage can increase customer satisfaction. The most stressful aspects of security are long waits and seemingly slow-moving lines. Terminal designs and informational displays should work to alleviate the uncertainty of the wait time.

One best practice is the use of display signage that explicitly states the average wait time at certain points, as this helps customers plan and, in turn, alleviates anxiety. For example, while the long lines at Orlando International Airport can appear daunting to customers, the airport has borrowed from the neighboring theme parks to offer static signs that read, "15 minutes wait from this point." Not only do these signs alleviate anxiety among passengers, but they also manage expectations—a key factor in increasing satisfaction.

Like check-in times, wait times at security are often overestimated by departing passengers. The perception of long wait times are more destructive to satisfaction than actual line queue waits themselves, and reducing the perception of time spent waiting can help to reduce anxiety. In addition to communications regarding line queue timing, airport operators can integrate television screens and digital signage in the security and line queue areas for other programming. Best practices in other industries, from banking to grocery, have shown that giving customers screens to watch or signs to read while in line can reduce the perception of time spent in line. For airports, offering a map of retail and food concessions to the queue can perform a double duty; it allows shoppers to plan their next moves, and it also increases revenue at concessions. The signage allows shoppers to have a clear plan of action for their remaining time.

4.1.3 Airside Behavior

Overall, airport customers spend over two-thirds of their total time in the airport airside. Customers spend most of their landside time focused on the check-in process, and once in airside, their behavior is more varied. Customers often plan to visit concessions; sit and relax; use the restrooms; shop retail (including duty free); or read books, magazines, and newspapers. The activities airside passengers pursue post-security highlight that, once the anxieties of check-in and security have passed, travelers are open to exploring the airport. This exploration represents the greatest potential of their visit to capture additional sales and increase airport revenue.

4.1.3.1 First Destinations

Universal behavior at transit hubs (for example, airports and train stations) nearly always involves passengers looking to establish their bearings. The first stop, invariably, is the departure board. More than 85 percent of travelers in any airport or train study have begun their journey at this point (*15*, *16*, *17*). Anything located before the departure board is generally ignored, and it is not until customers have confirmed the status of their flight and the gate location that they begin to look at food or retail concessions.

The departure board (post-security) marks the point at which visitors check their watches, evaluate the retail and food concession offerings, and plan their journeys. Airport operators should use the departure board as a road map for passengers by offering clear directions to gate areas, estimated times to travel to the gates, and a guide to concessions and retail offerings for passengers. Passengers surveyed about their needs post-security screening stated that food and drink was most often the first priority (*15*). Decisions on where to eat and shop are most likely to be made at this point in the trip; consequently, the options not presented here are the least likely to be considered by post-security airport customers.

4.1.3.2 Need To Be at Gate

Passengers' anxiety is at its lowest while at the gate. In fact, departing passengers spend the longest amount of airside time at their gate, and over half cited the desire to "sit and relax" at the gate before their flight as something they hoped to do. Comfortable seating options would decrease anxiety and, in turn, increase satisfaction.

Notably, leisure travelers were more likely than business travelers to desire sitting and relaxing before their flights. However, seating has traditionally not accommodated leisure travelers, who tend to cluster in groups. While long rows of seats accommodate the solo business traveler well, they ignore the realities of groups, particularly families. Families do not naturally sit in rows. cluster seating at JFK, shown in Figure 4.1, utilizes beanbag-style seating to provide a comfortable alternative to the standard holdroom seating. Airports should accommodate group travelers with flexible seating options that allow passengers to move seats into clusters that face each other. Similarly, passengers who purchased food were likely to bring this food to the gate, yet few tables exist outside the clustering of restaurants. Accommodating passengers'

Source: AirProjects, Inc., 2013

Figure 4.1. Cluster seating at John F. Kennedy International Airport, Terminal 5.

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existing behavior by including tables at the gates would increase passenger comfort and satisfaction.

