Airport Landside Capacity

A Growing Concern

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Air travelers know that on a busy day in midsummer or on holidays when people want to get together the skies can turn unfriendly. Crowds throng the airport. Lines grow at ticket counters and restrooms. The wait for baggage appears to be longer than the flight. Traffic reaches a gridlock in front of the terminal. Too many people are using the airport at the same time.

Some airports are exceeding capacity almost on a daily basis. New airline services can in a matter of months double or triple the number of passengers passing through an airport during the busiest hour. Airport operators, the federal government, and local communities—as well as many airline passengers—are becoming concerned.

The U.S. air transport industry has changed radically during the past 10 years. Deregulation, high interest rates, fluctuating fuel prices, and community opposition have made it difficult to program major new airport development. Many cities are trying to adjust to the realization that they may have to make do with their current facilities.

At the same time, air travel continues to increase and competition is forcing airlines to rapidly shift operations and demand new aircraft designs for serving specialized markets. Airport managers are striving to operate their facilities with maximum efficiency, both to serve the demand over which they have little direct control and to maintain a level of quality of service and type of image desired by the local community.

Above: Getting into the terminal is a challenge at some airports.

Right: Ground access is a major issue at about two-thirds of the airports that experience landside problems.

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The Problem

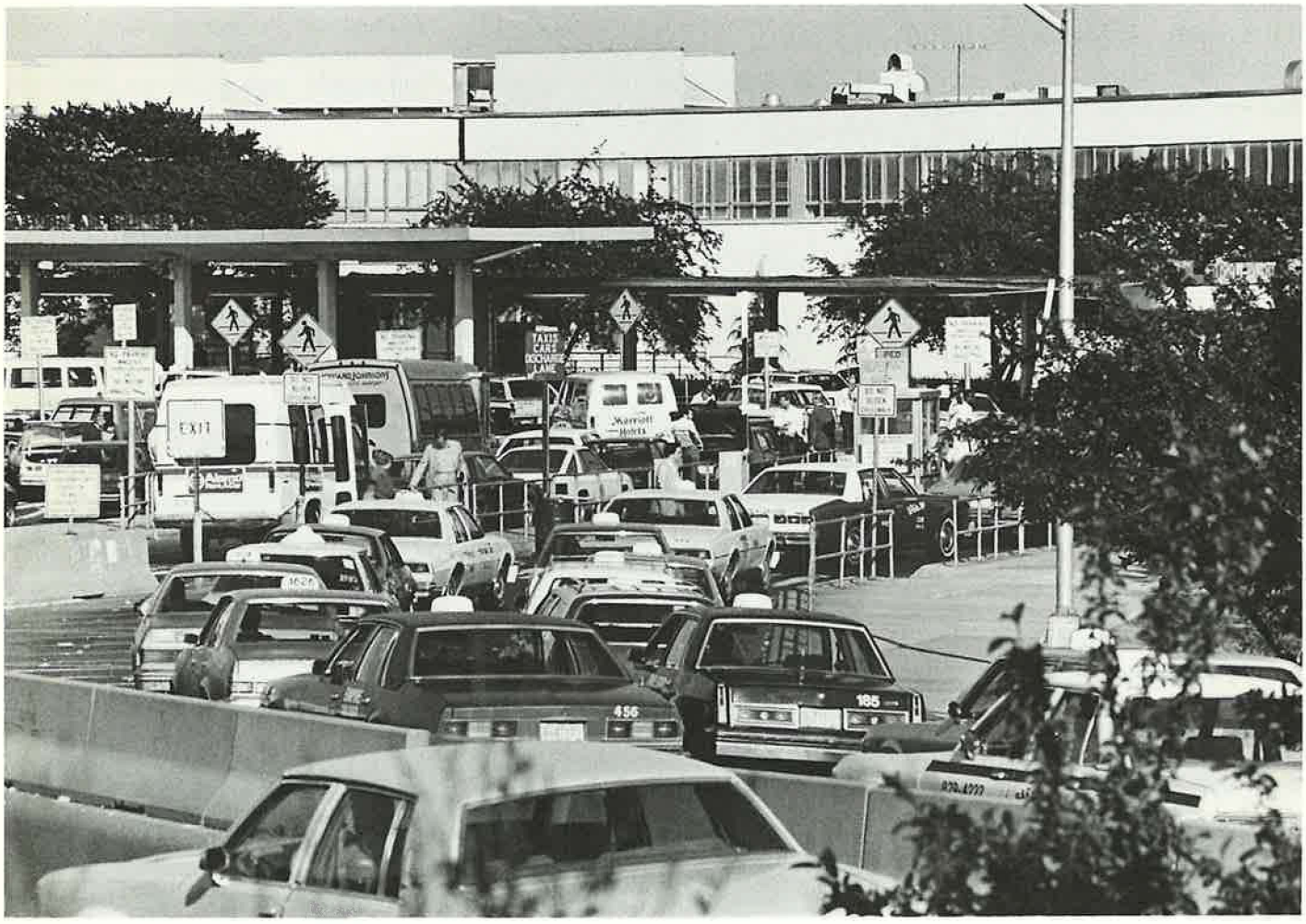
The Federal Aviation Administration (FAA) expects that the annual number of passengers using the nation's airports will increase more than 70 percent during the next 10 years—to 633 million by 1996. Flights will increase at an average annual rate of 4.5 percent during the same period, and more airlines will provide service to meet this demand. Continued growth in the number of passengers, flights, and airlines will place increasingly large and complex demands on the nation's airports.

