Time Stamping: A Method For Keeping Track Of Your Visitors

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Abstract

Lack of precise knowledge of visitor movements in a facility hampers program planning and could inadvertently lead to a poor level of service. Visitors might miss scheduled programs due to poor layout and timing. Visitors could be subject to long queues, long walking distances, and congestion. There is, however, a way to obtain precise knowledge of visitor movements. The method is called **Time-Stamping.**

Time-stamping was first introduced by the author in 1975 at the Winnipeg International Airport passenger terminal. Time-stamping involves "tagging" each pedestrian and tracing his/her movements through the terminal. The tagging was accomplished by issuing to each pedestrian – passenger and visitor alike – a card when he or she entered the terminal either at the gate or at the doors at the curb. Tracing was accomplished by stamping the card at various checkpoints in the terminal with a time-stamp. The card was collected when the pedestrian left the terminal either by gate or door at the curb. When aggregated over a day, the result was a complete travel pattern for all pedestrians. The result was a massive amount of data. For example: passenger loadings in the terminal over time; occupancy counts at various facilities; measures of density and level of service; time spent in facilities; queue lengths and waiting times; walking distances and travel times; origin-destination patterns; traffic composition such as males, females, passengers, and visitors; and flow rates at check points.

Over the next ten years, the Department of Transport of Canada surveyed nearly all its air passenger terminals. The result of such a massive amount of data was the production of space standards and layout techniques used in every Canadian airport terminal design today. The author also conducted numerous other surveys, for example:

- Ottawa Bus Terminal, 1976
- Ottawa Railway Station, 1978
- Carleton University Open House, 1978
- Sacramento Airport, California, 1978
- Carleton University Pedestrian Tunnels, 1979
- Schiphol Airport, Amsterdam, 1980
- West Palm Beach Airport, Florida, 1983

The Time-stamping technique can be applied quickly and unobtrusively in almost any pedestrian facility. The technique yields a tremendous amount of precise, quantitative data on pedestrian movements. The data can be used to improve programming and to produce better layouts with an enhanced level of service for all.

Introduction

The planning, design, and operation of public facilities such as museums, exhibitions, galleries, zoological parks, aquariums, amusement parks, institutions, and transportation terminals requires a sound theoretical base. This is necessary to ensure that visitors to the facilities have the best possible level of service in terms of comfort and convenience. The layout of space and the arrangement of facilities in that space must be such that it minimizes visitor frustration in finding facilities and maximizes the visual experience.

To achieve such good layout requires a thorough understanding of association charts and traffic flow patterns. The relative location of space and facilities in that space must be well thought out in terms of routing, guidance, and capacity. The foundation for good layout and programming is a knowledge of visitor behavior, their desires, and the number of visitors expected. For successful planning much of this knowledge must be in some quantifiable form. For example, we need to know: size of spaces, location of spaces and facilities, travel times, dwell times, waiting times, and so forth.

Quantitative planning, design, and operation requires a sound data base. Visitor information is needed to establish: peak loads of visitors, waiting times, queue lengths, walking distances, walking speeds, densities, congestion, processing times, flow rates, desire line patterns, origin-destination matrices, and timing of programs.

Data Collection Methods

It is clear from the nature of the data required that some kind of survey must be conducted in the facility. In the past, various types of traditional surveys have been conducted. For example:

- **Observation Techniques:** Here head counts and time readings are done manually at specific locations.
- **Photograph Techniques:** These are deferred observation techniques using still photos or videotape.
- **Mail-back Questionnaires:** Visitors are sampled and handed a self-administered mail-back questionnaire.

- **Collected Questionnaires:** Visitors are sampled and the questionnaires filled in on the spot by the visitors and returned to the surveyors.
- **Interview Techniques:** Visitors are sampled with survey personnel asking questions and recording information.
- **Tailing Techniques:** Small samples of visitors are followed in their travels and behavior patterns noted by observers.
- **Pseudo Visitors:** Groups of people pretending to be visitors record behavior patterns about themselves as they travel through the facility.

The Time-Stamping Technique

Traditional survey techniques have serious limitations. Due to cost and staffing considerations, only small samples can be surveyed. Often the sample sizes are too small to make the results statistically significant. Traditional surveys are usually done for individual components of a facility. Little, if any, information is collected about the interaction of the components in the system. Interview surveys rely on the memories of the visitors which is not always reliable. A more comprehensive, objective technique was needed.

Time-stamping is such a technique. With this method all visitors in a facility are "tagged" and their movements traced as they travel through the facility. Time-stamping was developed for collecting pedestrian traffic data in airport terminals. It was invented in the summer of 1974 for the Airport Group of the Canadian Department of Transport (Transport Canada), tested in the summer of 1975 (Braaksma, 1976), and has been used since at a variety of pedestrian facilities.

The Survey Technique

The time-stamping technique involves first "tagging" the pedestrians, then tracing their movements through the terminal. The tagging was accomplished by issuing to each pedestrian – passenger and visitor alike – a card when he or she entered the terminal, either at the gate or at the doors at the curb. The card was sturdy, the size of an airline ticket envelope, and had on its reverse side instructions in French. (See Figure 1.)