The human behavior factors that cause passengers to wait at the gate may be the same ones that drive passengers to consistently check the departure board as soon as they enter; passengers feel the need to track their flight statuses and complete all required tasks. As airports move to create concession clusters in more central areas of the airport, accommodating this need to view the departure board is essential to prevent customers from abandoning these clusters until they are required to be at their gate. An abundance of departure FIDS—within retail outlets, at waiting areas, and even at individual tables—allows passengers to keep control of the situation and continue exploration of the airport.

Further, as passengers make more use of mobile phones as a departure board, the opportunity to create smartphone applications ("apps") becomes more prevalent. In addition to offering departure information, mobile apps should offer a road map of services available or even the closest outlets available. Push notifications that alert passengers when they need to be at their gate would give them the reassurance that they can continue shopping and exploring rather than sitting idly in the gate area.

Alternatively, if passengers need to be at the gate, concession products can be brought to them. In Copenhagen's Kastrup Airport, for example, many retail outlets are among the holdrooms, offering seats adjacent to cafes and shops, as shown in Figure 4.2. As passengers board the aircraft, they are led to a lower level below the retail concourse. Waiting at the gate *is* waiting among concessions, and one does not prevent access to the other. Also shown in Figure 4.2, in New York City at LaGuardia's Delta gates, airport concessions have iPads stationed at tables throughout the gate areas that allow customers to access the Internet, as well as place orders from the nearby café and have them delivered to customers' seats.

(a) Holdroom concessions (b) iPads in gate area for placing concession orders

Source: Envirosell, 2013

Figure 4.2. At-the-gate concessions in (a) Copenhagen's Kastrup Airport and (b) LaGuardia Airport.

4.1.4 Planning for the "Backward Stroller"

When considering human factor engineering, airport operators face a unique challenge of needing to provide space that is accessible to people who are unaware of their personal space. Passengers are often pulling a "backward stroller" of luggage behind them. A parent pushing a stroller is aware of the space they are occupying, but people pulling luggage are largely oblivious to their spatial mass. As airlines continue to charge for checked baggage, passengers find ways to carry more with them to avoid the airlines' fees. Aisles throughout concessions need to be wide and account for these customers, so as to not impede traffic flow or the spatial needs of others.

4.1.5 Food Service and Retail Concessions

Currently, both airport and train research shows that most departing passengers plan their food and beverage purchases ahead of time (*15*, *16*, *17*). Those who purchase food without planning cited, "I realized I was hungry/thirsty" as the primary reason for adding this to their trip. An airport operators' objective should include making food service concessions easy to find, catering to those who plan ahead, and offering fast service for those who may be making an unplanned stop.

To aid the pre-planned visit, airport operators should consider alerting passengers to the food service offerings prior to their arrival. With more cities planning light rail travel to the airport, such as the light rail that links the city of Minneapolis to the airport, messaging within the train provides the airport with an ideal opportunity to present food service options that departing passengers will soon encounter.

Retail shopping among airport customers was less frequent than food service purchases. Certain factors add to the likelihood that airport visitors will choose to shop. Primarily, the longer the customer's wait at the airport, the more likely they are to shop (shopping is not always a cure for boredom—these long-wait visitors were very likely to have planned to shop at the airport).

4.1.5.1 Increasing Revenue at Food Service Concessions

Freshness and price are typically customers' top food service needs. In planning food service concessions, focusing on these two needs will accomplish both goals of increasing sales and revenue as well as customer satisfaction.

Conversely, the actual behavior of customers showed they are most likely to visit food service concessions that have (1) short lines and (2) clear options. Both allow for smooth transactions that enable passengers to better plan their limited time in the airport. Long lines with indeterminate wait times were a deterrent to food service establishments and often received the lowest satisfaction ratings from passengers. Despite citing a desire for freshness, passengers also gravitate toward fast-food options, citing them for speed and ease of ordering.

One often overlooked element in planning for human behavior is the effect of the queue on the storefront. While storefronts may (and should) be designed to be open, drawing in interest from passing traffic, in reality long queues often become a negative aspect for the establishment. For example, at the Dublin airport, deli cases were often used to display food and convey a sense of freshness. However, long queues blocked views to the deli cases, and customers were unable to make purchase decisions until they reached the counter. This further delayed the process and elongated the queue, leading to increased walkout rates.

