

Level of Service Design Concept for Airport Passenger Terminals: A European View

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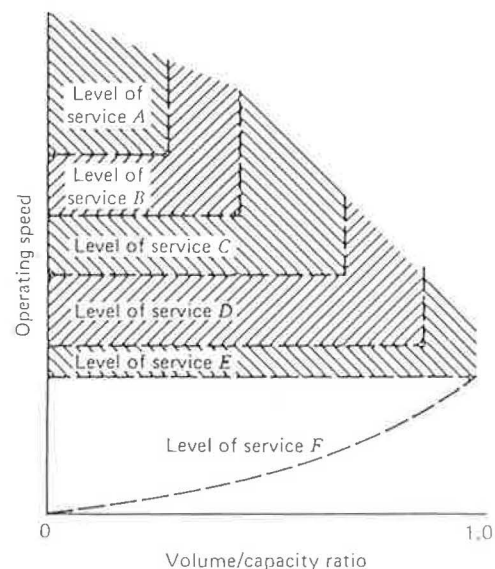
The concept of level of service has been developed by planners and designers to provide some degree of sensitivity in the processes of design and capacity analysis for transport facilities. By designating a number of service levels in lieu of a single capacity figure, a designer is able to evaluate the performance of a facility under the varying load conditions that might reasonably be anticipated in the life of that facility. Level of service analysis provides, to some degree, a measure of the comfort and convenience experienced by system users when the facility is operating at the various possible levels of design and service volumes. Allied with cost, the level of service criterion is a useful input to the design or operation of a transport facility.

The earliest widespread use of the concept of transportation level of service emerged in the area of highway capacity analysis. The earliest forms of highway capacity analysis defined capacity in three ways. *Basic capacity* was the maximum number of passenger cars that could pass a given point on a roadway in one hour under ideal road and traffic conditions. *Possible capacity* was defined as the maximum number of vehicles that could pass a given point during one hour under prevailing road and traffic conditions. *Practical capacity* was the maximum number of vehicles that could pass a given point without the traffic density being so great as to cause unreasonable delay, hazard, or restriction to the driver's freedom to maneuver under prevailing road conditions (1). These definitions were irritatingly vague, and highway engineers were unable to judge the effect of operating significantly above or below what had been designated as the practical capacity of a facility.

To provide better sensitivity in the processes of highway design and capacity analysis, the concept of level of service was introduced in 1965 (2). Figure 1 shows the now familiar, six-service-level diagram that defines the basic relationship between speed, volume/capacity ratio, and level of service. Using a methodology based on this concept, the *Highway Capacity Manual* described a series of techniques that could be used to determine the levels of service provided by a range of facility types (rural roads, freeways, city streets, etc.) under varying traffic mixes and

traffic loads. The original 1965 manual has recently been updated (3) to conform with more recent experience and improved data, but the basic concept remains essentially unchanged. The modern *Highway Capacity Manual* enables the highway engineer to evaluate how altering traffic throughput affects the level of service provided by a highway facility and permits the determination of the "capacity" of a facility in terms of a design service volume.

The considerable improvement of the 1965 *Highway Capacity Manual* over its predecessor led Fruin to apply a similar methodology to the design of pedestrian spaces (4). In this work, it was stated that the dimensional design of pedestrian spaces involves the application of traffic engineering principles and the consideration of human convenience and the design environment. Fruin further noted that the maximum capacity of a pedestrian traffic stream is attained only when there is dense crowding of pedes-



(Courtesy Transportation Research Board.)

FIGURE 1 General concept of relationship of level of service to operating speed and volume/capacity ratio (not to scale).

trians. It was noted that such crowding results in significant reductions in pedestrian convenience, as normal human walking speeds are restricted by a lack of freedom to maneuver in the traffic stream. Since convenience is a primary consideration in the environmental design process, Fruin suggested that pedestrian design standards should be based on a scale related to convenience. Using the six-level structure originally developed by the highway engineers, a set of walking design standards was proposed based on the relationship between pedestrian flow and the area provided per pedestrian. This relationship is shown in Figure 2. This work also provided guidelines for service standards for stairways and queues. Table 1 summarizes these findings.

The highway capacity work was based on many thousands of hours of traffic observations. The conclusion drawn was that level of service could be viewed as dependent on ease of flow and freedom of movement. The criteria on which these could be evaluated were:

1. ability of individual drivers to choose their own speed;
2. ability to overtake; and
3. ability to maneuver in the traffic stream.

Fruin's work was based not only on many observations in the terminals of the Port Authority of New York but also on anthropometry and ergonomics. For pedestrian flow, the level of service was also viewed as being dependent on the ease of flow and freedom of movement. The criteria by which these were evaluated were rather similar to those used in highway capacity analysis:

1. ability of an individual to choose walking speed;
2. ability to overtake; and
3. ease of cross- and reverse-flow movement.

Success with applying the level of service concept to vehicle and pedestrian facilities has generated considerable

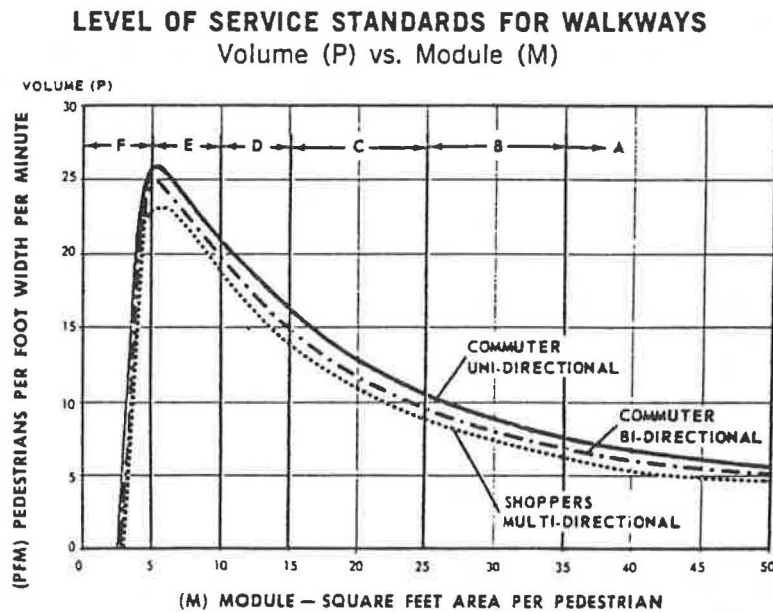


FIGURE 2 Pedestrian flow levels of service (4).