Tracing was accomplished by asking the pedestrian to have his/her card time-stamped at various checkpoints in the terminal, where surveyors stood equipped with lightweight portable time-stamps as shown in Figure 1. Checkpoints were placed at entrances and exits of processors, waiting areas and corridors; at doors, stairs and escalators; in general and special waiting areas; at ticket and check-in counters; at baggage claim areas; in U.S. pre-clearance areas; in holding rooms; at gate positions; at immigration and customs areas; and in duty-free shops. The time-stamps were coded by checkpoint. The cards were collected from the pedestrians as they left the terminal, either through gates or doors. When aggregated over a day, the result was a complete travel pattern of all pedestrians.

Winnipeg Airport Terminal Pilot Study

To test the new survey technique a pilot study was first conducted. The objectives of the pilot study were:

1. To test public acceptance of this new technique;
2. To test the surveyor's acceptance of the technique, and the ability of survey personnel to cope with large volumes of traffic;
3. To test the equipment of the survey, the time-stamps and the design of the cards;
4. To test the logistics of implementing the survey (Can the survey be started and stopped with ease?; Is the work schedule adequate?);
5. To test the impact of the new survey technique on the terminal's operation (Will it alter flow patterns?; delay passengers?; impede airline operations?);
6. To provide useful data to an airport planning team.

The pilot study was done at the terminal at Winnipeg International Airport because it was relatively small, thus, keeping the cost down and also keeping the survey to a manageable size. Winnipeg also had a representative sample of air traffic, i.e., domestic, trans-border and international. Furthermore, traditional surveys were planned for the terminal for two weeks commencing July 21, 1975, to be conducted by the Winnipeg Area Airports System Study team (WAASS) as the first phase of a two-year study to formulate a plan of long-range development for airports in the Winnipeg area. The WAASS team provided the survey staff.

Terminal Layout

In order to keep the pilot study within manageable proportions, it was decided to survey the north end of the terminal only. The Winnipeg terminal is of symmetrical design, the north end, which accommodates all other airlines, being a mirror image of the south end, which is exclusively Air Canada's domain. The division, made with rope barricades, in effect creates a self-contained mini-terminal.

Forty checkpoints were identified and coded in the north end of the terminal as shown in Figure 2. Openings in the rope barricades dividing the terminal were treated as entrances and exits to and from the mini-terminal. Thus if a passenger walked from the CP Air counter to the Air Canada counter, he/she effectively exited the mini-terminal and, in fact, surrendered his/her card. If he/she returned he/she would be given a new card and treated as a new person. Therefore the cards really represented person-trips, rather than persons.

Staffing and Equipment

Since some of the 40 checkpoints required two surveyors, 50 people with time-stamps were needed to conduct the survey. In order to keep costs down it was also decided to operate only one shift per day. On August 1, 1975, the survey ran from 11:30 to 20:30 hours, a period covering 34 scheduled flights and three charter flights. On August 2, 1975, the survey started at 11:00 hours and ran till 18:30 hours (30 scheduled flights and two charter flights). In total, 69 flights of seven airlines were surveyed.

Running the Survey

The surveyors, after two briefings on the survey technique, were sent out in two groups: first, those manning the internal checkpoints of the terminal, so as to be in position when the public started coming through with cards; second, 10 minutes later, the group assigned to the entrances and exits. During the first two hours there were some difficulties as the surveyors learned their task; thereafter, the survey ran smoothly, coordinated by supervisors equipped with walkie-talkies. Thirty minutes before closing down the survey the surveyors at the entrances and exits were instructed not to hand out any more cards, only to collect. This allowed most pedestrians with cards to leave the terminal and have their cards collected.

Video-taping

Nineteen and a half hours of video-tape were produced before, during, and after the time-stamping survey to check the validity of the data, to record the survey technique, and to permit an analysis of the impact of the survey on the terminal's operations. Taping was done by two TV cameras mounted at the same place each day. All major activities were taped including entrance doors, check-in counters, stairways, security checks, hold rooms and baggage claim areas.

Results of the Pilot Study

Public Acceptance

The survey technique was a great success. In two days, 10,055 cards were carried by the public through the terminal, even by those laden with baggage.

During and after the survey, the terminal was searched for discarded cards. A total of 52 cards were found in the north end of the terminal and another 44 cards which had somehow escaped the surveyors at the barricades were found in the south end of the terminal. About 150 cards were unaccounted for. The result: a return of 98%. From surveyors' notes, recollections and video-tape analysis an estimated 150 people refused to carry cards. It is also estimated that another 300 people were inadvertently missed in the survey. This resulted in a sample size of 94.4%.

Surveyors Acceptance

In general, the surveyors accepted the technique well. Some poor starts were quickly corrected, and a more thorough training program would have eliminated a lot of start-up problems. No difficulties were encountered in keeping up with the volumes of traffic (heavily-loaded areas, such as doors and gates, had more than one surveyor).