Food service establishments must plan for waiting customers. Even the best-run establishment experiences crowding at peak hours. Keeping storefronts open and visible, providing menus that are visible before joining the queue, *and* offering a perception of freshness are important factors in achieving high customer satisfaction.

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Another problem in food service establishments came from menu boards that were often not complete (or simply not offered), which confuses the ordering process and further elongates the queue. As airports move toward offering more local and branded food service establishments, ensuring that passing customers can easily determine the menu is important. All restaurants should have easy-to-read menu boards to aid in customer selection.

Lastly, managing perceptions of pricing is an important step in meeting passenger needs and increasing shopper conversion within establishments. London Heathrow's Terminal 5 promotes "High Street" pricing and Portland International Airport offers "street pricing" to combat the perception that the airport is inflating prices. Outside of duty free, customers rarely feel that they "got a deal" (a feeling that increases customer satisfaction) in airport establishments.

4.1.5.2 Increasing Revenue at Retail Concessions

Leisure travelers were the most likely to plan long dwell times at the airport before their flights, so some retail may carry products that would appeal to those on vacation.

As certain demographics (such as leisure travelers and women, who tended to spend more time shopping) exhibit different behaviors, retail concessions that can adapt to changing conditions in the airport through the week or day may best serve passengers' needs. For example, showcasing products for leisure travelers on Sundays and business travelers on Mondays may maximize the sales potential of retail concessions and generate higher revenue for the airport operator.

One of the challenges for airport retail concessionaires is that airport shoppers are on the go. Despite carrying luggage, they lack much, if any additional space to carry items purchased and they are typically limited to the reserve space in their luggage or simply their hands. Airline restrictions may even prohibit passengers from taking a newly acquired shopping bag full of purchases onto the plane if their carry-on limit has already been reached. In many ways, the retail concessions need to conform to this limitation. Many of the products offered should be small, portable, and light. However, it appears that in an era of Internet shopping where customers are "showrooming" traditional retail outlets (viewing products in a store and ordering online), there is an opportunity to encourage using the stores as showrooms. New product categories, such as electronics or housewares, may be showcased at the airport, purchased, and shipped home. Moving beyond souvenirs and travel pillows, the airport concessions could offer the same full browsing experience that shoppers seek at large retailers.

Whereas retail outside of the airport has seen a convergence between the online and in-store sectors, retail in airports seems to have a limited to non-existent online presence. Airport operators may benefit from becoming more connected to online retailing by adopting practices such as allowing customers with travel plans the ability to pre-shop duty-free options; they could also allow customers to pre-order items to be ready for pickup upon arrival. Such an online presence can make airport retail operators more competitive with their off-airport counterparts. Cathay Pacific begins the duty-free experience online with a preview of the items available for purchase.

4.1.6 Arriving Passengers

While most airport food service and retail concessions appear to be aimed at passengers coming to the airport to depart on a flight, less consideration is given to those who are arriving and passing through the airport upon arrival.

For passengers arriving at the airport, concessions should be fast and easy. A purchase should be something that can be accomplished within a similar amount of time as it takes for checked baggage to arrive. Following the same guidelines for all airport concessions—easy-to-read menu boards, efficient operations, and short lines—should also benefit these customers. Food service

options should be easily portable—to the train, to the city, the taxi ride to the hotel, or the drive home—as well.

4.2 Conclusion

The more airport terminal design reduces anxiety and uncertainty among airport customers, the more customers are open to the idea of exploring food service and retail offerings, resulting in increased sales and ultimately, additional revenue. Additionally, providing opportunities for customers to stay updated on the status of their flights throughout the terminal will make them feel more comfortable to wander from their gate areas. Strategically locating maps or directories that outline the full array of concessions in the terminal aids customers in making informed purchase decisions, thereby further reducing uncertainties and resulting in enhanced passenger satisfaction.