TABLE 1 SUMMARY OF PEDESTRIAN SPACE STANDARDS (SQUARE FEET PER PERSON) (4)

	Level of Service					
	A	B	C	D	E	F
Walkways	35 or greater	25 - 35	15 - 25	10 - 15	5 - 10	5 or less
Stairways	20 or greater	15 - 20	10 - 15	7 - 10	4 - 7	4 or less
Queues	13	10 - 13	7 - 10	3 - 7	2 - 3	2 or less

interest in the application of a somewhat similar methodology to terminal facilities. Evaluation and selection of terminal designs have been problems for a number of years, and no generally agreed-on procedure has evolved. Some evaluation methods concentrate on optimizing a single parameter. Simple cost-benefit analysis that ignores externalities would come into this category. Some authors have concentrated on optimizing nonmonetary parameters; passenger orientation is regarded by some as the major functional requirement of a transportation terminal (5). Partial solutions to design evaluation have been recommended on a basis of functional adjacencies (6, 7). These and other techniques, including planning balance sheets (8), decision effects matrices as used for the Atlanta Hartsfield design, matrix evaluation sheets (Baltimore Washington International), and the Emphasis Curve Technique (Hong Kong Airport), deal mainly with overall design evaluations. Designers and operators, however, frequently require an evaluation technique that provides information on the suitability of individual facilities or chains of individual facilities within a system. Level of service analysis, analogous to that used in highway engineering, would seem an excellent method of providing such a measure.

Determining the level of service provided by an airport terminal is not a straightforward process. A terminal must provide space for three different classes of passenger activity: processing, holding, and circulation/mode transfer.

- processing: check-in, bag drop, immigration, customs, security, baggage claim;
- holding: departure concourse, departure lounge, gate lounge, transit lounge, arrivals concourse; and
- circulation and mode transfer: drop off/pick up, corridors, airside interface (9).

It is clear that each of these three functional areas is likely to require different techniques for evaluating level of service.

Processing normally requires some form of queuing. Fruin's work dealt with queues, but it is not clear that the individuals observed using the Port Authority of New York terminals are similar to airport passengers. The acceptability of a queue is, according to Fruin, determined by space provided. It is more likely that the queue process is more truly evaluated by the air passenger in terms of time spent in the queue, although there may be an interaction effect in terms of space provision.

Holding areas are normally evaluated in terms of space provided per passenger, but here again it is likely that any perception of service level should consider space and time interactively. For example, it is entirely possible that passengers would evaluate space provision differently in a

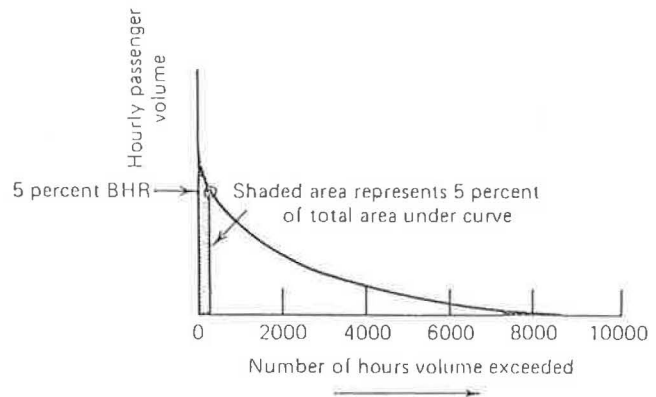


FIGURE 4 Location of 5 percent busy hour rate (10).

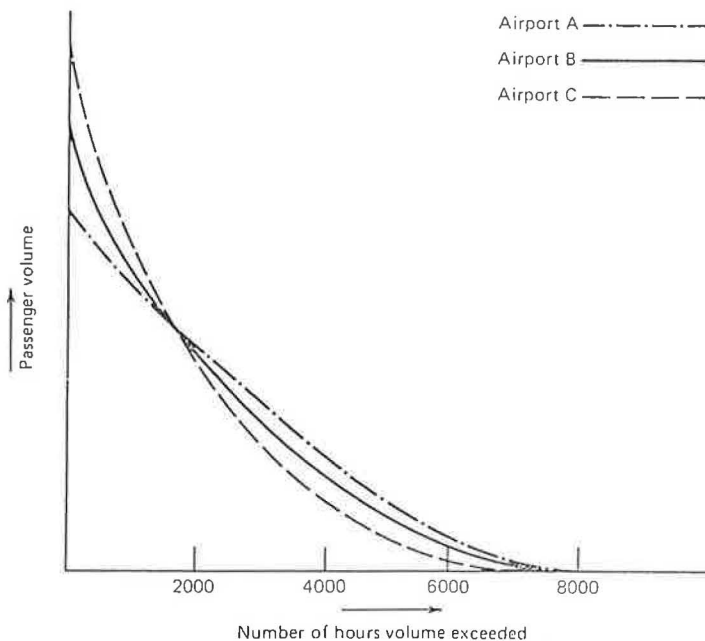


FIGURE 3 Variation of passenger volume distribution curves for airports with different traffic (10).

main departure lounge, where waits of about an hour are anticipated, from the way they would evaluate it in a forward gate area, where much shorter waiting periods are normal.

Circulation areas in airports are not really functionally different from circulation areas in the type of terminal that formed the basis of Fruin's investigations. It is likely, therefore, that his approach can be used for airport terminals. The validity of applying his results directly to airport terminals is questionable, however, because the mix of passengers (age range) and degree of encumbrance with hand luggage and baggage trolleys (if available) are quite different.