Equipment

The time-stamps did cause some difficulties. Occasionally a clock would stop ticking; the surveyor would then record the time by hand until the clock could be started or repaired by a supervisor. Another problem with the clocks was synchronization. Most of the clocks lost two or three minutes a day, a problem minimized by the supervisors who checked each clock every hour. Another synchronization problem occurred between clockface and stamp imprint: play in the gears and hands caused some time-stamps to be in error by two minutes. The resulting data are not as precise as was anticipated. A problem was also encountered with the clarity of the imprint on some cards, but as the surveyors gained experience this difficulty righted itself. Some surveyors found the size of the grid on the card too small for the stamp, and the stamping process messy. The cards themselves appeared to function well; they were the correct size and weight, and not one was bent, torn, crumpled or mutilated in any way.

Impact on the Terminal

Except for a couple of isolated incidents, the time-stamping survey appeared to have had little impact on the terminal's operation. One incident occurred at Checkpoint 39 near the top of the escalator (see Figure 2). Some 200 charter-flight passengers came up the escalators *en masse*. The two surveyors at the checkpoint attempted to handle the volume, but since queuing space was very small at the top of the escalator a dangerous situation developed. The time-stamping was suspended for a few minutes at the checkpoint until the backlog cleared. On the second day that checkpoint was eliminated. Another way to handle traffic at escalators is to conduct the survey at the bottom of the up escalator and at the top of the down escalator.

During the peak period a second bottleneck occurred at Checkpoint 8 on the second floor (Figure 2). This checkpoint was on the main corridor between the two halves of the terminal. The problem was quickly corrected by adding a second surveyor to the checkpoint.

After the survey the author interviewed several agencies to learn if they had been inconvenienced in any way. Canadian Immigration and Customs said that the survey had had no impact on their operation, and a similar response came from the agents for Northwest Airlines, Transair and CP Air and the agents at the Security check position.

Before the implementation of the pilot study, many people had expressed concern over the impact of so many surveyors in the terminal building. This concern is unfounded. From a vantage point above the first floor the author had difficulty in spotting the surveyors among the hundreds of passengers and visitors – they were well-dispersed throughout the terminal. Also, most passengers encountered only six to eight surveyors in their path of travel.

Data Collected

The data were processed by computer and the results verified by comparing the computer print-out with video-tape head counts. The results were excellent. Analysis of the data yielded the following comprehensive set of terminal traffic characteristics (Braaksma, 1978).

1. *Loads on facilities.* Occupancy counts were made of the terminal and its 22 component areas for every minute of the day on August 1 and 2, 1975. The load data for three components – the ticket lobby, the general waiting area and the baggage claim area – and for the whole terminal, were plotted to illustrate the peaking characteristics. (See Figure 3.) Three peaks occur at Winnipeg: in the morning, between 12:00 and 14:00 hours, and in the afternoon.

From the occupancy counts the peak loads for the 22 component areas were tabulated as shown in Table 1. Since the average sample size was 90%, the loads were adjusted upwards to approximate the 100% sample size. Gross areas were estimated for a number of components to determine the "pedestrian modules." (A pedestrian module is the inverse of density, e.g., it is more convenient to use 3.2m^2/person than use 0.3 person/m^2.) The pedestrian modules can be used to assess the level of service in the various components by comparing them with space standards. For example, if the space standard for ticket lobbies were 2.3m^2/person, then a ticket lobby operating at a peak pedestrian module of 3.2m^2/person would be providing a good level of service, assuming that other factors such as inter-person distances were adequate and no traffic flow conflicts existed.

2. *Traffic Composition.* From the occupancy counts a picture of the traffic mix was obtained. For example, of the 5,367 pedestrians on August 2, 782 were enplaning passengers, 635 were deplaning passengers, and the remaining 3,950 were 'transients' who had passed through the north end of the terminal. Of a sample of 1,212 passengers on the same day 549 were terminating, 570 were originating and 93 were connecting passengers. Of the 549 terminating passengers, 347 were domestic, 151 were trans-border, and 51 were international passengers; and of the 570 originating passengers, 317 were domestic and 253 were trans-border passengers.

It is also possible to determine the composition of the traffic in each component for every minute of the day. For example, on August 1, 1975, of the 69 enplaning passengers in the ticket lobby at 13:10 hours, 19 were with flight CP86 and nine with flight NW382. It was also possible to extract each flight and examine how it moved through the terminal.

3. *Occupancy durations.* Average occupancy durations for each terminal component were also produced as shown in Table 2. The longest waiting times were in the hold rooms with an average duration of 15.6 minutes.

4. *Traffic volumes at checkpoints.* Pedestrian volumes flowing past the 40 checkpoints in five-minute intervals were also calculated.

5. *Arrival and departure curves.* Arrival and departure curves for processors were derived from the traffic volumes flowing past the checkpoints. For example, Figure 4 shows the arrival and departure curves for Hold Room No. 2 check-in position for Flight NW736 on August 2. (The departure curve from checkpoint 35 was approximated by the departure curve from checkpoint 36.) These curves can be used to estimate the number of passengers in the queue at any time, the duration of waiting time and the processing rates: from Figure 4, the maximum queue length is 24 passengers, the maximum waiting time is eight minutes and the maximum processing rate is four person/min. These curves can also be used to construct simulation models.