Unlike when they visit off-airport establishments, airport passengers are carrying more than just a purse or umbrella. The addition of a carry-on bag and/or briefcase or backpack means that their maneuverability is compromised. Wider aisles and organized queues are important in helping passengers gain access to concessions and manage their space, resulting in higher satisfaction for them and their peers.

These physical limitations may also restrict passengers' ability to make retail purchases. Items that do not fit in their accompanying bags may not be bought, and shipping options should be offered.

Finally, flexible seating options should be offered that account for the variety of travelers visiting the airport—from those that want to be alone to those traveling with extended family or a group.

CHAPTER 5

Ancillary Land Development Considerations

Chapter 5 discusses a new approach airports are employing to generate additional revenue while improving customer (air traveler) satisfaction: developing land adjacent to or near their terminals into commercial complexes. Some of these terminal-area developments have taken on features of metropolitan downtowns becoming multimodal, multifunctional concentrations of office buildings, retail facilities, hotels, conference and exhibition centers, and leisure and recreation venues.

5.1 Ancillary Land Development

In more than a few cases, this landside development has contributed a substantial portion of airport revenues. Depending on whether the airports follow single-till/residual or dual-till/compensatory accounting policies, they have been able to use ancillary land use revenues for expansion and modernization of their aeronautical infrastructure and facilities and/or to cross-subsidize airline costs, keeping the airport competitive for air service.

Equally important, ancillary land development has provided commercial facilities and services which enrich the passenger experience. A positive airport experience has been shown to play a role in helping hubs compete for transit passengers. This indirectly bolsters airport revenue through additional aeronautical fees and terminal commercial revenues generated by these incremental transit passengers.

The following sections provide a summary of primary commercial developments on ancillary airport land, highlighting both airport revenue and customer satisfaction aspects.

5.1.1 Retail Facilities

Some airports have been able to develop significant retail facilities near their terminals, and others have not. Good highway access and passenger rail service appear to be factors in fostering retail development beyond the terminal. Retail space for non-travelers depends critically on the market catchment area and the ease of airport access. In some cases, air travelers find such landside retail offerings a draw as well. For example, Minneapolis's huge Mall of America (located three miles from the airport terminal, but connected by an APM) reportedly derives over 10 percent of its sales from airport-based visitors. The airport is also a major Delta hub for trans-Pacific flights, which attract a large number of passengers with long layover times. This mega-mall likewise draws "retail tourists" who fly in from Asia and across the United States to shop, dine, and even sleep in the mall's hotels.

Duty-free sales inside and outside the terminal depend largely on passenger demography and retail alternatives open to travelers. Dubai duty-free retail has more than U.S. $1.4 billion in sales

Source: Aerotropolis Business Concepts

Figure 5.1. Retail facilities on ancillary Athens International Airport land.

annually since many of its transit passengers from Africa and Asia do not have good shopping facilities in their home cities. Factory outlets and big box retailers requiring large, flat land parcels with sufficient parking have operated successfully, serving mainly local non-travelers when the catchment area is sufficiently large and highway access favorable. Some airports such as Athens and Brisbane have been able to substantially boost their revenues through direct factory outlets and big box retail facilities located on their ancillary land, as shown in Figure 5.1.

5.1.2 Hotels

Demand for airport and airport-area hotels is also largely determined by volume of passenger traffic, especially business travelers. Upscale terminal-linked hotels (four- and five-star) are becoming increasingly common and have generally been successful. Passengers value quick, pedestrian terminal access and the business services, fine dining, and meeting and leisure amenities such high-quality hotels provide. Some terminal-linked hotels serve as virtual corporate headquarters and meeting locations for executives and sales people who fly in for meetings with perhaps just one overnight stay. Corporations often fly their customers and clients to these larger airport hotels for meetings and seminars, as well.

The above description characterizes the Grand Hyatt linked to Dallas/Fort Worth's Terminal D, shown in Figure 5.2, where nearly as much airport revenue is derived from business meetings and ancillary business services as from overnight guest stays. Chicago O'Hare's Hilton and the Weston at Detroit Metro report similar trends in terminal-linked hotel business revenues.

