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Publication of this paper sponsored by the Ad Hoc Committee on Economics of Air Transport.

Response to Terminal Access Problems at American and United Airlines—John F. Kennedy International Airport

FRANK LaMAGNA AND EDWARD M. WHITLOCK

Air travel at Kennedy International Airport has increased so much that ground transportation systems have become taxed beyond practical capacities. American and United Airlines, in conjunction with the Port Authority of New York and New Jersey, decided to act expeditiously to reconcile bottlenecks in front of the two respective terminals. Surveys were conducted of all traffic on the ground, including pedestrians and vehicles. Findings concluded that (a) curb frontage was insufficient; (b) much of the congestion resulted from the close proximity of the American Airlines exit roadways and United Airlines entrance roadways; (c) substantial through traffic on the same roadways was interacting negatively with the traffic destined for the American and United Airlines terminals; and (d) parking regulations were not being enforced sufficiently. Major change was suggested on the road system and new roads were constructed, which required taking a portion of the parking lot in the central terminal area. Further, through traffic was assigned to a new road system and diverted to a new road on the back side of the parking lot. Crossover areas were eliminated between the two terminals and new, independent hold areas for taxis were developed. Finally, commercial vehicles were separated from private vehicles and new regulatory measures were inaugurated to achieve necessary order and dignity, and thereby eliminate chaos. Construction commenced immediately, and all aspects of the recommended plan were completed within nine months. At a cost of some 100 parking spaces, a new road system produced substantial amenity for all ground travelers. The owners are of the opinion that the benefits far outweigh the costs. This project is a successful example of how carefully designed surveys and total cooperation between owners and operators can result in a properly engineered and constructed project to provide necessary amenity and utility to major ground vehicle-pedestrian congestion.

Continued escalation of air passenger volumes has created burdens on the existing roadway and curb frontage facilities at many air terminals throughout the world. This was the case at the American and United Airlines terminals at John F. Kennedy International Airport.

The airport was designed and opened in the 1950s to accommodate approximately 16 million passengers annually. Since then, the basic roadway system was modified to accommodate 21 million passengers in 1976 and 27 million passengers in 1980.

As passenger traffic continued to escalate, airport authorities undertook studies to revise the present road concept and devise a master plan that would eliminate much of the congestion and provide adequate capacity to handle future air passengers.

Because these plans were long term, American and United Airlines, with the cooperation of the Port Authority of New York and New Jersey, indicated their desire to develop plans that could alleviate some of their immediate problems, in view of the expected growth patterns.

PLANNING PHASE

To obtain a thorough knowledge of traffic activities, an extensive field study of all travelers was conducted at the American and United Airlines terminals. The date and time of survey were chosen by the carriers and consultant, Wilbur Smith and Associates, as representative of typical peak-period activity.

Figure 1 identifies the traffic survey stations and roadway configuration in existence at the time of the study. The existing roadway system was a one-way configuration that had free turns, merging lanes, and required minimum stops except at grade-level pedestrian crossings.

Special in-depth roadway surveys and passenger interviews were conducted to trace the vehicle paths in the vicinity of the two terminals. The studies provided passenger characteristics that were useful in developing future plans, including the following:

1. Mode of arrival and departure;
2. Arrival distribution patterns of passengers;
3. Number of visitors versus passengers;
4. Parking duration patterns at long-term and short-term parking lots; and
5. Vehicle dwell and loading-unloading times at curb.

Some of the key survey results are shown below and were the basis for the development of future plans.

Item	Number	Minutes Prior to Scheduled Departure	Percentage of Persons Arriving	
			American	United
Peak-hour passengers, American and United Airlines terminals				
Enplanements	990	30-45	20	16
Deplanements	1020	45-60	16	23
Total	2010	60-90	14	26
Transfer passengers, enplanements (%)	18	90-120	12	9
Vehicles entering terminal area during peak hours	2085	>120	14	3
Vehicles using curb frontage roadways and exiting (%)	46			
Vehicles using curb frontage roadways and parking (%)	7			
Vehicles parking directly (%)	12			
Vehicles exiting area directly, through traffic (%)	35			
Visitors per passenger				
American Airlines terminal	0.9			
United Airlines terminal	0.6			
Pedestrians crossing airport roadway during peak hours, both directions				
American Airlines terminal	500			
United Airlines terminal	435			

During the peak hour, a total of 2085 vehicles entered the American and United Airlines terminal areas. Of these, 730 vehicles were oriented to other terminals at the airport. The arrival patterns of passengers prior to scheduled departure are shown in the table below.

Minutes Prior to Scheduled Departure	Percentage of Persons Arriving	
	American	United
0-15	6	9
15-30	18	14

Vehicle dwell times are given in Table 1.

The study resulted in two types of improvements:

1. An immediate action plan to be implemented within three months and
2. A short-term improvement plan to be implemented within one year.

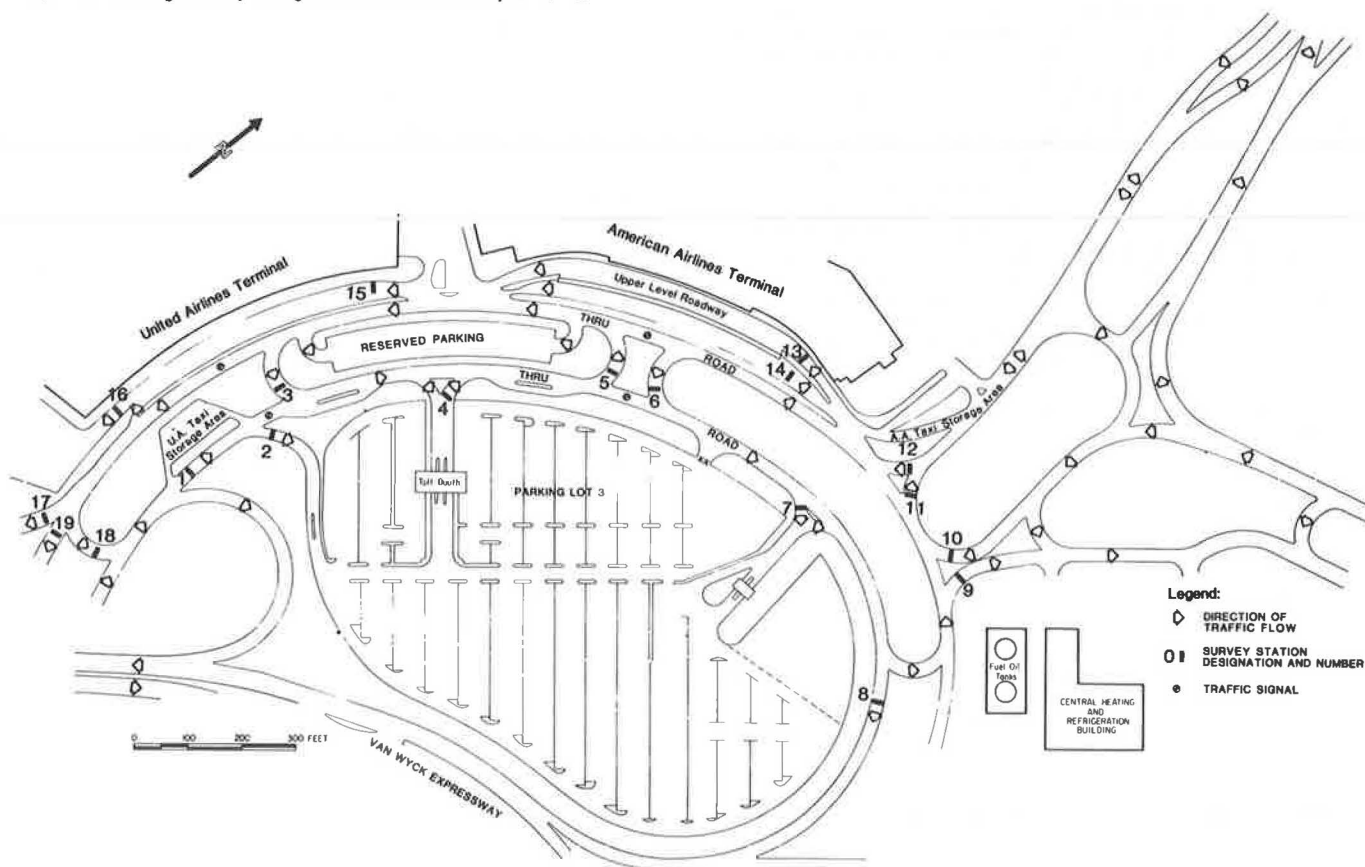
Immediate Action Plan

Because many of the passengers on the airport roadway are infrequent travelers, some confusion on the roads and a misorientation of vehicles add to the congestion problems. Figure 2 presents the immediate action plan for the two terminals. The plan was developed to provide low-cost traffic engineering improvements that would ease congestion and improve traffic flow.

The immediate action plan to be implemented within three months recommended the following improvements:

1. Provide a more informative and easily understood signing program to reduce the amount of through traffic,
2. Increase roadway lighting intensity on various roadway segments (the low intensity in lighting

Figure 1. Existing roadway configuration and traffic survey locations.



limited visibility and caused drivers to reduce speed),

3. Close certain turn-around roadway portions opposite American Airlines and United Airlines terminals (during peak hours, congestion resulted from vehicles that crossed the outer through roadway and backed up onto the inner-loop roadway),

4. Monitor and enforce vehicle activities at the curb,

5. Modify taxi queue lines and operations, and

6. Use baggage carousel locations and curbside check-in areas to provide a more even distribution of curb use.

The studies and analyses identified and quantified three basic problem areas:

1. Considerable congestion results from the close proximity of the American exit roadway and the

United entrance roadway, which compounded the back-ups and delays;

2. Significant amounts of through traffic oriented to other terminal buildings at the airport use roadways that serve American and United Airlines; and

3. Insufficient curb frontage area exists to accommodate increases in vehicle activity.

The photographs in Figure 3 identify these areas.

The most predominant congestion occurred at the crossover point between the exit of American Airlines enplaning (departures) and deplaning (arrivals) roadways and the entrance to the United Airlines terminal curb frontage. The design capacity for this roadway crossover section at level of service C is estimated at 800 vehicles/h. During the peak hour of survey, more than 1200 vehicles used this roadway section.

Field surveys also indicated that many of the private automobile drivers on the airport roadways were using the roadway system for the first time. As a result, some vehicles seemed to wander through the road system in an effort to reach their destination or to exit the airport. Studies indicated that about 35 percent of the total vehicles were through vehicles that did not stop at either terminal or use parking lot 3.

Other areas of congestion were noted along the curb frontage areas of the two terminals. Many vehicles parked for extensive time periods, which limited the availability of curb frontage, in addition to a general lack of curb frontage capacity to accommodate the traffic flow. Future projections of air passengers provided by the carriers were used to

Table 1. Curb frontage vehicle dwell times.

Vehicle	American Terminal (min)		United Terminal (min)	
	Enplaning	Deplaning	Enplaning	Deplaning
Automobile	2.4	2.6	2.2	2.9
Taxi ^a	1.4	1.3	1.3	1.4
Bus	1.9	1.0	1.5	1.5
Limousine	2.3	2.6	3.0	4.0
Courtesy van	1.5	1.3	1.5	1.5

^a During a six-hour period, 620 taxis were required at the American Airlines terminal and 800 taxis were required at the United Airlines terminal.

Figure 2. Immediate action plan—1977.

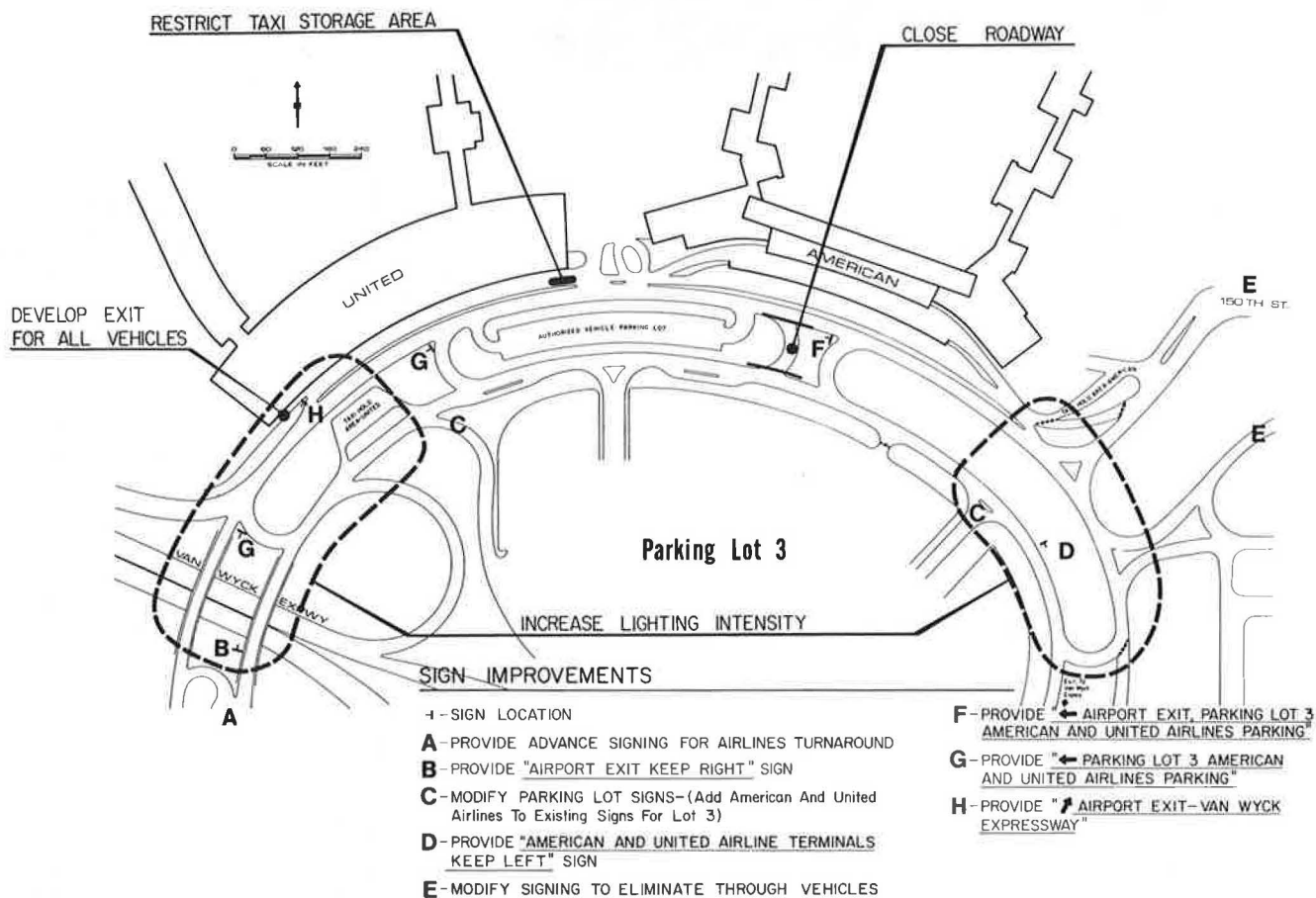


Figure 3. Existing areas of congestion.



AMERICAN-UNITED
AIRLINES
CURB FRONTAGE
CROSSOVER AREA



CURB FRONTAGE
ROADWAY (LOWER LEVEL)
AMERICAN AIRLINES



Table 2. Summary of future American and United Airlines terminals peak-hour vehicle trips for an average day during a peak month.

Mode	American Airlines Terminal		United Airlines Terminal		Combined Terminals	
	Enplaning	Deplaning	Enplaning	Deplaning	Enplaning	Deplaning
Automobile, park directly	75	50	80	25	155	75
Automobile use of curb frontage	210	195	240	75	450	270
Taxi	240	200	280	75	520	275
Limousine	25	25	15	10	40	35
Public bus ^a	20	20	20	20	20	20
Car rental bus ^a	15	10	15	10	15	10
Total	585	500	650	215	1200	685
Visitor automobiles, park directly	30	30	25	10	55	40
Total	615	530	675	225	1255	725

^aAssumes dual use of vehicle at terminals.

determine long-range needs at the terminals. Estimated air passenger forecasts predicted a 70 percent increase in peak-period (5:00-7:00 p.m.) activity.

Table 2 presents the results of the analysis of future peak-hour traffic activity for the two terminals. As noted, about 2000 vehicles are expected to be in the areas during the peak hour of an average day in a peak month. More than 80 percent of these vehicles are expected to use the curb frontage, resulting in a total need for about 1900 linear ft of curb at the American Airlines terminal and 1400 ft at the United Airlines terminal, as shown in the table below.