Like most transport facilities, airport terminals suffer from the problem of having to cope with very large variations in passenger flow. Unlike railway and urban rapid transit stations, this variation is seasonal as well as daily. It is also important to remember that when considering airport terminals, the nature of traffic is important to

traffic peaking characteristics. In North America the predominance of domestic air traffic is quite different from the situation in Europe, where traffic is mainly international, and a large proportion of it of a leisure nature. It has been pointed out elsewhere (10) that the form of the passenger volume distribution curve differs between airports carrying different forms of air traffic. For example, more than half the total annual passenger movements at Almeria Airport in southern Spain occurs in a two-month vacation period during the summer; this degree of peaking is unknown in the typical North American context. Figure 3 indicates how the normalized shape of the volume curve could be expected to differ among various airport functional types:

- Airport A: a high-volume airport with a large amount of short-haul domestic traffic (a typical U.S. hub);
- Airport B: a medium-volume airport with balanced international-domestic traffic and balanced short-, medium-, and long-haul operations (a typical North European hub); and
- Airport C: a medium-volume airport with a high proportion of international traffic concentrated in a vacation season (a typical Mediterranean airport serving a resort area).

TABLE 2 ANNUAL, PEAK, AND SBR FLOW RATES FOR LARNACA AIRPORT, CYPRUS

Year	1981	1981	1983	1984
Annual passenger volume	1.053m	1.222m	1.363m	1.530m
SBR	796	677	905	929
Peak	981	904	1442	1226
Peak SBR ratio	1.23	1.34	1.59	1.32

Airport C carries a much higher proportion of its traffic during peak periods; therefore, its graph has a leftward skew in comparison to that for Airport B. A high-volume domestic airport hub, however, carries an even greater

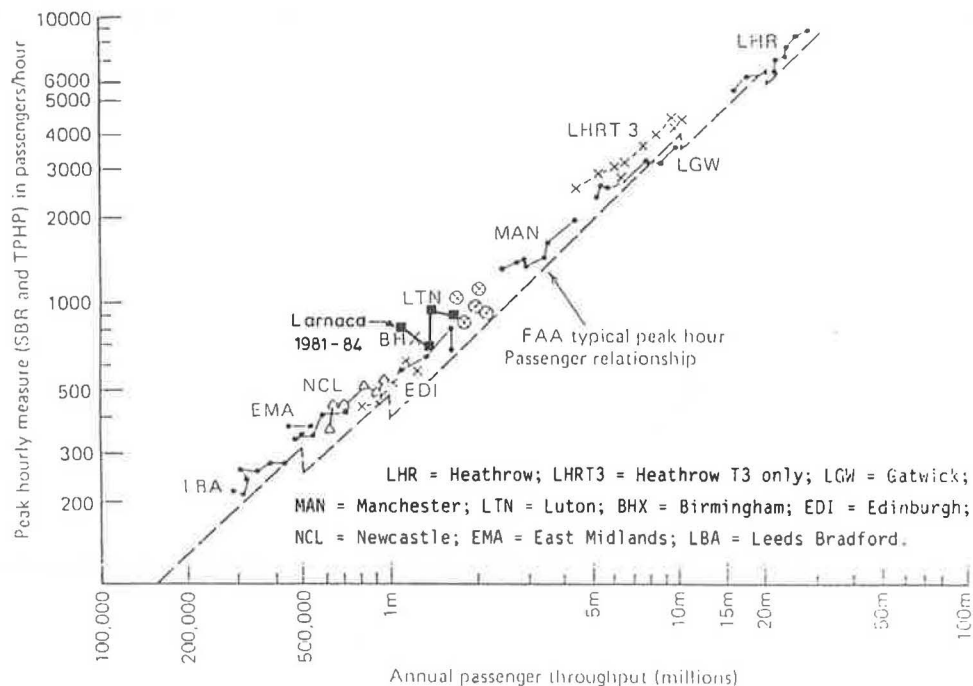


FIGURE 5 Relationship between standard busy rate, typical peak-hour passenger volume, and annual passenger volume for selected airports (Sources: Civil Aviation Authority and Federal Aviation Administration).

volume over the entire year, decreasing the leftward skew to give the flatter graph form shown for Airport A.

Because designers in general do not have the resources to design for the absolute peak flow, it is customary to choose a design criterion that will accommodate the actual peak without serious overload. In selecting such a measure, airport designers have in the past tended to fall back on the standard highway engineering practice of designing for the thirtieth highest hour. In airport practice this is called the standard busy rate (SBR), and its location on the passenger volume distribution curve is shown in Figure 4. American practice differs from this approach by using averaged conditions, such as the peak hour of the average day of the peak month. Experience has shown that, by allowing volume overload for a limited number of hours, an acceptable service level can be provided to passengers. Various European authorities favor different standards. Schiphol Airport Amsterdam uses the twentieth highest hour, while Aéroports de Paris prefers the fortieth highest hour. Until the early 1970s, the British Airports Authority

(BAA) adopted the thirtieth highest hour as its design standard. Subsequent experience has led them to use the 5 percent busy hour rate (BHR), which means that 5 percent of the total annual passenger traffic operates at volumes in excess of the total design level. The location of the 5 percent busy hour rate is shown in Figure 4. In practice there is little difference between these measures. Table 2 shows the relationship between SBR and peak flows for Larnaca Airport, Cyprus, for the years 1981–1984. The Larnaca figures are also shown in conjunction with SBR annual volume relationships plotted for a number of British airports (both BAA and non-BAA) in Figure 5. As could be anticipated from the vacation traffic orientation of the Larnaca traffic, the SBR/annual traffic ratio for this Mediterranean airport exceeds the less peaky British airport figure and considerably exceeds the peak-hour passenger estimates using FAA guidelines, which are also indicated in Figure 5.