Passengers' satisfaction is further enhanced by quick and easy access from these hotels to the terminal concourses where they can visit a variety of shopping, food, and entertainment venues. Such venues are typically not offered by the clusters of three-star hotels found near highway off-ramps further from airport terminals.

5.1.3 Conference and Exhibition Complexes

Conference and exhibition facilities tend to be most successful at and around large hub airports (e.g., Atlanta, Frankfurt, Hong Kong, Chicago O'Hare, and Amsterdam Schiphol). Some mid-size

Source: Aerotropolis Business Concepts

Figure 5.2. Dallas/Fort Worth Grand Hyatt Hotel.

airports such as Helsinki, Munich, Stockholm, and Oslo have developed profitable conference and exhibition venues, drawing on their centrality in a market region and air networks.

In addition to sufficient air networks, multimodal surface transportation access (rail and highway) plays a key role in airport area conference and exhibition success. This is especially true in the conference and exhibition areas near Atlanta's, Chicago's O'Hare, and Hong Kong's airports (such as the AsiaWorld Expo shown in Figure 5.3). Because they are often not on airport property, such facilities may not directly generate airport revenues. However, they do indirectly benefit the airport's bottom lines by attracting substantial numbers of air travelers who boost airport aeronautical and terminal commercial revenues.

Convenient access to airport area conference and exhibition facilities also contributes to customer satisfaction by reducing airport commuting time to the facilities. Conversely, airport area conference facilities that are stand-alone may not provide other forms of customer satisfaction that downtown facilities provide via nearby urban amenities.

5.1.4 Office Buildings

The signature headquarter buildings of hub-based airlines sometimes grace major airports, but the offices of travel-intensive sectors such as producer services are often the most difficult segment of demand for most airports to capture. Office functions need to balance the costs of airport

Source: Aerotropolis Business Concepts

Figure 5.3. AsiaWorld Expo at Hong Kong International Airport.

Source: Aerotropolis Business Concepts

Figure 5.4. Amsterdam Schiphol Airport offices.

access for travelers with the commuting costs of employees. In some cases, these considerations reinforce the attraction of airport areas, but in many cases they do not. With the exception of the World Trade Center (commonly known as the WTC) at the Amsterdam Airport Schiphol and The Squaire (formerly known as the AirRail Center) at the Frankfurt Airport, which are both centered on regional passenger rail and major highways with good commuter access, most airports have difficulty in attracting office functions beyond those that are directly connected to the provision of air transportation. However, Schiphol's (Figure 5.4), Frankfurt's, and other hub airport office buildings have commanded premium rents and thus generate substantial airport revenues.

5.1.5 Cargo and Services

The location determinants of services vary widely. Traveler services and some cargo-handling services are strongly attracted to airport locations and are among those types of businesses willing to pay a premium for an on-airport site. The greater the degree to which the services depend upon air transport, the higher their likelihood of locating on airport land, assuming it is available.

Many other services are attracted to airport areas primarily by the value proposition of land availability for cost. Though not major revenue generators, educational and health facilities can be good anchor tenants that attract other tenants and add prestige to the airport. For example, the GMR Group, developer of the Hyderabad, India Aerotropolis, recruited an international business school and major health provider to its airport. It did this as much for stature and for attracting other facilities as for real estate revenue returns.

5.1.6 Recreational, Green, and Cultural Venues

Recreational areas, such as nature preserves (without birds), as well as certain warehouse functions, can serve as good airport safety and noise buffer areas. The large parcels of land area sometimes available at and near airports have led to proposals for theme parks and green recreation; however, accessibility to the regional customer base remains an important determinant of revenue success. Airport solar farms are likewise increasingly found both airside and landside in open areas.

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Terminal area recreation and cultural facilities are often located in zones that are not yet sufficiently attractive to support higher-revenue-generating commercial facilities. Travelers appear to value the relaxation afforded by cultural offerings, which may reduce stress. Some airports offer community-oriented concerts and festivals. The aim appears to be air travelers' enjoyment and generating community good will, rather than revenues.