The 3,219 airports that make up the nation's air transport system will be swamped as a result of this growth. Current problems at existing airports are encountered on the apron, where aircraft maneuver and park, and at the curbside, where private cars, taxis, buses, and pedestrians compete for space. At 40 percent of airports reporting capacity problems, the terminal buildings are too small or poorly designed.

Several communities have tried to control the new demands through airport growth restrictions. For example, at MacArthur Airport in Islip, New York, the town board proposed that flights be limited to no more than 550 departing and arriving passengers in any given hour; proponents cited limited capacity of airport terminal facilities as the basis for the proposal. In 1983 officials in Orange County, California, concerned about crowded terminal facilities and insufficient parking, attempted to limit the number of commercial flights serving John Wayne Airport by denying entry to airlines wishing to serve the airport.

Community opposition to noise has led to many proposals to restrict growth. In spite of the introduction of quieter aircraft, modifications of flight operations, and local land-use planning, aircraft noise remains a source of recurring conflict between the air transport industry and communities. At almost 60 percent of airports that have landside constraints, noise is a major factor.

The problems are greatest at small and medium-sized airports. Deregulation of the airline industry has led to the formation of airline hub operations and a sudden increase in aircraft traffic at many of these airports. Medium-sized airports on the average experienced 38.5 percent growth in the number of weekly departures between 1978 and



1984. At the smaller hub airports, the increase was 19 percent. The neighbors of many of these airports have begun to object to the increased air traffic.

Airport operators, at the center of the conflicts caused by the growth in air travel, community concerns, and the sudden changes in the deregulated aviation industry, cannot always meet the demands placed on them. The FAA, responsible for ensuring the safety and adequacy of the nation's air transport system, finds that at times it must mediate and resolve conflicts that threaten the system's operations. But so far the agency has had to operate without the help of commonly accepted measures and standards of landside capacity that can facilitate the difficult decision making involving airport investment and operations.

TRB Study on Airport Landside Capacity

The FAA developed procedures in the past for calculating the number of flights that can be safely handled at each airport. These procedures are used routinely to estimate *airside* capacity. However, attempts to estimate the limits of *landside* activity must contend with the unique conditions of each airport, the concerns of airport patrons, and many other factors outside the control of the airport operator.

Because airport operators and the FAA have the need for current and reliable guidelines for assessing airport landside capacity, which take into account the varied and unique circumstances of each airport, the Transportation Research Board was requested to develop such guidelines. A study is being conducted by a TRB committee, chaired by Marjorie Brink of Peat, Marwick, Mitchell and Co. and composed of airport operators, representatives of airlines and government agencies, and members of the consulting and academic communities (see accompanying box). This committee will be faced with difficult judgments in suggesting standards where none exist as guidelines are prepared for the broadest range of users. It is expected that a report will be submitted to the FAA by January 1987.

Defining Airport Landside

The airport landside includes all facilities and services associated with the supply of air transportation services up to the point at which the aircraft arrives at or departs from the terminal. The ways by which people get to and from the airport, how they get from private automobiles, taxis, and buses to the terminal, how they board and leave the aircraft, and how they deal with baggage—all these activities are part of the landside. For many of these activities, the situation is similar at most airports. Analysis of these aspects of capacity is primarily a technical problem, with little relationship to the community served or the specific character of an airport.

Other aspects of landside capacity are more dependent on the unique character of the individual airport and the community standards under which the airport operates. Broad organizational, legal, and political issues influence the judgment of what may be the practical limits of airport capacity. And standards that define capacity may differ from one community to another.

Some factors that influence landside capacity are not as closely related to actual service to air passengers or cargo. Support utilities, such as water, electricity, and sewerage, may pose constraints on the increased use of an airport. Safety problems caused when buildings on surrounding land conflict with airport operations and air-traffic rules to control noise exposure may also be factors that affect landside capacity.

Passengers waiting in line may signal a capacity problem.

Capacity may also be limited when the airport's neighbors are reluctant to tolerate additional aircraft noise, highway congestion, water consumption, air pollution, or simply expansion of airport property development. Such reluctance can lead to political decisions, which in turn become limits to expansion of airport operations. These limits, no less significant than serious crowding in the terminal building or lack of space for aircraft parking but not required by concerns for aircraft operating safety, are also part of the landside. Limits imposed to relieve noise problems are already recognized by FAA policy.

Capacity Measurement Issues

The measure of landside capacity is the airport's ability to process airline passengers. Capacity limits are strained when "choke points" or bottlenecks occur; queues, crowding, and processing delays are visible signs that a problem exists.

Quality of Service

An airport provides a variety of services to the passengers and the airlines that use the facility. Most people will agree that long lines at check-in counters; crowded corridors, waiting areas, and baggage-claim areas; and congested roads are marks of poor-quality service. In addition, many people also consider an airport's overall design—the types of restaurants and newsstands available, the color scheme of carpets and furniture—when they make judgments on the quality of the service provided by an airport.

The airlines recognize that passengers complain about delays and unpleasant conditions. Airport operators recognize that business travelers and vacationers and domestic and international passengers all have different expectations regarding acceptable levels of service. What is considered crowded in one airport may be viewed as an acceptable condition by the patrons of another. This variety of opinion makes it difficult to measure an airport's capacity.

Tolerable Crowding and Delay

Rarely does a clearly defined limit exist for any airport feature—whether gate space, baggage claims, or counter space—beyond which an airport simply cannot function. Nevertheless, each user of the airport has a sense of when capacity is approached. As more passengers are served, long queues form at ticket counters and departure lounges become crowded. Nonetheless, travelers reach their destinations. The conditions that are tolerated during busy holiday periods are unacceptable if they occur at other times, but even these conditions do not necessarily imply that the airport is completely full.

Thus landside capacity is related to the convenience, comfort, and delay experienced by passengers at the airport. And conditions that are acceptable once in a while become intolerable if they occur on a daily basis. The definition of capacity at an airport is essentially a matter of judgment: How bad can conditions be, and for how long or how frequently, before the limits of tolerance are reached? The TRB study will propose standards to define critical service conditions that can be used by the airport operator and the community for estimating capacity.

Peak Demand

The patterns of air-transport demand heavily influence the need for various landside facilities. Capacity is generally an issue only during peak travel periods. For example, if business travelers did not prefer to travel during the early morning and late afternoon, or if August

TRB Airport Landside Capacity Study Committee

The TRB Airport Landside Capacity Study Committee is being chaired by Marjorie Brink, Peat, Marwick, Mitchell and Co., San Francisco, California. Committee members are as follows: Margaret Ballard, Maryland State Aviation Administration, Baltimore; George J. Bean, Hillsborough County Aviation Authority, Tampa, Florida; Frank T. Bishop, Robert Mueller Municipal Airport, Austin, Texas; George W. Blomme, The Port Authority of New York and New Jersey; Thomas H. Brown, United Air Lines, Chicago, Illinois; William C. Coleman, Massachusetts Port Authority, Boston; Kenneth McK. Eldred, Ken Eldred Engineering, Concord, Massachusetts; John J. Fearnsides, The MITRE Corporation, McLean, Virginia; John Glover, Port of Oakland, California; Adib Kanafani, University of California-Berkeley; Peter B. Mandle, Wilbur Smith and Associates, New Haven, Connecticut; Dorn Charles McGrath, The George Washington University, Washington, D.C.; Francis X. McKelvey, Michigan State University, East Lansing; Robert S. Michael, Regional Airport Authority of Louisville and Jefferson County, Kentucky; Ray A. Mundy, The University of Tennessee, Knoxville; E. Wayne Power, Canadian Airport Authority, Transport Canada, Ottawa; J. Donald Reilly, Airport Operators Council International, Washington, D.C.; and James W. Spensely, Spensley & Associates, Ltd., Boulder Colorado. Gary L. Olin, Federal Aviation Administration, U.S. Department of Transportation, is the liaison representative. TRB staff representatives are Damian J. Kulash, Director for Special Projects, Andrew C. Lemer, Senior Research Advisor, Special Projects Division, and Peter Schauffler, Air Transport Specialist, Technical Activities Division.

Parking is both a source of revenue and a problem at many airports.

and major holidays were not the most likely times for vacations, then fewer airports might experience problems of capacity constraint.

However, these patterns do exist, and they must be accommodated. Because these patterns of demand are generally outside the control of the airport operator, they must be recognized as elements of the system in an assessment of landside capacity.

How Can Capacity Be Measured?

Recognizing demand variations, the traveler generally expects that an airport's quality of service will be higher, for example, during the relatively quiet midday period than during the peak morning rush hour. During the busiest times, such as major holiday periods, most airports operate at levels of low-quality service.

The capacity of an airport's terminal landside system is reached when quality of service reaches a minimum acceptable level. This minimum level can be established through an expression of local preferences, involving participation of airlines and local officials working with the airport's management. When these preferences have been expressed, they become the standards against which capacity may be measured.

To aid in the decision making, the TRB Airport Landside Capacity Study Committee is working to define prototypical levels of service in terms of a few factors, such as crowding and time delay—factors that are important to how airport users view quality of service and that can be measured.

In the field of highway planning and design, the definition and measurement of service quality have been relatively well developed. The *Highway Capacity Manual,* recently updated and published by TRB and for more than 20 years a key handbook for highway design practice in the United States, contains a set of six explicitly described levels of service for highway segments and intersections. The Airport Landside Capacity Study will use a similar approach, but probably with a smaller range of defined levels of service.

After the standards for measuring capacity are set, the next step is to deal with the sometimes confusing relationship between supply (service provided by the facilities of the airport) and demand (numbers of people trying to use these services). Capacity limits are likely to be seen over time periods of 15 minutes to 1 hour, the times when surges of passenger demand typically occur. But many decisions are based on some larger measure such as annual numbers of people boarding aircraft. Translating capacity from 1-hour time periods to a 1-year time period requires making assumptions about the patterns of variation of demand throughout both a typical day and the months of a year. Such assumptions must be carefully

examined if they are to be used for making major technical and economic decisions.

The TRB study focuses on the peak 1-hour time period when physical capacity constraints are most likely to occur. Capacity of the airport landside is defined primarily by the number of people who can be served during this single hour at a level of service equal to or greater than that defined as the minimum acceptable for that airport. However, the committee will also consider how this measure can be used to deal with more aggregate issues such as annual traffic.

This measurement of landside capacity will yield a number analogous to the peak hourly capacity (PHOCAP) number calculated for airside operations. However, the estimates of capacity will not be strictly comparable because of the assumptions that must be made in order to translate between PHOCAP, measured by aircraft operations, and landside capacity, measured by numbers of passengers.

Experience demonstrates that even when levels-of-service standards for capacity have been identified, measurement still presents significant technical problems. Surveys of passenger opinion may be needed. Predictions may depend on complex and costly computerized models simulating airport conditions. The guidelines being developed by TRB in this study will include advice on analysis tools to be used in capacity assessment.

Applications of Capacity Assessment

The analysis of passenger-service conditions at the airport, after level-of-service standards have been set, is essentially a technical process. The guidelines being developed by TRB's study committee will provide a broad framework by which airline and airport management professionals will be able to conduct such an analysis. However, the way in which the guidelines are used will vary with application.

Several relatively distinct situations in which capacity guidelines might be applied are given below.

1. An airport is currently experiencing capacity problems. Management could use the guidelines to determine the extent to which these problems are a result of airline, vendor, or airport management practices, or are an indication of insufficient facility capacity.

2. An airline wishes to introduce a new service at an airport. Management is concerned that this new service cannot be accommodated at the existing facility without severely reducing quality of service in landside operations. The guidelines could be used to forecast conditions under the new service.

3. The community served by an airport has expressed concern that traffic at the airport is exceeding the capacity of the facility and standards of service have consequently decreased to intolerable levels. The guidelines could be used as a basis for discussion among responsible authorities and the community and to provide an objective basis for reaching a resolution to the conflict.

4. An airport intends to add airside facilities to increase total terminal capacity. The guidelines might be used to determine the concommitant need for expansion of landside facilities to match the forecast increase in traffic at the airport.

5. The federal government is faced with the question of how to allocate limited funds to achieve maximum benefits for the air transport system as a whole. The guidelines could be used to identify locations at which constraints exist that could only be relieved by requiring substantial expenditures.

The situations described above represent different levels of uncertainty, particularly with regard to patterns of demand. In the first and possibly third cases, assessment may be made on the basis of direct observations of the airport in operation. The second case requires assumptions about additions to the current flight schedule and about airline load factors and ground operations. In the last two situations, assessment must deal with a period several years in the future after new airside facilities may have become fully operational and airlines have responded to changed patterns of air traffic capacity.

The central question is what levels of service will be considered acceptable. Given that it costs money to raise levels of service and to serve more traffic, the decision has significant economic consequences. Certainly the airport's users and the financial community will be interested in the answer.

The answer also has consequences for the nation's air transport system as a whole. Limits on capacity at one airport may affect flights to and from other airports. Because of its responsibility for keeping the system going, the FAA will want to ensure that the capacity of each airport is kept at a reasonable level.

Current Status of TRB Study

The Airport Landside Capacity Study, initiated by TRB in late 1985, is scheduled to be completed in January 1987. Because the topic is of great importance to the professional community, a conference on airport landside capacity is planned for September 1986, sponsored jointly by the American Society of Civil Engineers and the Transportation Research Board. Members of the TRB study committee will be among the participants at the conference.

The final report of the TRB study committee will include three principal elements:

- A proposed set of level-of-service standards for defining capacity at specific airports,
- A review of available analysis tools for assessing capacity, and
- Proposed guidelines for determining ranges of airport capacity.

Together, these three elements can provide the FAA and all parts of the air transport industry with a common basis for discussing future needs for development and for managing resources of the nation's airports.