There is no standard method of dealing with a design passenger volume in terms of levels of service or design

TABLE 3 SELECTED BAA AND IATA DESIGN AND SERVICE STANDARDS—DEPARTURES

Facility	BAA Standards		IATA Standards	
	Space Standard	Time Standard	Space Standard	Time Standard
Check-in Baggage Drop	0.8m ² per pass. with hold baggage 0.6m ² per pass. with cabin baggage	95% of pass. < 3 min.	0.8m ² per pass. with baggage 0.6m ² for visitors	95% of pass. < 3 min; at peak times 80% < 5 min.
Departure Concourse	1.0m ² per seated person 1.0m ² per standing person. Seating for 10% of those present	None	None	None
Departure Passport Control	0.6m ² per pass. without hold baggage. 0.8m ² per pass. with hold baggage	95% of pass. < 1 min.	0.6m ² per pass. without hold baggage. 0.8m ² per pass. with hold baggage	95% of pass. < 1 min.
Central Security	0.6m ² per pass. without hold baggage	95% of pass. < 3 min.		95% of pass. < 3 min; for high security flights. 80% < 8 min.
Departure Lounge	1.0m ² per seated pass. 1.0m ² per standing pass. Seating for 60% present.	None	1.0 - 1.5m ² per seated pass. 1.2m ² per standing pass. with trolley. 1.0m ² per standing pass. Seating for 50% of throughput.	
Gate Lounge	1.0m ² per seated pass. 1.0m ² per standing pass. Seating for 60% of those present.	None	0.6m ² for queueing pass. without hold baggage. 0.8m ² for queueing pass. with hold baggage 1.0m ² per pass. within gate lounge	80% should queue less than 5 min. for gate check-in.

service volumes, as is now well established in the sphere of highway engineering. Although airport operators and designers individually have a clear idea of what acceptable service levels are, these are not universally agreed on within the airport community; nor is the design service level set within a range of service levels, as has been shown to occur in highway design. Service levels are currently set simply in terms of standards that the authority attempts to meet either in terms of design (space standards) or in terms of operation (time standards). In a number of facilities, standards are set in terms of both time and space, but the interaction of time and space has never been examined.

In 1982, the BAA/International Air Transport Association (IATA) study group examined BAA standards in comparison with those of IATA at that time. Some of these comparisons are contained in Tables 3 and 4, which show design standards for departing and arriving passengers, respectively. In general the BAA adds additional space for circulation. Notwithstanding the waiting time standards that the BAA attempts to provide, it is recognized that during peak periods delays considerably greater than the standards are observed. The delays cause considerable queuing, which can cause extreme overcrowding. Therefore the BAA has recently modified its design standards to

TABLE 5 TIME-RELATED SPACE STANDARDS (BAA)

Facility	Space to be provided for waiting time up to
Check-in	10 min.
Passenger search	5 min.
Passport control	1 min.
Immigration:	
UK/EEC	12 min.
Others	30 min.

TABLE 4 SELECTED BAA AND IATA DESIGN SERVICE STANDARDS—ARRIVALS

FACILITY	BAA Standards*		IATA Standards	
	Space standards	Time standards	Space standards	Time standards
Immigration	0.6m ² per pass.	UK/EEC 95% < 4 min. Others 95% < 12 min.	0.6m ² per pass.	95% of all pass. < 12 min. 80% of nationals < 5 min.
Baggage reclaim	1.25m ² /domestic passenger. 2.0m ² per short haul international passenger, 3.25m ² per long haul passenger	Max of 25 min. from first pass. out of immigration to last bag on unit	0.8m ² per domestic and short haul international pass. 1.6m ² for long haul passenger	Max of 25 min. from first pass. in hall to last bag from unit. 90% of pass. wait < 20 min. for baggage
Customs	None	None	2.0m ² per pass. interviewed	None
Arrivals Concourse	1.0m ² per standing person; 0.8m ² per seated person. Seating for 20% of people present	None	0.6m ² per standing meeter; 1.0m ² per seated meeter. 0.8m ² per short haul pass, 1.6m ² per long haul pass.	None

* Additional Standards

- Forecourts: 95% chance of finding space
- Piers: Walking distances: < 250m unaided
< 650m with walkway (of which 200m unaided)
Rapid transit for point-to-point journeys over 500m
- Pier service: Loading bridges for at least 75% of passengers.

TABLE 6 SCHIPHOL AIRPORT DESIGN STANDARDS

SPACE STANDARDS	
Waiting Lounges	1m ² per passenger for the expected number of departing passengers taken over the average of the 20 highest peak hours. Provision of seating for 30 per cent of these passengers.
Gate Lounges	1m ² per passenger based on the capacity of the largest aircraft to be handled at that gate. Provision of seating for 50 per cent of these passengers.

HANDLING TIME STANDARDS	
Overall handling time	< 30 minutes
Check-in	< 5 minutes
Passport control (departure)	< 5 minutes
Passport control (arrival)	< 5 minutes
Baggage claim waiting time (narrow body)	< 15 minutes
Baggage claim waiting time (wide body)	< 20 minutes
Embarking/disembarking passengers from aircraft	< 15 minutes

provide space standards that are related to waiting times. These are shown in Table 5. Broadly, this comes to 25 percent for concourses at departure lounges and 20 percent for gate rooms. The BAA design standards are such that under design conditions 95 percent of passengers receive the desired level of service. For comparative purposes, the design standards for the Schiphol Airport Authority are shown in Tables 6 and 7. From an examination of Tables 3 through 6, it can be seen that the current approach to design is to set a space standard in conjunction with operational standards where necessary, rather than to use any quantification of the variation of level of service with the various throughputs.

In a paper presented to the then-extant Western European Airports Association, the results of a survey of operating criteria of 20 west European airports were summarized (11). The range of space provisions is shown in Table 8.

A more comprehensive level of service approach was suggested in 1979 in Canada (12). This method, which has

subsequently been proposed by IATA as a method of determining airport passenger terminal service levels, relies on setting different levels of space provision with respect to six levels of service, A to F, as shown in Table 9 (13). Unfortunately, the linearity of the relationships between space provision and service level suggests that the values provided by this table may not correspond with level of service as perceived by airport users.

It was reservations such as these that led to the proposal of a perception response model for approaching level of service analysis (14). This work attempted to tie the passengers' perception of level of service to the time spent in various processes. A three-category level of service structure was proposed: A, good; B, tolerable; and C, bad. Initially, passengers were asked to indicate their perception of service level on a more refined, six-level scale, but the results indicated that the respondents were confused. The method used in the perception response model was quite simple. As passengers proceeded through the various airport processing points on both arrival and departure, they

TABLE 7 AEROPORTS DE PARIS DESIGN STANDARDS

	Space Standard	Time Standard
DEPARTURE		
Check-in	30m ² per check-in unit 10m min. dimension in front of desk.	80 per cent of passengers queue < 15 minutes.
Departure concourse	3.0m ² per passenger with luggage 1.5m ² per passenger without luggage 1.0m ² per greeter No seating provision	
Departure passport control	20m ² per check point unit	80 per cent of passengers queue < 15 minutes.
Central security		80 per cent of passengers queue < 15 minutes. Average processing time 7 passengers per minute.
Terminal departure lounge	1.5m ² per seated passenger 1.0m ² per standing passenger Seating for between 50 and 75 per cent of people present 20 per cent of area for circulation.	
Departure coach-gate	1.5m ² per seated passenger 1.0m ² per standing passenger 50 per cent of passengers seated.	
Gate lounge	0.6m ² per queueing passenger	80 per cent of passengers queue < 5 min.
ARRIVAL		
Immigration	0.6m ² per passenger	95 per cent of passengers queue < 12 minutes.
Baggage reclaim units	Reclaim frontage of 1.0m for every 5 passengers Length of 60m for B747 sized a/c Length of 45m for A300 sized a/c Length of 30m for B727 sized a/c.	Max. of 25 minutes between arrival of first passenger in hall and reclaim of last bag from unit
Baggage reclaim	Space set by dimensions of reclaim units as above, with 8m min. between units and 4m min. between unit and wall.	
Customs	1m per passenger along searching bench.	
Arrivals concourse	As for departure concourse above.	

TABLE 8 SPACE PROVISIONS IN WAITING AREAS (11)

Area per seated passenger	1.0 - 1.5m ²
Area per standing passenger	1.0m ²
Average seating provided as a per cent of occupation at capacity:	
landside concourse - departures	30 - 50%
- arrivals	20%**
airside - departure lounge	40 - 80%***
- gate holding areas	50 - 80%

*** Higher end of range applies where there is high transfer traffic (e.g. Kastrup and Frankfurt)

** In predominantly domestic traffic airports (e.g. Hamburg) short dwell times require only 5% seating.

* Reported ranges from survey of twenty west European airports (1976).

TABLE 9 AIR TERMINAL BUILDING SPACE STANDARDS (SQUARE METERS PER OCCUPANT)

Level of Service:	A	B	C	D	E	F
Check-In	1.6	1.4	1.2	1.0	.8	
Wait/Circulate	2.7	2.3	1.9	1.5	1.0	
Holdroom	1.4	1.2	1.0	.8	.6	
Bag Claim Area (Without Device)	1.6	1.4	1.2	1.0	.8	
Pre-PIL	1.4	1.2	1.0	.8	.6	

Level of Service	Description
A	Excellent level of service; condition of free flow; no delays; direct routes; excellent level of comfort.
B	High level of service; condition of stable flow; high level of comfort.
C	Good level of service; condition of stable flow; provides acceptable throughput; related subsystems in balance.
D	Adequate level of service; condition of unstable flow; delays for passengers; condition acceptable for short periods of time.
E	Unacceptable level of service; condition of unstable flow; subsystems not in balance; represents limiting capacity of the system.
F	System breakdown; unacceptable congestion and delays.

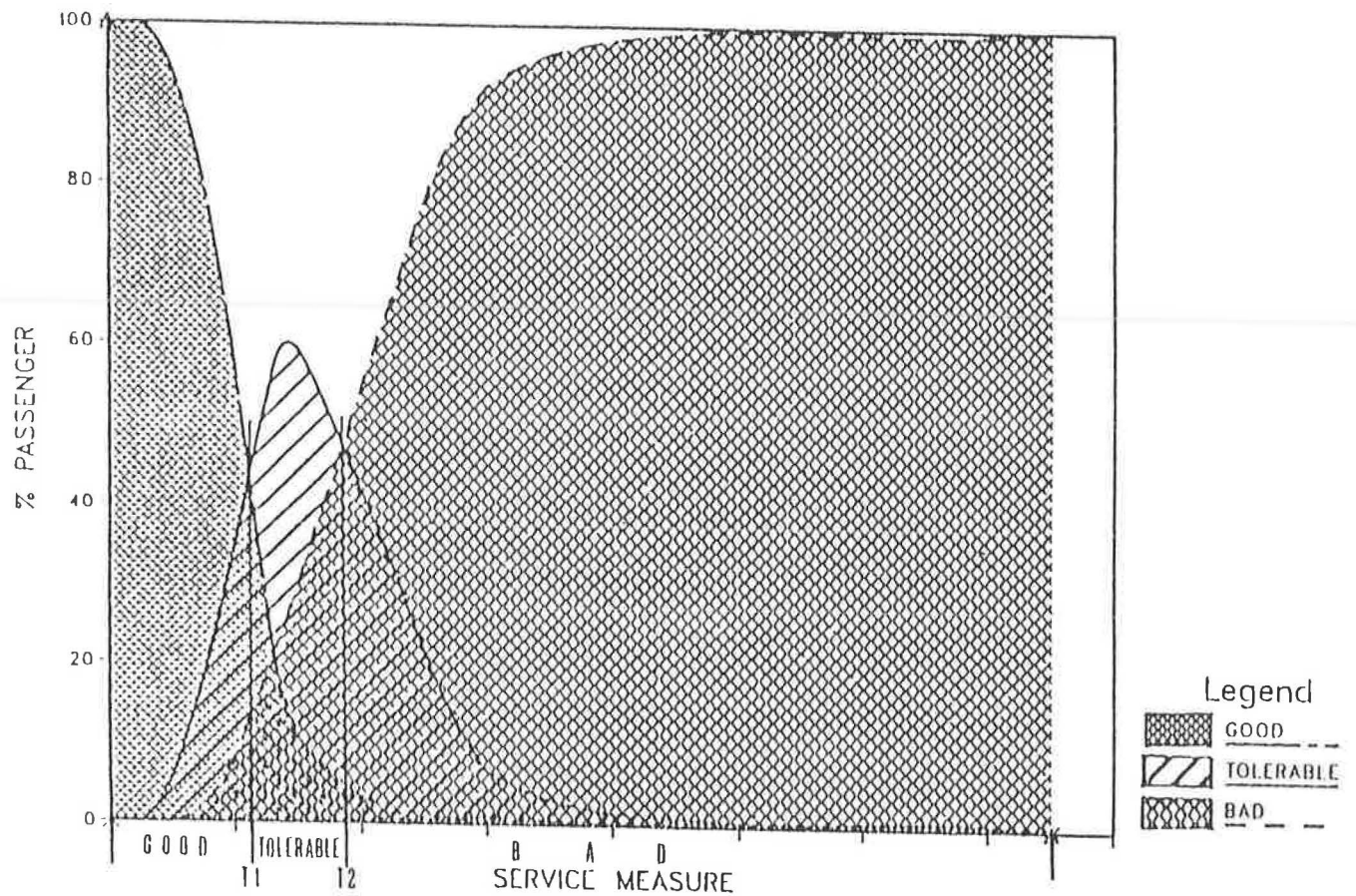


FIGURE 6 Concept of perception response model (14).