5.1.7 Managing Ancillary Land Development

Numerous airports (both public and private-sector operated) have established commercial and/or real estate divisions to develop their ancillary landside areas as well as foster development beyond airport boundaries. These airports include Aéroports de Paris; Dallas/Fort Worth International Airport; Frankfurt Airport; Amsterdam Schiphol; Singapore Changi; and Spain's Ferrovial Group, which also owns United Kingdom airport operator, the British Airport Authority (now known as Heathrow Airport Holdings). To briefly note some management structures:

- Aéroports de Paris established a real estate division in 2003 to act as the developer, general contractor, and construction project owner and manager of landside commercial properties at Paris Charles de Gaulle and Orly International Airports.
- China Capital Airport Holdings, a corporatized state-owned enterprise that operates much like a private entity, is rapidly proceeding with its highly ambitious Beijing Capital Airport City. Working with partners such as Airport City Development Corporation, Ltd., and municipalities such as Shunyi, it is developing shopping, entertainment, education, exhibition, sports and leisure, logistics, light manufacturing, finance, trade, and housing facilities at and around Beijing Capital International Airport. Its Airport City Logistics Park, being led by Airport City Development Corporation, Ltd., covers over 2.5 million square meters.
- Dallas/Fort Worth International Airport's management is aggressively expanding its commercial and real estate divisions to lease airport land to a wide variety of commercial tenants. It is also forming public–private partnerships to develop over 5,000 acres of ancillary property for office, hospitality, retail, entertainment, and wellness facilities.
- Hong Kong International Airport has likewise established both commercial and real estate divisions to boost its terminal retail and develop its adjacent SkyCity commercial complex.
- Malaysia Airports Holdings Berhad is an entrepreneurial organization developing Kuala Lumpur International Airport's airport city, commercially anchored by its large Gateway Park that, in addition to retail and office development, includes motor sports, an automotive hypermarket, and leisure venues drawing on the local as well as aviation-induced markets.
- Incheon International Airport Corporation is forming a variety of joint ventures with the private sector to develop its expansive ancillary land encompassing hotels, office buildings, logistics zones, shopping, entertainment, and tourism districts, as well as housing and services (e.g., medical) for its "AirCity" workers.
- Dubai Aviation City Corporation has been established to build and manage Dubai World Central, a US$33 billion airport-centered set of cities under development 25 miles south of downtown Dubai. Its cornerstone is the initial phase of the new Al Maktoum International Airport, which opened in 2011. Dubai World Central is planned to include logistics office towers, aviation-related industry, hotels, a mega-mall, golf course, and housing for 40,000 on-site workers. Slowed by Dubai's real estate crises, Dubai Aviation City Corporation's current focus is on developing its "Logistics City."
- Amsterdam Schiphol, through its Schiphol Real Estate, which operates on the basis of private-sector principles, has been a key revenue-generating arm of its airport operator, the Schiphol Group. Over 50 percent of the Schiphol Group's profits come from aviation-linked commercial activities.

5.2 Conclusion

Airports from Amsterdam to Zurich and from Athens to Seoul are pursuing ancillary land development as a pivotal means to financing airport operations while contributing to their profitability, cost competitiveness in attracting airlines, and passenger satisfaction. Other international airports (not quite the scale of Amsterdam Schiphol or Seoul's Incheon) have given landside commercial development a high priority [e.g., Abu Dhabi, Athens, Belo Horizonte (Brazil), Brisbane, Calgary, Dublin, Helsinki-Vantaa, Munich, Stockholm-Arlanda, Taiwan-Taoyuan, Vancouver, and Vienna]. They all are incorporating a broadening range of traditionally urban commercial functions to diversify their land use and revenue streams. Such land use diversification is creating additional rewards for airport operators, their development partners, airport businesses, and air passengers. In the process, it is transforming many city airports into airport cities.

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Abbreviations and acronyms used without definitions in TRB publications:

A4A	Airlines for America
AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMCRP	Hazardous Materials Cooperative Research Program
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
MAP-21	Moving Ahead for Progress in the 21st Century Act (2012)
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation