Evaluating Performance and Service Measures for the Airport Landside

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Before measuring the capacity of facilities of any transportation system, level of service must first be defined. Measuring airport terminal capacity has always been difficult to achieve, mainly because of this lack of definition. Presented in this paper is a concept for evaluating passengers' attitudes and their perception of and satisfaction with the quality of service at airport terminal facilities. By using this method, levels of service for airport facilities can be determined for different service measures associated with the performance of the system. When used in conjunction with capacity assessment techniques (e.g., simulation), this concept can facilitate the evaluation of operational performance of airport facilities.

Establishing measures to evaluate operational performance of the airport landside and quality of service is one of the major problems facing the airlines and airport operators today. A study conducted jointly by the Transportation Research Board (TRB) and the Federal Aviation Administration (FAA) on measuring landside capacity concluded that there are no generally accepted definitions or targets for acceptable landside service levels (*1*). Improving the level of service (LOS) is normally associated with adding physical capacity with major capital investments and costs incurred to users and airport operators. However, there is no means of providing an estimate of the level of capacity expansion to satisfy demands with predefined LOS, nor to evaluate the performance of the system and the LOS under which it is operating. Even when physical capacity is provided, the resulting service cannot be properly assessed.

Alternatively, it would be appropriate to improve the efficiency of those facilities through efficient operations management practices. This necessitates focusing on the issue of performance and involves the evaluation of LOS as well as capacity. In fact, capacity of the system or any of its components cannot be determined without reference to levels of some measure of service provided. Estimates of passenger capacity of the airport landside are meaningful only when they are referenced to set service standards (*1*).

Establishing a framework to set service standards at airports would therefore be requisite to evaluating landside capacity and to assessing the performance of the system or facility in different situations. Addressed in this paper will be three issues:

1. Theoretical background of the LOS concept and review of existing approaches to LOS,
2. Discussion of the LOS framework for the airport landside, and
3. Methodology proposed to establish the LOS framework and its applicability.

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LOS CONCEPT

Service standards and specified LOS are particularly important for evaluating the capacity of facilities in transportation systems and the calibration of the level of performance of their operation. The first known definition for LOS in transportation was introduced to describe and facilitate the determination of capacity of highways and streets (*2*). The LOS concept was also used for evaluating capacity of pedestrian facilities (*3*). In the *Highway Capacity Manual* (*4*), the LOS concept is regarded as the measure to describe the operational conditions at a facility and the perception of quality of service by users (the motorists). In general, LOS is described in terms of factors that are related to operation. LOS is essential to the estimation of amount of demand volume that can be accommodated by a given facility, while maintaining the prescribed quality of service over a range of operational conditions. Capacity analysis in the absence of LOS considerations is of limited utility because, as stated earlier, estimates of a facility's capacity in handling users are meaningful only when they are referenced to the service level provided. Rarely are facilities planned or designed to operate at or near capacity. It would be to the advantage of the planner-designer to employ the LOS concept and incorporate it into the design to obtain a better understanding of the performance of a facility and how it functions under different operating conditions.

LOS CONCEPT FOR AIRPORTS

Because no generally accepted service standards at airports are currently in use, not even a well-defined process for planning and management purposes, it is not surprising that current practices of planning and operations management of airport landside facilities lack a definitive and systematic approach similar to that used for highways and street intersections.

To overcome the absence of service standards specifically developed for airports, those of other reasonably comparable environments have been used for similar types of airport facilities. The three basic functional types of facilities in airport terminals are processing, transit (links), and storing-holding. Previous work on pedestrian movements in station terminals (*3,5*), ergonomics (*6*), and space planning of departure lounges (*7*), was used for LOS considerations in pedestrian facilities and storing-holding areas of airport terminals. Research on pedestrian movements in transportation facilities has recently been focused on particular characteristics relevant to airport landside LOS. Such issues are platooning of pedestrians in transportation terminals (*8*), where a seven-LOS framework that includes speed, flow, and area as service measures was proposed. A more important issue is relating service standards to passengers' perceptions of quality of service. Although evaluation of service should be based on people's perceptions of quality of service, such evaluation cannot be global but should be specific in time, place, and characteristics of operation. The evaluation should be based on attitudinal analytical techniques to derive quantifiable service levels [i.e., threshold values (*9*)]. Research on evaluating LOS in pedestrian facilities (city sidewalks) considered speed-density-flow relationships and defined LOS based on the behavior and perception of users to congestion (*10*).

In short, the current state of the art of airport landside lacks a well-defined and practically applicable airport landside LOS concept that can employ quantifiable service measures to describe and evaluate the quality of service.

Presented in this paper is a methodology for establishing a LOS framework for the airport landside. The underlying concept of this methodology is a technique to derive quantitatively target threshold values for passenger perception of service based on attitudinal surveys conducted at airports at regular intervals (*11,12*). This technique, Passenger-Response model (P-R), is described and its implementation and application discussed.

ESTABLISHING LOS FRAMEWORK

Establishing LOS for evaluating performance at U.S. airports is particularly important because

1. The service and performance measures set for airports are prerequisite for consistent systemwide assessment of landside capacity. Systemwide refers to airports in a system, each with unique service standards, and not uniform service standards for all airports in that system.
2. One approach of capacity evaluation is to use simulation to synthesize flow and congestion data. However, the lack of a suitable LOS to be used with simulation to measure capacity renders this approach ineffective. The issue therefore becomes how to establish LOS for different airports in a practical, efficient, and acceptable manner.
3. Airlines and airport operators cannot conduct consistent capacity assessment and provide effective operations management without establishing some service-level targets and thresholds for ranges of operation that can distinguish between excellent, barely adequate, and poor service. The FAA-TRB study concluded that available data are inadequate to support the proposal of firm service-level targets for landside (*1*). Therefore, a data base containing major factors of service and performance measures will be needed on an airport-specific basis and used to support the proposed LOS framework.
4. Service standards are airport specific and time dependent and vary with type, size, air service, and regional characteristics. Therefore, it is imperative that the LOS framework be easy to implement and flexible enough to include all these variations in a way that will be easy, quick, and inexpensive to implement.

The FAA-TRB study recommended that a data base on landside operation and service conditions be assembled where specific data that can describe typical crowding, delay, and other service-level indicators are gathered for all types of airports in the United States. This data base will then enable LOS for U.S. airports to be established. The study also recommended using a LOS framework similar to that used in highway capacity assessment, but composed of three instead of six levels (*1*). The methodology this paper presents adopts a LOS composed of three levels. It was found that in the attitudinal surveys it was relatively difficult for passengers to distinguish clearly between more than three levels and to identify these levels with values of the service measures used (*11*). Based on the study recommendations, levels of the LOS framework proposed are as follows:

- Level I: Good service, where passengers are unlikely to encounter delays, queues, or crowding.
- Level II: Tolerable but acceptable service, where passengers may encounter some delay at isolated locations or for limited times during peak periods. Some queuing and crowding are observed.
- Level III: Service is poor, congestion is bad, and passenger delays are likely to be long. Queues and crowding are observed throughout peak periods.

In addressing issues of airport terminal planning, design, and management, several perspectives, which may overlap or conflict, have to be balanced. These perspectives reflect how different major parties engaged in terminal development and operation (i.e., passengers, airlines, and airport operators) view the issue of performance and service of the airport landside (*13*).

From the viewpoint of passengers, performance is characterized by such factors as compactness (walking distance and level changes), delay and dwell times, service reliability and convenience, cost (airport fees and concession prices), and comfort of the internal environment (way finding, orientation, and aesthetics). From the passengers' perspective, delay and compactness are the two most important performance measures (*13*).

The airport operators focus mainly on facilitating the transfer of passengers and their baggage, as well as ensuring the economic success of the airport. Therefore, from their perspective, performance means operational effectiveness (passengers and baggage accommodated); efficiency and best use of resources (space, gates, and manpower); functional effectiveness, safety and security; financial effectiveness to ensure good return on the investment; and operational flexibility of facility use (*13*).

The airlines' view of performance centers on the potential for success in using the terminal as the major resource for the conduct of profitable business. Airlines would be assessing performance with relation to the return on investment characterized by operational and cost-effectiveness, corporate market considerations, and flexibility in providing service in a dynamic market subjected to major capital-intensive technology advances (*13*).

In such a dynamic environment, defining performance and service standards will undoubtedly be difficult. However, the passengers should ultimately set the standards in this competitive market because airlines develop terminals to satisfy the demand for air travel requested by air travelers. The airline provision of service should be responsive to the passengers' perception of the quality of service they want.

The definition of LOS should therefore encompass the following:

1. Identification of an effective measure of service to assess performance,
2. Quantification of the LOS to facilitate evaluation of service and performance, and
3. Application of the quantified LOS to operational measures of performance.

To establish the LOS framework, service measures are identified based on their relevance to both operational aspects and passenger evaluation of service. Based on the previous discussion, the most important service measures that can be used to assess performance are delay time, processing time, total time in facility (dwell time), queue length, crowdedness (area/person), and walking distance. The LOS framework service measures used for the purposes of this paper were delay time, queue length, and crowding. These measures are the same as those recommended by the FAA-TRB study.

PERCEPTION-RESPONSE CONCEPT

The perception-response (P-R) concept is used to evaluate service at airport facilities in terms of some measure of service that is relevant to both passengers and airlines and airport operators. The P-R model is the graphical presentation of the collective attitudes of a category of passengers toward the range of operational service at a facility, expressed in terms of the perception of the passengers of different values of the service measure and their response to the respective service conditions classified into distinct levels of satisfaction with service (*11*). The P-R model depicts the relationship between the percentage of passengers stating their level of satisfaction with service encountered at a particular facility and the value of a measure of service. In this way, service standards can be derived and set based on the opinions and reactions of users toward the operational service of the system. Functionally, it serves to grade operational service in terms of the service measure. The P-R model is essentially a scaling device similar to those developed by social scientists to describe attitudes of individuals and to distinguish between different responses toward social phenomena or any aspect of life covered by a social survey. The operating characteristics of P-R models are described by three curves that summarize the attitude and behavior of the population. The first curve assumes an approximately normal pattern typical of the Thurstonian (or differential) scale that describes the attitudes of respondents when asked to objectively evaluate the issue in question (*14*). This curve is instrumental in formulating the collective preferences and general attitudes of respondents because it focuses on the middle region of satisfaction to identify its boundaries with the two extremities of complete satisfaction and total dissatisfaction. These are represented by the S- and inverted S-shaped curves typical of the Likert scale of summated ratings (*14*).

Personal perceptions and individual judgments of the quality of service are required to build the P-R models. These can be obtained, either directly from passengers surveys or indirectly from surveys of a panel of experts representing airlines and airport personnel experienced with passenger handling in airports. Typically, the information needed would include passenger evaluations of service conditions at different demand levels, and passenger-specific and system-related data. The latter include information needed to categorize flights, facilities, and passenger classes (e.g., flight type, flight range, origin or destination of trip, purpose of trip, passport type, or any other detail thought to be relevant to the operation).

In a typical attitudinal survey, passengers are asked to reply to the sets of generic questions shown in Table 1 stating their evaluation of quality of service expressed about their level of satisfaction with service at a particular facility.

P-R models, based on passengers' responses to this set of questions for the various processing facilities in the terminal, are developed by analyzing the passenger survey data. The analysis is carried out by grouping the responses for each facility and for each service measure value (x). Distribution of passengers' responses to each value of x for each LOS as experienced by the passengers (satisfaction level) are determined. Standard statistical analysis may be applied if desired to examine the variation of the distributions. In Figures 1 to 11, P-R models of application, discussed later in this paper, are shown with the three-level distributions in one graph.

The three curves that constitute the P-R graph, representing the three states of passenger satisfaction with service (i.e., Level I—good; Level II—tolerable; and Level III—bad) are examined. The threshold values are determined by tracing the dominant state of passenger satisfaction with service (the curve with higher passenger percentage) over the full range of the service measure (e.g., delay time or dwell time). The point at which there is a shift in the satisfaction of the majority of the population from one state to another identifies the boundary between the two states, hence a change in the LOS.

As shown in Figures 1 to 11, there are two threshold values (T1 and T2) related to the service measure. For values of time greater than T2, the service is perceived predominantly as "bad" (i.e., Level III). For values less than T1, the dominant perception of passengers to service is "good" (i.e., Level I). Service was considered by the majority of passengers as "tolerable" (i.e., Level II for values ranging between T1 and T2).

Based on these threshold values of the service measures, the LOS framework for all the facilities in question at the particular airport can be set. The airport operator-planner would then decide on the service standards that need to be set for the different processing facilities at the particular airport. The airport operator-planner should consider how frequently passenger perception surveys need to be conducted to verify whether the current standards still realistically reflect passengers' attitudes toward operational service. Implementing this methodology with airport passenger surveys conducted on a regular basis can help in establishing a framework of service standards for the airport system (national, regional, or under jurisdiction of an authority).

APPLICATION

This methodology was applied at Birmingham International Airport in England (*11*). Before the main survey was under-

TABLE 1 PASSENGER ATTITUDINAL SURVEY INDICATING EVALUATION OF QUALITY OF SERVICE AND LEVEL OF SATISFACTION WITH FACILITY

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==> Indicate your level of satisfaction with service, in terms of,
  GOOD/TOLERABLE/BAD, against the following service measure values:

__Service measure value:        | x1 | x2 | x3 | x4 | x5 | x6 | . . . | xn |

__Level of satisfaction:        | .. | .. | .. | .. | .. | .. | . . . | .. |
  GOOD, TOLERABLE, or BAD
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taken, preliminary surveys were conducted in two other airports to explore various features of this technique and test its general applicability. An alternative to passenger attitudinal surveys, the "panel of experts" survey was also administered and involved 25 airline and airport personnel. The participants in the panel of experts' survey were asked to evaluate service conditions on behalf of passengers, based on their own experiences with terminal operation and passenger handling, and their knowledge of passengers' behavior and attitudes.

In the main survey, questionnaires were distributed at prespecified locations inside the airport terminal building over a 2-week period following a daily pattern that reflected airline flight schedules. Methods of questionnaire collection were mail-back for arrivals and self-deposit in marked box (located at airside exit of the departure lounge) for departures. The number of questionnaires distributed was determined based on minimum response rates anticipated. Data from returned questionnaires were then processed, analyzed, and data plotted using a standard data statistical analysis package. For the purpose of data processing and graphics, any standard spreadsheet (Lotus 1-2-3, Quattro, or others) can be used. The outcome was that P-R models for all passenger and flight categories for the international arrival and departure channels were created, a sample of which is shown in Figures 1 to 11. Summarized in Table 2 are the threshold values (T1 and T2) for the service measure (total time spent or dwell time) for all passenger and flight categories and facility types as derived from the P-R models. Passenger and flight categories covered in the survey were scheduled long-haul (cross-Atlantic), medium-haul (European), and chartered holiday [inclusive tours (IT)]. Facilities included were airlines ticket and check-in, security check, and passport control for the departure channel; and immigration control, baggage claim, and customs control for the arrival channel.

Examination of the values of Table 2 and P-R models reveals that a distinct difference in response to service exists between different passenger classes and flight categories, with varying degrees of tolerance to delay noticed among those passengers. For example, the Scheduled-European passengers in check-in (Figure 5), Level I (tolerable) is significantly narrow (and on occasion diminished) [i.e., mean and variance of the service measure (time) are relatively small compared with the other flight categories and passenger types]. This behavior is typical of attitudes of business passengers toward service in airports, given that the predominant trip-purpose of this flight category was business. However, in Figures 1, 4, and 7, the P-R models for chartered passengers on a holiday

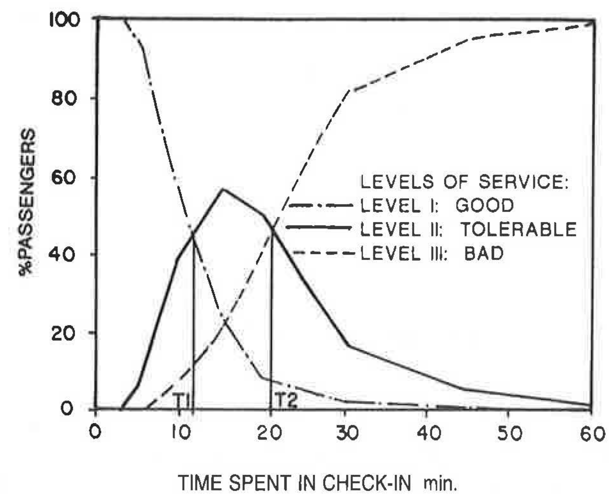

FIGURE 1 Airlines check-in: chartered (IT) passenger departures.

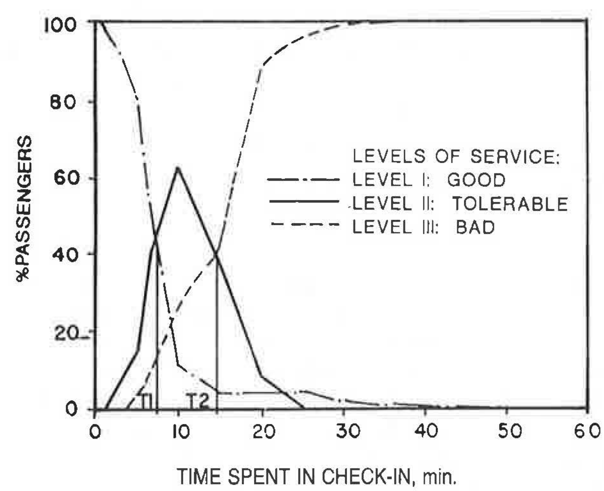

FIGURE 2 Airlines check-in: scheduled European passenger departures.

package including flight (IT), a different pattern can be seen that indicates a clearly different attitude toward delay, because these passengers do not normally attach a great value to time spent inside the airport. The behavior of cross-Atlantic passengers (Figures 3, 6, and 9) is somewhat similar to IT passengers, because the flight time is longer and pas-

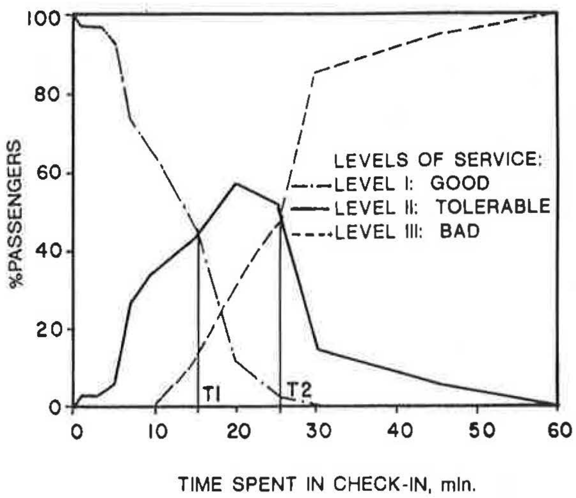

FIGURE 3 Airlines check-in: scheduled cross-Atlantic departures.

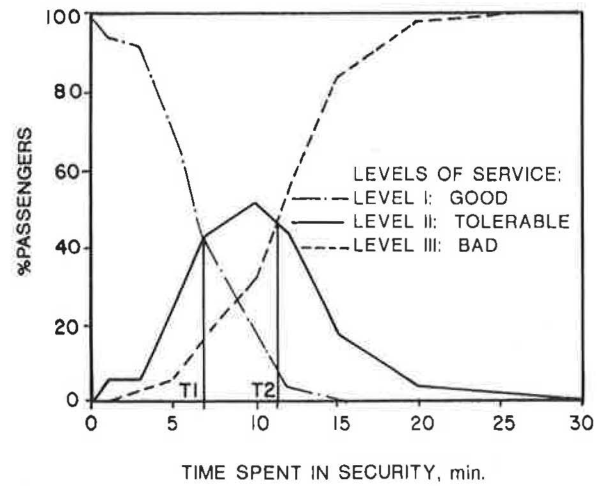

FIGURE 6 Security check: scheduled cross-Atlantic departures.

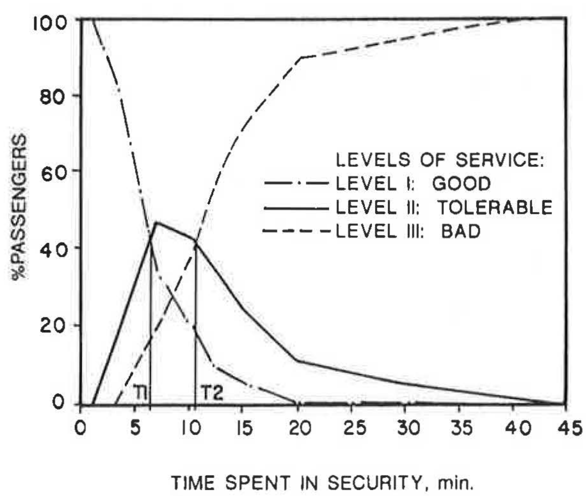

FIGURE 4 Security check: chartered (IT) passenger departures.

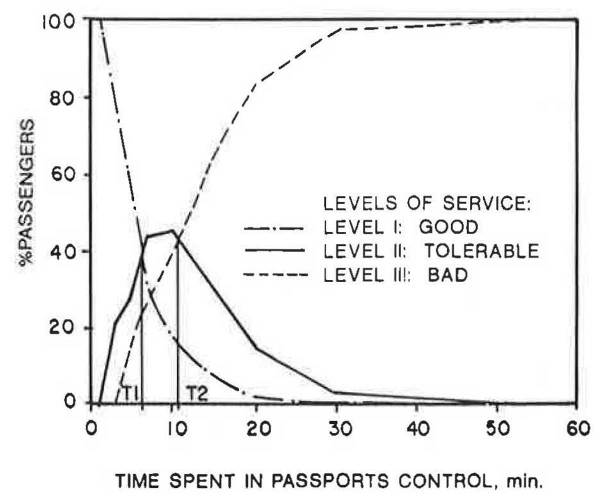

FIGURE 7 Passport control: chartered (IT) passenger departures.

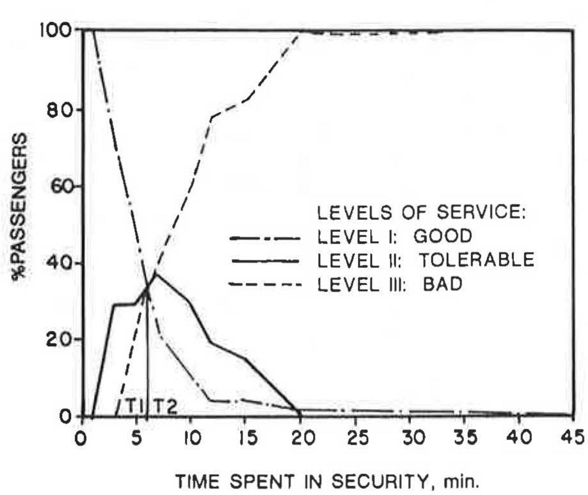

FIGURE 5 Security check: scheduled European passenger departures.

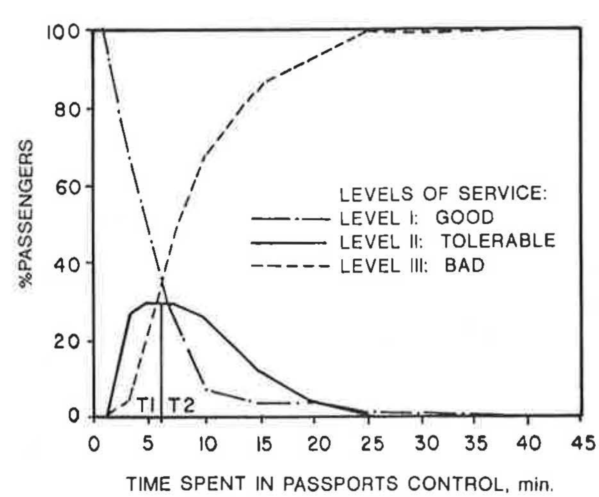

FIGURE 8 Passport control: scheduled European passenger departures.

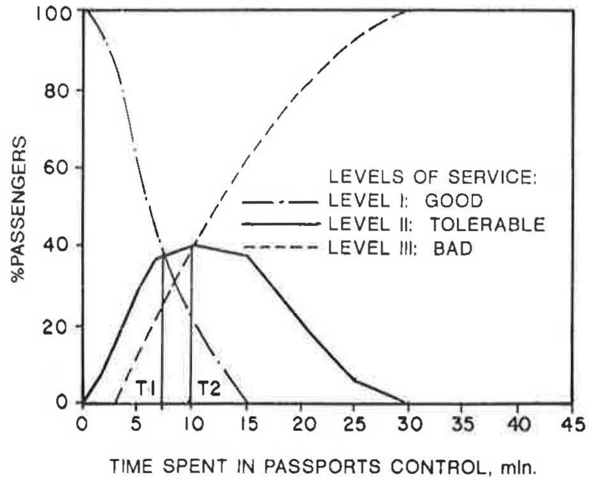

FIGURE 9 Passport control: scheduled cross-Atlantic departures.

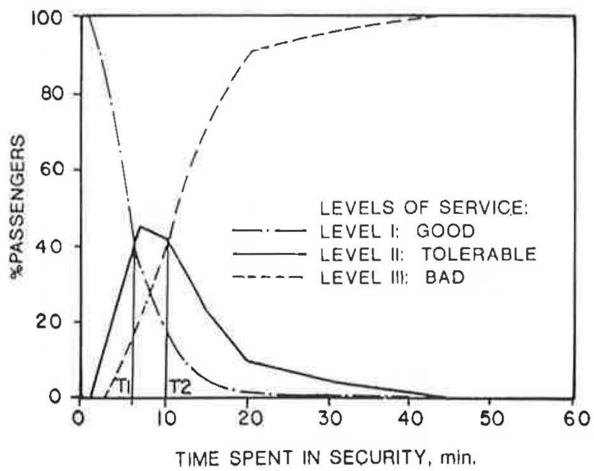

FIGURE 10 Security check: total departures.

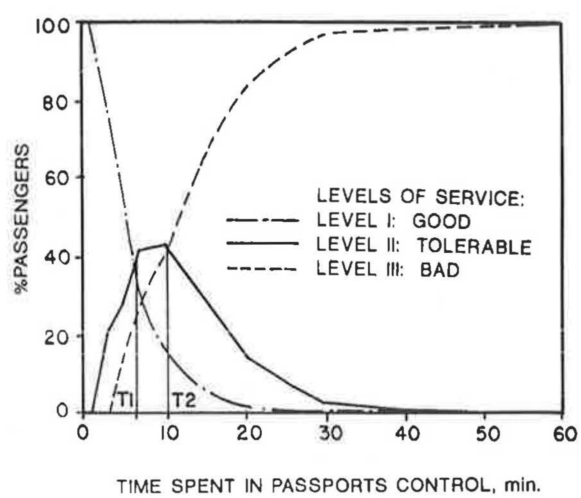

FIGURE 11 Passport control: total departures.

TABLE 2 LEVEL-OF-SERVICE FRAMEWORK

FACILITY TYPE and PASSENGER CATEGORY	[Figure Number]	SERVICE LEVEL THRESHOLDS (Time, minutes) T1 (Good/Tolerable)	T2 (Tolerable/Bad)
AIRLINES CHECK-IN:			
Chartered (I.T.)	[1]	11.0	21.0
Scheduled-European	[2]	7.5	14.0
Scheduled-Atlantic	[3]	15.0	25.0
SECURITY CHECK:			
Chartered (I.T.)	[4]	6.0	10.5
Scheduled-European	[5]	6.0	6.5
Scheduled-Atlantic	[6]	9.0	12.5
Total Departures	[10]	6.5	10.5
PASSPORT CONTROL:			
Chartered (I.T.)	[7]	6.0	10.5
Scheduled-European	[8]	6.0	6.0
Scheduled-Atlantic	[9]	7.5	10.5
Total Departures	[11]	6.5	10.5
IMMIGRATION CONTROL:			
Chartered (I.T.)		6.5	15.0
Scheduled-European		6.0	12.0
Scheduled-Atlantic		7.0	16.0
Total Arrivals		6.5	14.5
BAGGAGE CLAIM:			
Chartered (I.T.)		13.0	23.5
Scheduled-European		10.0	17.5
Scheduled-Atlantic		16.5	25.0
Total Arrivals		12.5	22.5
CUSTOMS CONTROL:			
Chartered (I.T.)		6.5	13.0
Scheduled-European		5.0	7.0
Scheduled-Atlantic		6.0	12.0
Total Arrivals		6.5	11.5

sengers are normally more tolerant about terminal delay. Shown in Figures 10 and 11 are the composite attitudes of total departing passengers that reflect the corresponding percentage of each passenger category, given that chartered passengers form about two-thirds of the total (*11*). It should be cautioned that values of T1 and T2 for an airport (e.g., Table 1) apply only for that airport based on the time when the passenger survey was conducted; hence they should not be transferred between airports. Table 1 and Figures 1 to 11 are intended to serve as a demonstration of the methodology and its results.

Normally, when the passenger population surveyed is homogeneous and there is a high degree of consensus in their attitude toward quality of service, changes in LOS occur around the median, reflecting the views of the average passenger. A multimodal pattern underlines nonhomogeneity, which implies that the P-R model is actually composed of more than one model. In such a case, the passenger population surveyed may consist of several homogeneous groups (e.g., flights or trip purposes).

Different peak periods can also be represented in this methodology. Performance analysis (capacity or LOS evaluation) was conducted in the Birmingham Airport study for the morning and evening peaks separately, under the assumption that passenger attitudes toward service at both times would remain unchanged.

The results shown in Table 2 hold for the environment where information was obtained and are not transferrable or applied directly to airports in different environments. The FAA-TRB study indicated that service rates are different for U.S. airports because of differing environments and operating characteristics (*1*).

CHARACTERISTICS OF PERCEPTION-RESPONSE MODELS

Some general features of the P-R model are (*11*):

1. It can directly interpret the attitudes of a group of passengers (whether passengers on individual flights or particular airlines, and purpose of travel and fare type) toward operational service, and can use the graphical representation to derive numbers (threshold values for the service measure) fairly accurately.
2. It is based on the assumption that the operational service passengers actually experienced is the kind of service carriers and operators can provide, and that decisions and policies related to operation and service are based on the carriers' and operators' own perception of available resources, technological standards, current regulations or operational procedures, or other air travel market-specific considerations.
3. Each model represents passengers' attitudes toward operational service where and when the survey was conducted (i.e., their attitudes are airport-specific and time-dependent). Passengers' views on a certain attribute of service tend to be dynamic and specific, and are susceptible to considerable changes in any given period of time. Being airport-specific, passengers' perceptions of service cannot be transferred between airports.
4. Because of the generic nature and simple data representation structure, the P-R model is convenient to handle and use. Several categories of passengers-flights and types of facilities can be merged to form one model (aggregated), or a single model of a particular facility can be split into several models for different passenger-flight categories using that facility (disaggregated).
5. Relatively low sample sizes are required for a representative P-R model. For a panel of experts' survey, a sample size of 25 to 30 is adequate, whereas for passengers that range should be the minimum for the smallest subset—provided sample representation is adequate.

In applying this methodology, it is important to note that data required to build the P-R model are particularly sensitive to the following (*11*):

1. The way passengers are directed to state their perception and reaction to service conscientiously and with reasonable accuracy.
2. The ability of the individual passenger to clearly distinguish between three or more different satisfaction levels and to tie each level with some boundary (a value of the service measure).
3. The influence of past experience with other airports on passengers when expressing their satisfaction level at the time of the survey.
4. Probabilities of inconsistent or shifted answers resulting from a variety of reasons, mainly misinterpretation by and confusion of the respondent and unrealistic or inconsistent views held by passengers toward service.

SIGNIFICANCE OF CONCEPT

Criticism of current philosophies of airport planning has been mounting for some time. This is directed toward their effectiveness in interpreting system operations, evaluation of capacity, and performance assessment. Some airport planners believe existing practices failed to address such important aspects of airport planning and management (*15*). Airports are considered to be the least understood and most problematic of all transportation systems. Nonetheless, the failure of airport planners to successfully solve the chronic problems at airports was largely blamed on poor judgment about individual behavior, disregard for collective preferences, failure to account for the political dynamics, and excessive concentration on localized technical problems. Consequently, planning and management practices of airports were not compatible with or responsive to the substantial growth in demand for air travel and the resources allocated for airport development and expansion.

The methodology described attempted to address these shortcomings and took into consideration the behavioral facet of the problem—a long neglected aspect. It considered the collective preferences of users and provided a convenient method of presenting their perceptions and evaluations. Of most importance, however, this methodology adopted a user-based approach to assess service that, when used with capacity analysis and airport simulation, could provide a better interpretation of the system's operational conditions. From an operational standpoint, this methodology did not focus specifically on localized technical issues, but instead adopted the premise of supply-demand equilibrium in a context of providing capacity to satisfy certain standards.

Based on this discussion, the method described can provide a suitable means for creating the data base needed to establish airport landside LOS. It is practical to apply because it is easy and inexpensive to implement. Airline market surveys and airport passenger surveys can be used to obtain the required information in the format already described. Data processing and analysis were shown to be easy and inexpensive and within the capability and resources of both airlines and airport operators. Moreover, it is equally easy to consider any service measure relevant to planning, operations, and marketing (e.g., walking distance, delay and queue lengths, and fares, respectively).

This methodology can also be augmented by other techniques of evaluating service to measure stated preferences in the modeling of travel demand behavior. The conjoint analysis approach (*16*) is one example where it can be used to measure the relative importance of each of a predetermined number of attributes of service in the formulation of passengers' preferences for alternative combinations of these attributes or measures of service. This technique can be adopted when it is required to determine what combination of service attributes is most relevant to passengers, particularly if there are more than two quantifiable measures of service.

Other research suggested certain extensions to this concept. Ashford suggested that strong interaction exists between space provision and time (i.e., the P-R model is actually multi-dimensional) (*17*). A three-dimensional "response surface" describes the relationship between passenger satisfaction and two principal independent variables—delay and space provision (compared only with delay in P-R model as presented in this paper). Ashford suggested that the perception of passengers to space provided is influenced by their perception to delay, and as passenger delays increase, their perception to space will vary inversely. However, no work has been done to support this hypothesis because of problems associated with adequately interpreting and collecting passengers' perceptions of crowdedness and space provided, and the costs and other difficulties of staging a coordinated research effort at several airports simultaneously.

Omer and Khan (*18*) estimated the cost-effectiveness of various LOS with respect to passengers' perceptions and their evaluation of service, and used utility theory to derive user-perceived values for LOS at airports.

CONCLUSION

Recent FAA-funded research to explore more scientific approaches to the design and performance measurement of airport passenger terminals (*19*) concluded that performance and service measures (operational, spatial, and economic) are required as input for any simulation-based system used to plan, design, and assess operation of airport terminals. However, there is a lack of well-developed data for measures of performance and service to support use of landside simulation, and for a procedure to establish LOS framework. Commercial, political, and community sensitivities in airports and costs of development and implementation are the major causes of scarcity of data. Establishing data bases for service and performance measures should be the first logical step and a prerequisite for a more scientific approach to design and operations management of airport passenger terminals.

As demonstrated in this paper, service standards can be conveniently developed through use of the concept of passenger P-R, which is similar to the LOS concept used in planning of highways and pedestrian facilities. Presented in this paper was a methodology to measure quality of service at processing facilities of airport terminals based on users' perception and evaluation of service. Although only one service measure—dwell time in facility—was used, any other quantifiable measure of performance and service may be included. Descriptions of feasibility, practical application, and implementation of this concept in airports were also described in this paper.

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