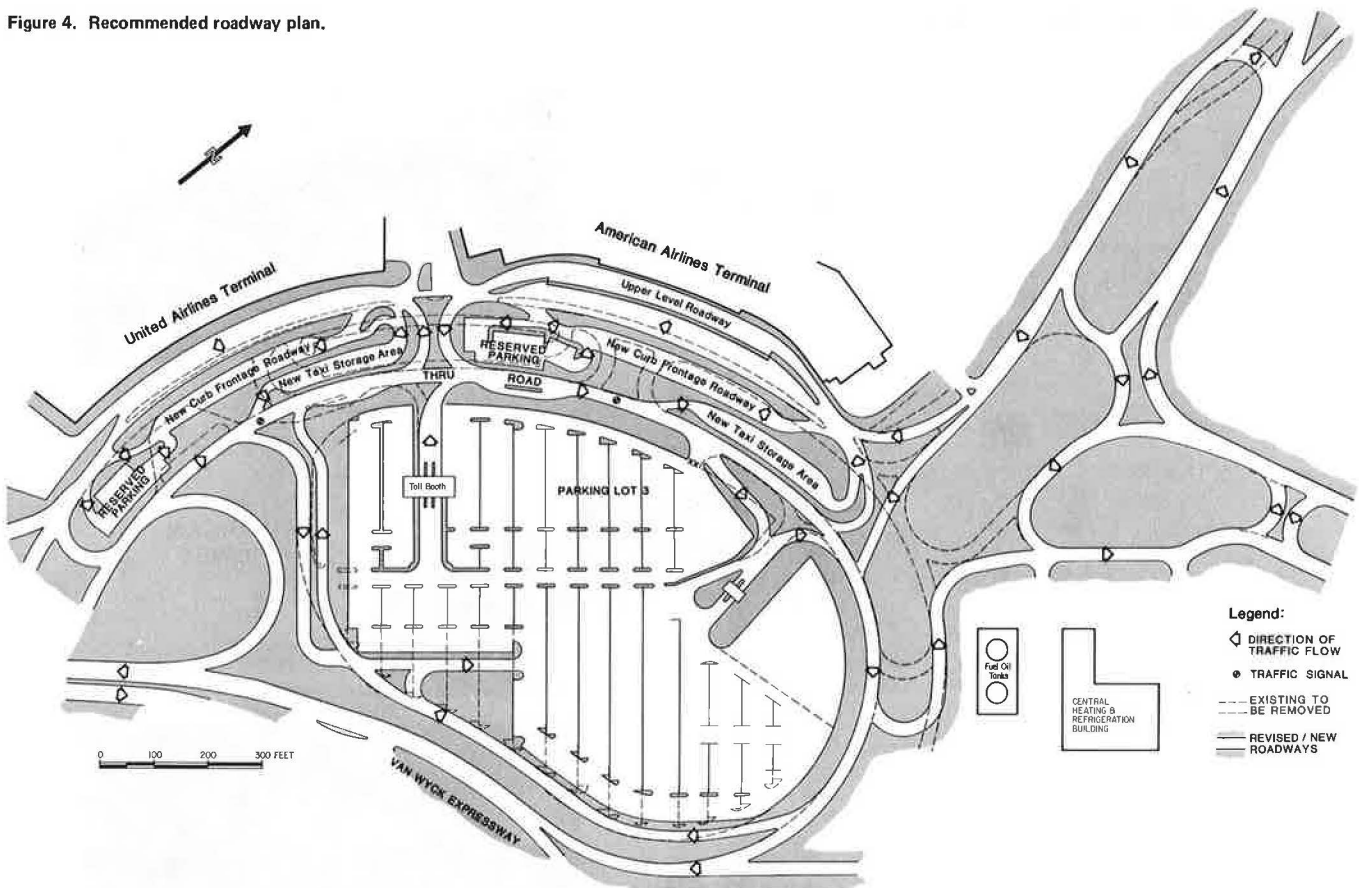
Terminal	Curb Frontage Requirement (ft)	
	Enplaning	Deplaning
American Airlines	675	1250
United Airlines	650	700
Combined	1325	1950

The analysis made evident that roadway revisions must be made in order to accommodate future traffic.