TABLE 10 LEVEL OF SERVICE OF PROCESSING TIMES (MINUTES) FOR BIRMINGHAM INTERNATIONAL AIRPORT, GREAT BRITAIN (14)

	Level of Service - A (GOOD)	Level of Service - B (TOLERABLE)	Level of Service - C (BAD)
Check In			
Charter	< 11	11 - 21	> 21
Scheduled - Long Haul	< 15	15 - 25	> 25
Scheduled - European	< 7.5	7.5 - 14	> 14
Security Check	< 6.5	6.5 - 10.5	> 10.5
Passport Control (outbound)	< 6.5	6.5 - 10.5	> 10.5
Immigration (inbound)	< 6.5	6.5 - 14.5	> 14.5
Baggage Claim	< 12.5	12.5 - 22.5	> 22.5
Customs Control	< 6.5	6.5 - 11.5	> 11.5

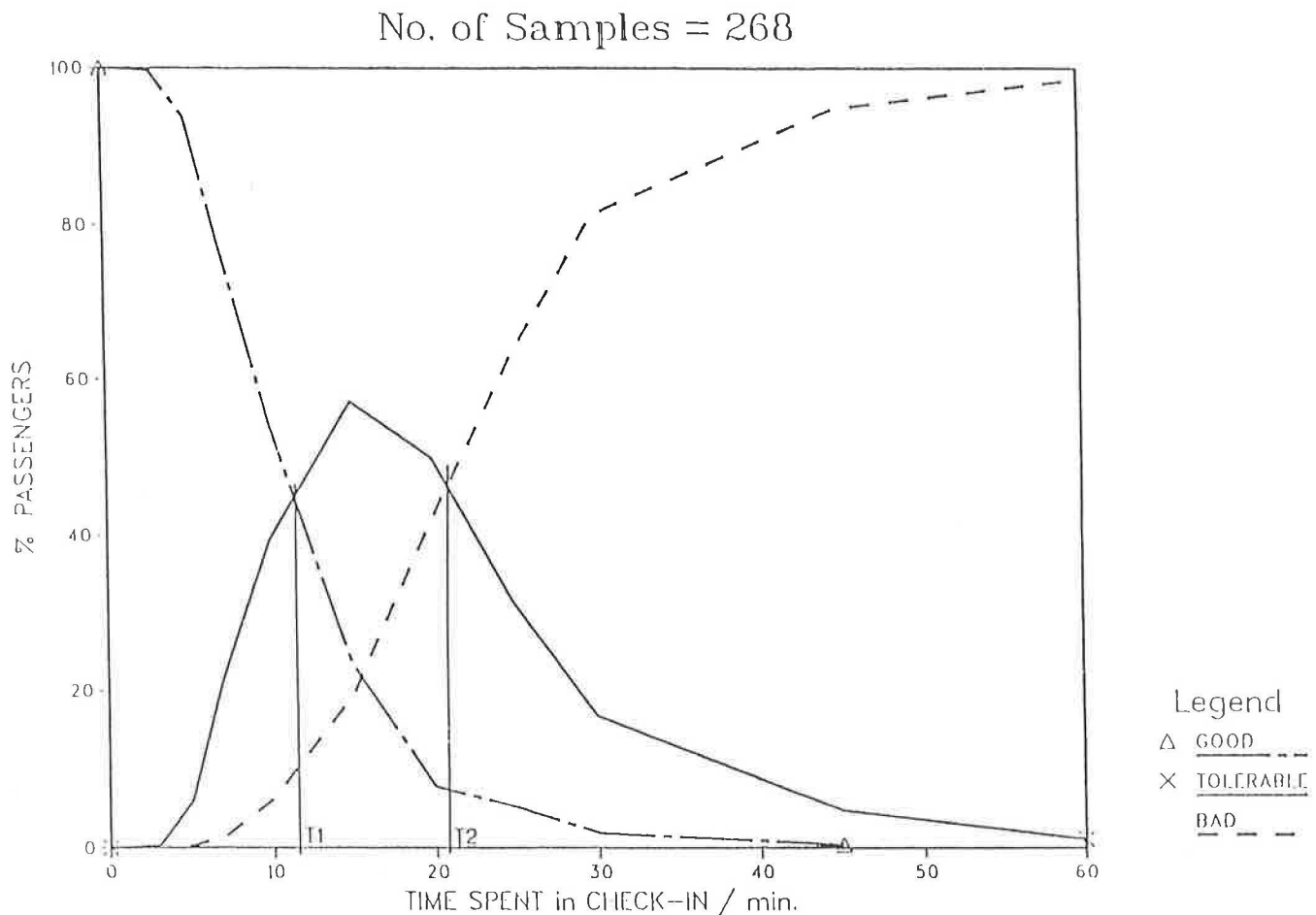


FIGURE 7 P-R model for charter I.T. check-in (Birmingham International Airport) (14).

were asked to rate the service as good, tolerable, or bad. The response rate for each type of answer was plotted against the time spent in each facility. Conceptually, it was expected that the responses would form a diagram of the shape shown in Figure 6. For short processing times, the number of "good" responses would be high and both "tolerable" and "poor" would have a low response rate. As processing time increased, the number of "good" responses would fall, the number of "tolerable" responses would peak, and the number of "bad" responses would grow.

Level of service A, or *good*, is defined as those times for which the "good" curve exceeds the "tolerable." Level of service C, or *bad*, is defined as those processing times for which the number of "bad" responses exceeds the number of "tolerable" ones. Level of service B, or *tolerable*, falls between these two limits. This model was calibrated at Birmingham, Manchester, and East Midlands airports in the United Kingdom. Table 10 summarizes the findings for Birmingham Airport, and Figures 7 and 8 show the observed forms of two of the curves that led to results for charter and scheduled long-haul check-in in the table.

The method described by Mumayiz and Ashford (14) also indicated a way of defining facility capacity on the basis of delay experience in the process. This was done by modeling processing time versus flow using the SLAM simulation program. Figure 9 shows that if capacity is defined as occurring at that point where levels of service A and B are contingent, then for inward immigration this amounts to 6.5 minutes (from Table 10), yielding a facility capacity of approximately 400 passengers per hour.

At the moment, the perception response model must be considered only prototypical, requiring considerable development before it can be applied widely to level of service analysis. The work, which was carried out by the University of Technology at Loughborough, is deficient in a number of areas:

1. The findings were obtained from a relatively small sample of respondents. For greater certainty of the validity of the values found in Table 10, a considerably larger survey would be necessary.
2. As carried out, that is, at one airport, there was no possibility of investigating any interaction between space

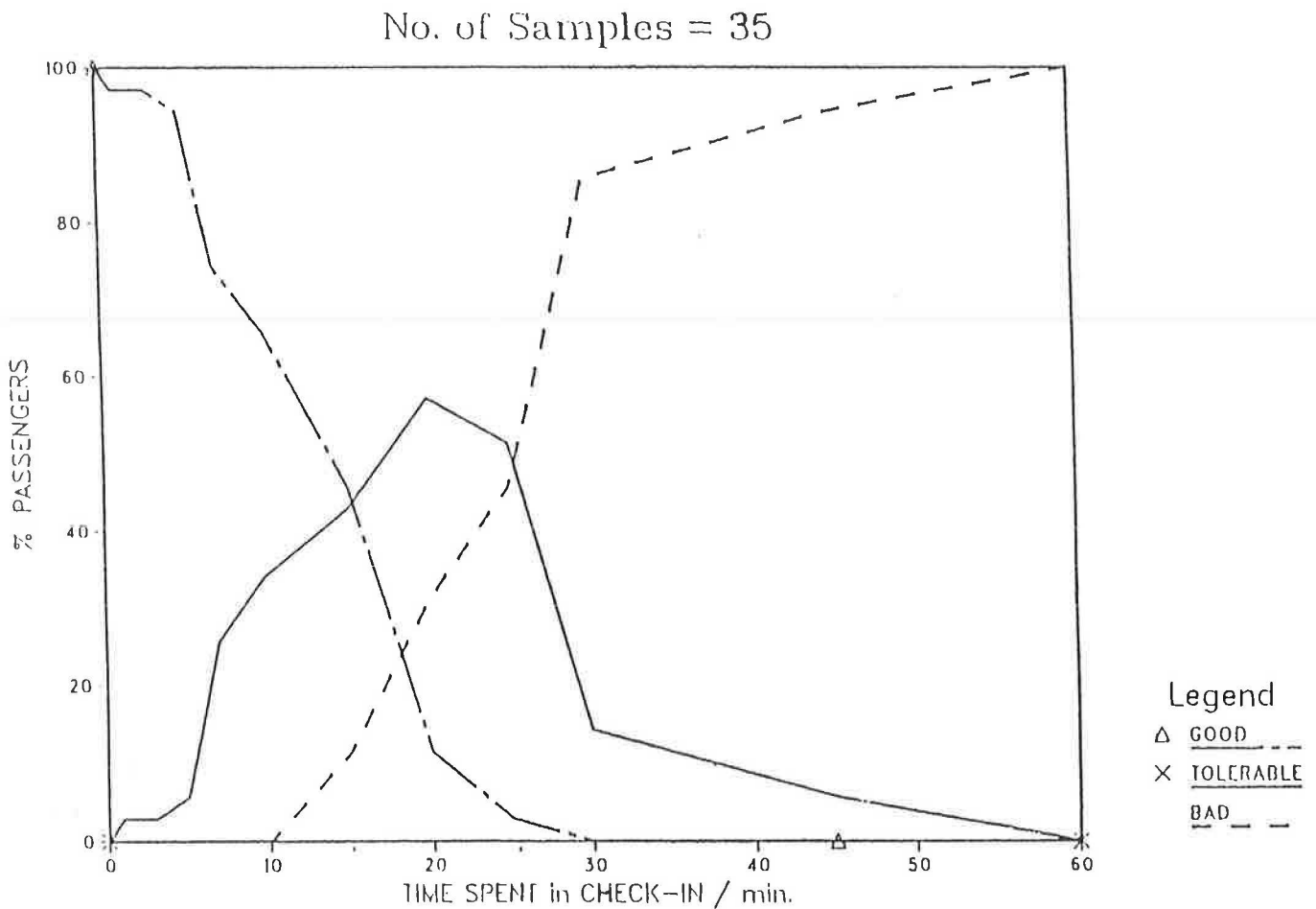


FIGURE 8 P-R model for scheduled long-haul check-in (Birmingham International Airport) (14).

provision and time spent in the process. In fact, both may affect a passenger's perception of service level, and there may well be a strong interaction between the two variables. The most effective way of determining this would be by conducting passenger perception surveys at a number of airports. If performed internationally, the surveys would indicate the transferability of results from country to country. (There is no reason to assume that perceived level of service standards are necessarily the same in developed and developing countries or across other cultural differences.)

3. As currently applied, the method has supplied criteria only for airport processing areas. The same methodology could well be applied to holding areas.

Properly developed, the perception response graph for both holding areas and processing facilities is likely to be a three-dimensional response surface, as indicated in Figure 10, with two principal independent variables—space provision and time.

CONCLUSIONS

In comparison with the status of level of service analysis in highway engineering, in airport design it is in a rudimentary state of development. Level of service standards have been set, but these are essentially straightforward design and operational criteria that provide no indication of sensitivity to overload conditions. To produce more comprehensive level of service standards, an industrywide approach to data gathering will be necessary to enable cross comparisons of design and operational standards across a large range of airports. Especially in Europe, where airports see themselves as in competition with one another, such an effort is clearly beyond the capability of any single airport or airport authority. Yet individual airports and airport authorities have a vital role to play in developing a more sophisticated level of service analysis. Most airports that have set performance standards (such as queuing time, bag delivery time, and the like) have some form of performance monitoring procedures. If pooled and linked to

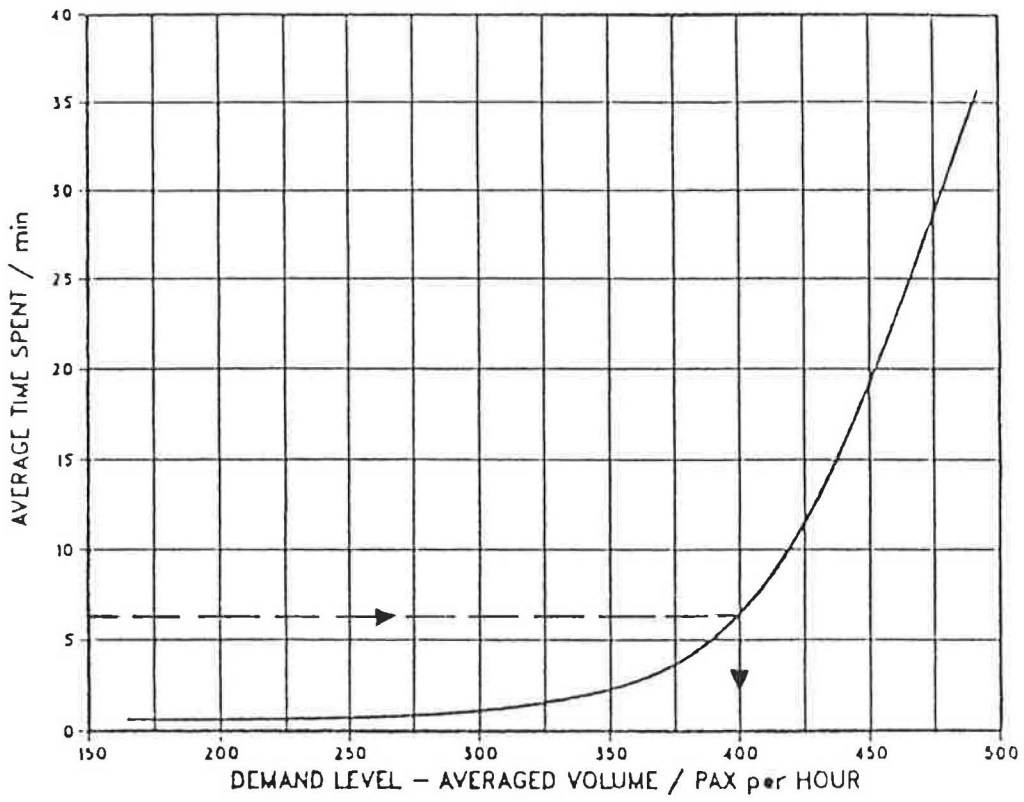


FIGURE 9 Computing capacity from the delay/volume curve (14).

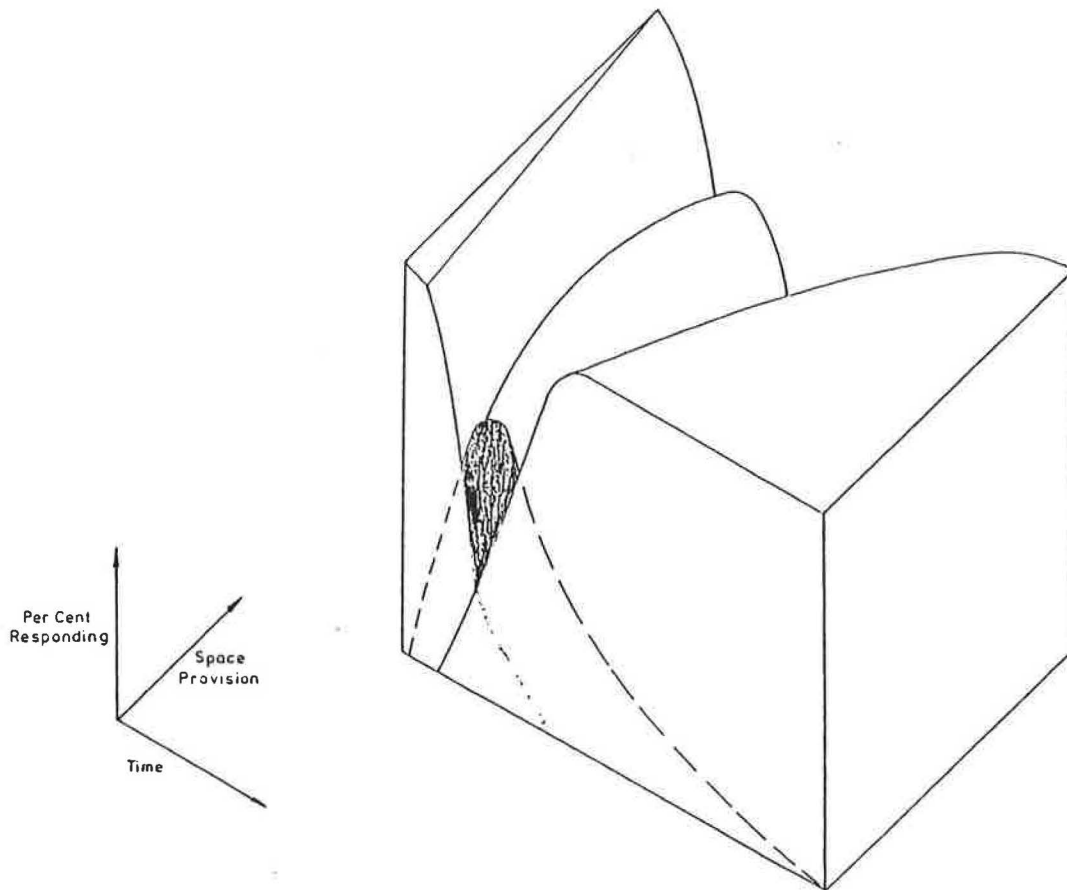


FIGURE 10 Isometric sketch of level of service concept.

passenger perception of service, these procedures can form the basis of a much more comprehensive level of service construct developed on both national and international data. It would be extremely helpful if one of the international bodies, such as IATA or ICAA, could be induced to back a research program into terminal design standards. Without this, the present rather unsatisfactory status quo is likely to continue indefinitely.

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