6. *Traffic flow between checkpoints.* Volumes between checkpoints were calculated and used to produce daily traffic flow matrices from which desire-line patterns were constructed. Desire-line maps as shown in Figures 5 and 6 were produced from these data. Desire-line patterns graphically illustrate the magnitude of traffic flow between pairs of checkpoints as well as the distance between pairs of checkpoints. If it is accepted that a good design criterion would be to place facilities with heavy traffic volumes between them closer together than facilities with light traffic volumes, then the desire-line map can be a useful tool for evaluating terminal layouts. Desire-line maps can also be translated into trip length frequency distributions. These distributions can be valuable tools in monitoring the effect of changes in terminal layout and operation.

7. *Walking distances and processing times.* Trip-length frequency distributions were prepared, firstly for passengers in the terminal and secondly for the various categories of passengers. From these frequencies weighted average walking distances were calculated as shown in Table 3. A similar analysis was performed on overall processing times as shown in Table 3. Note that connecting passengers on average, walk much further than other passengers and also spend much more time in the terminal.

Validation of Results

Before, during and after the time-stamping survey 19.5 hours of video-tape were produced to validate the results, to record the survey technique and to analyze the impact of the survey on the terminal's operation.

The taping was done by two TV cameras mounted at the same place each day. All major activities were taped including entrance doors, check-in counters, stairways, security checks, hold rooms and baggage claim areas. The video tapes were played back and head counts taken from the monitor. These counts were then compared with the survey results. The video-tape counts matched the survey results well.

Outcome of Pilot Study

The pilot study was designed to achieve four important objectives: (1) to test the time-stamping survey method; (2) to develop a procedure for analyzing the data; (3) to provide the Winnipeg planning team with useful data; and (4) to assess the capability of the data to evaluate the terminal. The study was a success on all four counts. The time-stamping survey was a success in that:

(a) Public acceptance of the survey technique was excellent. People cooperated to the fullest in carrying their cards and presenting them for stamping.
(b) The pilot study demonstrated that ordinary people with little training can do a good job with this type of survey.
(c) The equipment worked satisfactorily, but there is room for improvement in the time-stamps.
(d) No great problems were encountered in the logistics of the survey.
(e) The impact of the survey on the terminal operations appeared negligible. No significant delays were experienced by passengers, no complaints were received and no detrimental effects were observed.
(f) As a direct result of this work, the time-stamping survey technique was adopted by Transport Canada for full-scale surveys at Canadian airports.

Applications of the Time-stamping Technique

Airport Terminals

After the success of the pilot study in Winnipeg, Transport Canada began a massive time-stamping survey program under the heading of CASE – Canadian Airport Systems Evaluation. Each of Canada's 75 major airports was surveyed at least once. Some were surveyed several times to determine trends in passenger traffic.

The surveys, conducted over a period of about ten years, yielded an enormous amount of quantitative data. This data was used to analyze terminal capacities, pedestrian behavior, establish space standards, and construct simulation models. Transport Canada now has the world's most precise method for designing airport terminals. Furthermore, the method has saved large amounts of money (Twidale, 1980).

The CASE studies clearly demonstrated the applicability of the time-stamping technique at Canadian Airports. But, would the technique also work outside Canada? In 1978 an opportunity presented itself to conduct a time-stamping survey at Sacramento Airport in Sacramento, California (Bechtel Inc., 1979). The airport required a computer simulation model for its passenger terminal. The time-stamping technique was used to collect the data to construct and validate the model. The survey method worked as well in the U.S.A. as it did in Canada.

But would the technique work outside of the U.S. and Canada? In 1980 an engineering student at Delft University in The Netherlands wanted to construct a simulation model of Schiphol Airport in Amsterdam for his research thesis. He selected the time-stamping survey technique as the best way to gather the necessary data. On May 16 and 17, 1980, under the author's supervision, Vis (Vis, 1982) conducted a time-stamping survey of Piers A and D at Schiphol Airport. As in previous surveys, the results were excellent. Since Schiphol Airport is a truly international airport, processing passengers from all parts of the world, it was an ideal laboratory to test people's reactions to the technique. There was absolutely no problem in conducting the survey with such an international mix of people. Nearly everyone accepted the cards and cooperated fully with the time-stampers.

The author conducted one more time-stamping survey at an airport in the United States. Palm Beach International Airport in West Palm Beach, Florida, was experiencing rapid passenger growth in the early 1980's. In 1983 the airport called for a study of its terminal facilities. On March 19, 1983 a time-stamping survey was conducted in the Delta Airlines Passenger Terminal (Greiner Engineering Inc., 1983). The purpose of this survey was to document passenger and visitor characteristics, and to calibrate the terminal simulation model. Once again, the technique worked well, producing a vast amount of quantitative data.

Bus Terminals

To test the applicability of the time-stamping technique to other public facilities, the technique was tried in an inter-city bus terminal. A graduate civil engineering student undertook the assignment as a master's thesis. In 1976 he conducted the time-stamping at the Voyageur-Colonial Bus station in Ottawa (Braaksma & Johnson, 1978). Again, the results were excellent. A large amount of quantitative data was collected on passenger and visitor travel patterns in the bus station.

Railway Stations

In 1977 the time-stamping technique was applied at the Ottawa Train Station by two civil engineering students (Beamish & Donahue, 1978). They conducted the survey on Friday, November 18, 1977, which was one of the busiest days of the year. Train passengers cooperated well with the surveyors. The resulting data yielded a large amount of quantitative information about pedestrian travel in the railway station.

MacKenzie Engineering Building Open House

An opportunity to test the time-stamping technique outside of transportation terminals presented itself in the fall of 1977. The Faculty of Engineering at Carleton University scheduled an Open House on November 5, 1977. Two civil engineering students conducted a time-stamp survey of visitors through the MacKenzie Engineering Building on November 5, 1977 (Gaudenzi & Fortin, 1978). The result was a large amount of quantitative data about visitor movements in the building. The information was used to plan subsequent open houses. The time-stamping technique worked very well in a non-transportation setting.

Carleton University Tunnel System

Time-stamping was used in one other non-transportation setting. In 1979, a civil engineering student conducted a time-stamping survey of pedestrians using Carleton University's tunnel system (Wasef, 1979). All the buildings on Carleton's campus are connected by tunnels and heavily used by students, staff and faculty, especially during inclement weather. The purpose of the study was to determine pedestrian flow characteristics in the tunnels. The time-stamping technique proved to be the ideal tool for collecting this information.

Conclusions and Recommendations

Conclusions

The pilot study in 1975 demonstrated clearly the practicality and usefulness of the time-stamping technique in airport terminals. The travelling public accepted the technique well; surveyors require little training; the equipment is satisfactory for most applications; and the impact on the terminal's operation was negligible. So successful was the technique that Transport Canada mounted a massive data collection program using time-stamping. The result was a vast data base, good space standards, and practical simulation models.

Other airports also benefitted from the time-stamping technique. In the U. S., Sacramento and Palm Beach Airports acquired solid information about their passenger flows. Schiphol airport in Amsterdam was also provided with a sound data base about its passengers flows.

It was also demonstrated that time-stamping will work in other transportation facilities. Time-stamping surveys were conducted in Ottawa's bus and railway stations. Good pedestrian flow characteristics were obtained in both terminals.

For non-transportation facilities time-stamping has also worked well. The technique was applied at Carleton University's engineering building's open house, and its tunnel system.

Sufficient experience has now been gained that it can be said with confidence that time-stamping will work in almost any pedestrian environment. It is the only technique that will yield a vast amount of quantitative data about pedestrian behavior. It is the only technique that will produce a comprehensive picture of pedestrian travel in a facility. It is a technique that can help facility planners and operators provide a better level of service for their visitors.

Recommendations

In light of the success of time-stamping in many transportation and non-transportation facilities, it is recommended that the technique be applied whenever there is a need to understand pedestrian travel. The technique can be applied at such facilities as: museums, exhibitions, galleries, zoological parks, aquariums, amusement parks, institutions and transportation terminals.

Time-stamping is an expensive technique. Its high cost is due to the high cost of labor in staffing the checkpoints, in coding the time and checkpoint readings, and in inputting the data. Therefore, it is recommended that a better way be found to time-stamp the cards, code the data, and put it into the computers for analysis. Research is required to harness such high tech tools as bar code readers and other electronic scanners.

References

Beamish, D. J., & Donahue, B. J. (1978). *Pedestrian traffic flow analysis of the Ottawa Train Station.* Department of Civil Engineering, Carleton University. Ottawa: March.

Bechtel, Inc. (1979). *Time-stamp survey for Sacramento Airport.* Department of Airports, County of Sacramento, CA: September.

Braaksma, J. P. (1976). Time stamping: A new way to survey pedestrian traffic in airport terminals. *Transportation Research Record, No. 588.* Transportation Research Board, Washington, D.C.: January.

Braaksma, J. P. (1976). Time stamping: A new way to survey pedestrian traffic in airport terminals. *Traffic Engineering and Control, 17*(5), 204-206.

Braaksma, J. P. (1978). Surveying pedestrian traffic: Results of time stamping method used at Winnipeg Airport. *Traffic Engineering and Control, 19*(6), 274-276.

Braaksma, J. P. & Johnson, W. P. (1978) Bus terminal performance measured with time stamping. *Transportation Research Record, No. 663*. 63-69. Transportation Research Board, Washington D.C.: August.

Gaudenzi, D. & Fortin, D. (1978). *Utilization of the time-stamp survey technique at the 1977-78 Engineering Open House*. Department of Civil Engineering, Carleton University. Ottawa: March.

Greiner Engineering, Inc. (1983). *Time-stamp survey for Palm Beach International Airport*. Palm Beach County, FL: March.

Twidale, P. (1980). How to beat the high price of floor space. *Transpo 80*, Fall, 10-12.

Vis, J. R. (1982). *Time-stamp research at Schiphol Airport*. Delft, The Netherlands: Department of Civil Engineering, Technical University of Delft.

Wasef, S. (1979). *Pedestrian traffic flow characteristics in pedestrian tunnels*. Department of Civil Engineering, Carleton University. Ottawa: March.

Table 1

Peak Occupancy in Terminal Components for August 2, 1975

Component Description	Time	Peak Occupancy (No. of People)		Gross Area (ft^2)	Module (ft^2/ person)
		Surveyed	Adjusted		
Ticket Lobby	1325	268	289	9,785	34
General Waiting Area	1255	99	107	9,775	91
Hold Room No. 1	1325	57	62	1,304	21
Hold Room No. 2	1304	93	100	2,730	27
Hold Room No. 5	1720	98	106	2,420	23
Baggage Claim Area	1330	97	105	3,477	33
Queue CP Air Check-in	1315	14	15	-	-
Queue Transit Check-in	1231	9	10	-	-
Queue Frontier Check-in	1247	1	1	-	-
Queue Northwest Check-in	1212	18	19	-	-
U.S. Pre-clearance	1205	23	25	500	20
Canadian PIL	1140	75	81	2,250	28
Customs Baggage Area	1145	64	69	1,300	19
Customs Inspection Area	1156	15	16	-	-
Queue Security Clearance	1230	27	29	-	-
Queue Check-in Hold #1	1301	20	21	-	-
Queue Check-in Hold #2	1237	25	27	-	-
Queue Check-in Hold #5	1543	14	15	-	-
Immigration Corridor	1628	54	58	-	-
Customs Corridor	1149	19	20	-	-
Hold Room Concourse	1323	60	65	-	-
Greeters' Waiting Area	-	-	-	-	-

Table 2

Average Occupancy Durations of Terminal Components

Component Description	Average Time Spent in Component (min.)	
	August 1	August 2
Ticket Lobby	5.00	5.25
General Waiting Area	8.50	5.75
Hold Room No. 1	14.50	19.50
Hold Room No. 2	15.25	18.25
Hold Room No. 5	12.75	13.50
Baggage Claim Area	23.00*	7.00
Queue CP Air Check-in	1.25	3.00
Queue Transit Check-in	2.50	1.00
Queue Northwest Check-in	8.25	13.25
U.S. Pre-clearance	5.25	7.25
Canadian PIL	6.00	5.50
Customs Baggage Area	4.25	6.00
Customs Inspection Area	4.75	6.75
Queue Security Clearance	7.75	5.00
Queue Security Clearance	1.50	2.00
Queue Check-in Hold #1	6.00	4.00
Queue Check-in Hold #2	1.50	2.75
Queue Check-in Hold #5	0.50	1.50
Immigration Corridor	2.75	3.50
Customs Corridor	2.00	0.75
Hold Room Concourse	1.25	1.75
Greeters' Waiting Area	2.25	-

*Long duration due to a departing Charter flight.

Table 3

Walking Distances and Overall Processing Times for August 2

Type of Passenger	Average Distance Walked (ft)	Average Distance Walked (m)	Average Time Spent in Terminal (min)
Any Passenger	367.5	112.1	27.9
Terminating			
Domestic	305.3	93.1	16.5
Trans-border	553.9	168.9	21.0
International	365.0	111.3	26.0
Originating			
Domestic	326.8	99.7	37.2
Trans-border	397.9	121.4	36.5
Connecting	530.4	161.8	41.5

Figure 1

The Time-Stand and Pedestrian Traffic Flow Survey Card

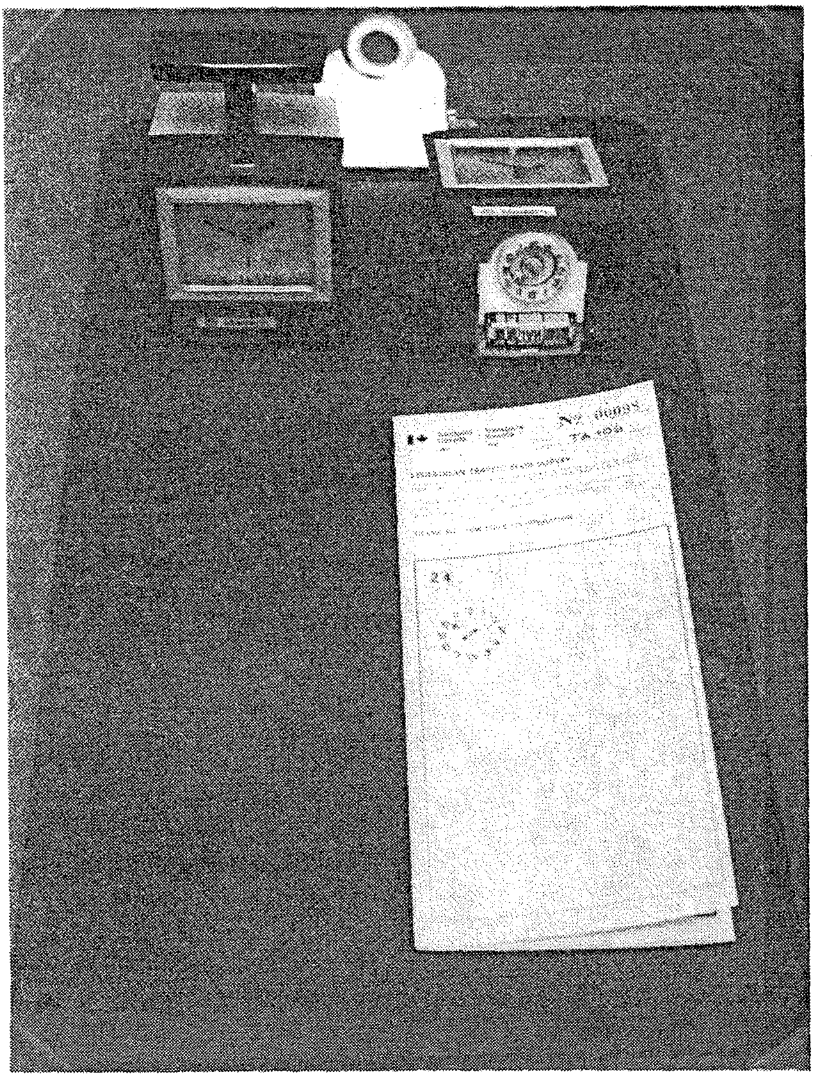
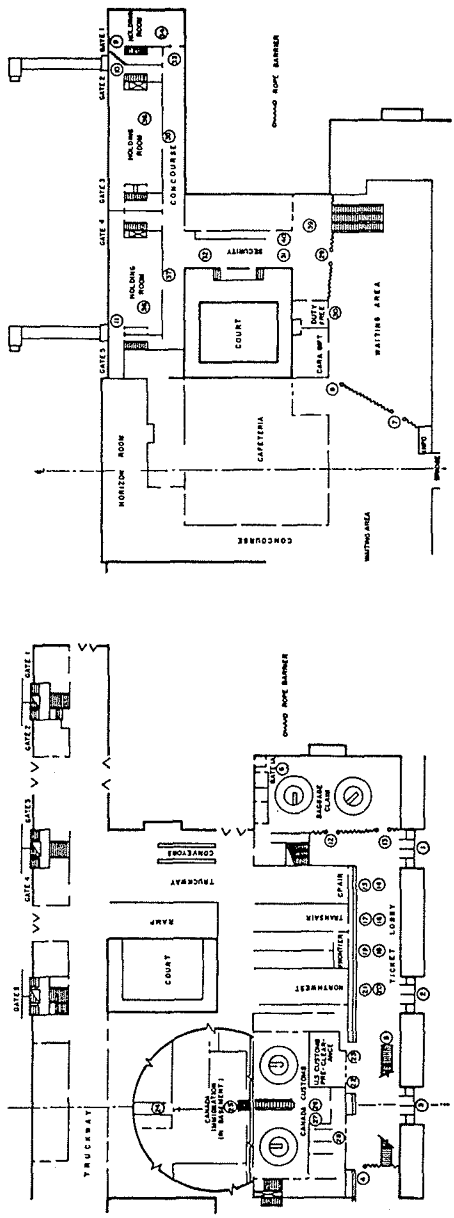


Figure 2

Checkpoints in the North End of the Terminal



1. In/Out Door No. 1
2. In/Out Door No. 2
3. In/Out Door No. 3
4. In/Out Barrier at South Stairs
5. Up/Down North Stairs
6. In/Out Gate 1A
7. In/Out Barrier at Information Counter
8. In/Out Barrier at Cafeteria
9. In/Out Gate 1
10. In/Out Gate 2
11. In/Out Gate 5
12. In Baggage Claim Area
13. Out Baggage Claim Area
14. In CP Air Queue at Check-in Counter
15. Out CP Air Check-in Desk
16. In Transair Queue at Check-in Counter
17. Out Transair Check-in Desk
18. In Frontier Queue at Check-in Counter
19. Out Frontier Check-in Desk
20. In Northwest Queue at Check-in Counter
21. Out Northwest Check-in Desk
22. In U.S. Preclearance Facility
23. Out U.S. Preclearance Facility
24. In Immigration Queue (PIL)
25. Out Immigration Desks (PIL)
26. Out Baggage Claim (Customs)
27. In Customs Queue (Secondary)
28. Out Customs Hall
29. In/Out Waiting Area
30. In/Out Duty Free Store
31. In Security Check
32. Out Security Check
33. In Hold Room #1 Queue
34. Out Hold Room #1 Desk
35. In Hold Room #2 Queue
36. Out Hold Room #2 Desk
37. In Hold Room #5 Queue
38. Out Hold Room #5 Desk
39. In/Out Greeter/Wellwisher Area
40. Out Corridor

Figure 3

Loading Diagram of Terminal and Components for August 2, 1975

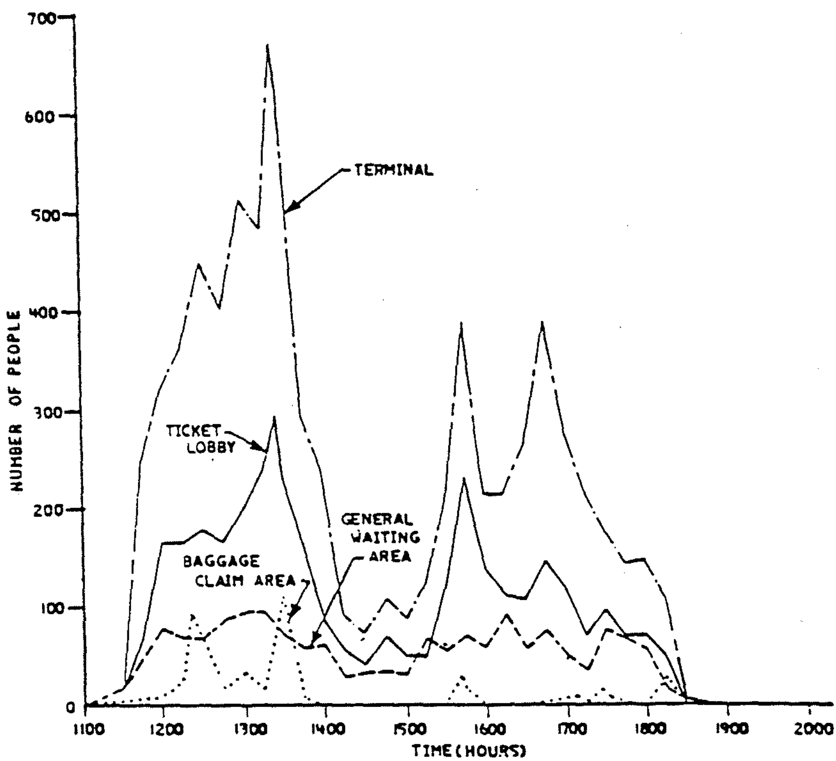


Figure 4

Arrival and Departure Curves for Check-in Position at Hold Room No. 2, NW Flight 736, August 2, 1975

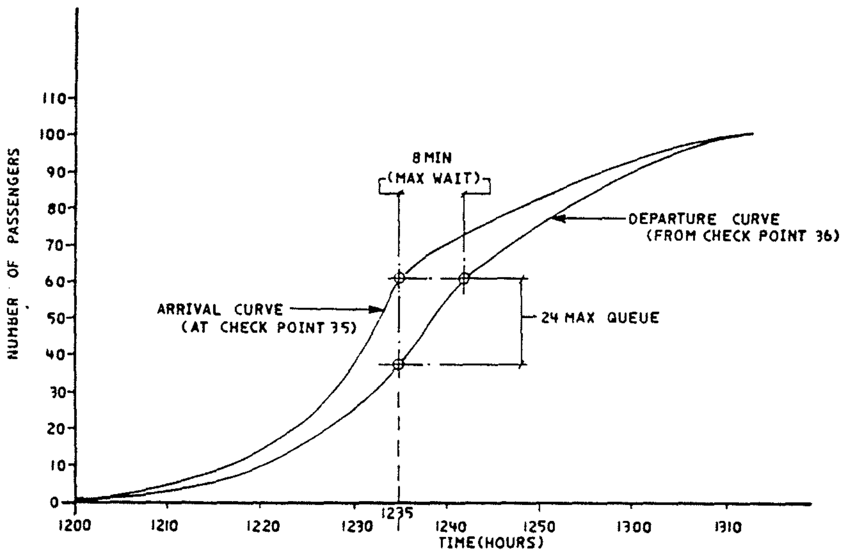


Figure 5

Pedestrian Desire Lines, Daily Two-Way Trips, August 2, 1975 First Floor and Baseline

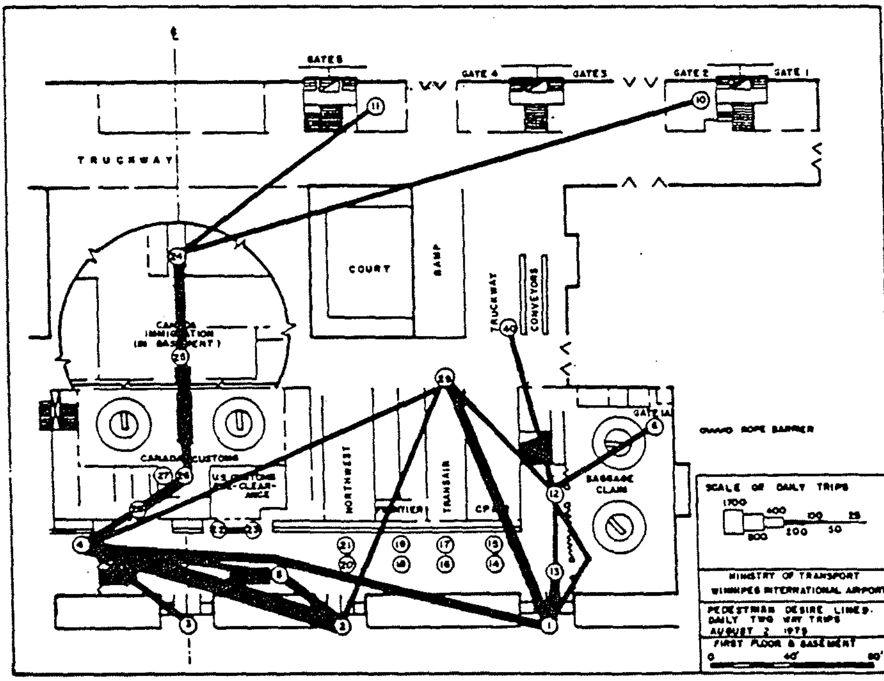


Figure 6

Pedestrian Desire Lines, Daily Two-Way Trips, August 2, 1975, Second Floor