Short-Term Improvement Plan

At this point in time, the airlines were experiencing an overwhelming increase in passenger traffic.

Figure 4. Recommended roadway plan.



As a result, short-term roadway improvement plans that could be implemented readily were developed in conjunction with the air carriers and the Port Authority. These included the addition of approximately 450 ft of additional curb frontage to each of the terminals, elimination of the conflicts of the entrance-exit weave at the terminal buildings, and authorization to design and supervise construction of the project.

Along with developing a plan to facilitate the immediate needs of the two carriers, the plan had to be responsive to long-range needs to further expand the existing roadway system at Kennedy International Airport in response to the increased traffic demand throughout the entire airport complex. The airlines and Port Authority helped in formulating a plan, shown in Figure 4, that includes the following features:

1. Widening of existing lower level curb frontage roadways to 44 ft,
2. Provision of a second lower level curb frontage roadway that has a 44-ft width at the United Airlines terminal and 55-ft roadway width at the American Airlines terminal,
3. Possible segregation of traffic on the curb frontage roadways,
4. Reduction of through vehicles from the roadway system,
5. Elimination of the existing traffic congestion-crossover area between the two terminals,
6. Provision of adequate independent taxi storage areas,
7. Maintenance of the existing pedestrian walking distance to and from the parking lots and provision for safe crossings,
8. Provision of a reserved parking lot at each terminal building, and
9. Provision of a pedestrian canopy and lighting over the new curb frontage island.

CONSTRUCTION PHASE

The project included the relocation of a bus maintenance yard; new roadway signing, lighting, and drainage; and a pedestrian canopy.

Key to the design was the construction staging necessary to complete the project with minimum disruption to the daily operations of both terminals. A complex construction staging plan was developed to facilitate most of the pedestrian-vehicular access throughout the area. Construction on the roadway portion of the project began in June 1978 in an effort to complete the roadway portion of the project within the 1978 construction season. The initial stage of construction required completion of all new entrance and exit roadways from the respective terminals, as well as all the external roadway segments.

Two months later, all necessary elements were in place in order to discontinue the through roadway, most closely adjacent to the terminals, from the airport roadway system in the vicinity of the American and United Airlines terminals. Barricades were strategically placed in a previously planned sequence of events to ensure the safe operation and ability of vehicles to continue to their destination without undue delays.

As parts of the elimination of the outer through roadway, close coordination was necessary with the Port Authority of New York and New Jersey and the roadway contractor. Newly installed signs had to be in place and uncovered and old signs bagged so that

Figure 5. New roadways and canopy at American and United Airlines terminals.

NEW
UNITED AIRLINES



AMERICAN
AIRLINES

TYPICAL
WIND SCREEN



motorists would be properly directed to their destinations during this sequencing of construction.

The entire conversion of the roadway system took approximately 6 h and used extensive manpower and more than 2500 linear ft of vehicle barricades. The only problem that arose during the rerouting of traffic was in communicating effectively with the vehicle drivers most familiar with the old airport road network (taxis and buses)--they neglected to observe and follow instructions of the new signs.

Construction continued and focused on the exclusive areas of the terminals; that is, the new curb frontage roadways, pedestrian islands, and very important persons (VIP) parking lots. Because of the significant amount of traffic oriented to the terminals, extensive maintenance and protection of traffic practices were employed to permit the terminals to continue their operations. The major underlying factor within this construction project was not to restrict or shut down terminal or roadway operations. The project continued for approximately two more months, at which time the project was essentially complete, except for minor items.

The most important features of the revised roadway plan enabled American Airlines to segregate private and public vehicles on the deplaning roadway and, at the United Airlines terminal, enplaning and deplaning traffic could be segregated. Only one

curb frontage area previously served the United Airlines terminal. In addition, the plan also provided a VIP parking lot that has a capacity of about 35 spaces at each terminal. Access to these lots is controlled by card actuations and radio control.

The second phase of the project involved the design and construction of pedestrian canopies on the newly installed canopy islands. As the plan always contained this aspect of the design, all necessary footings, anchor bolts, conduit, and drainage for the canopy were contained in the canopy islands under removable sidewalk panels as part of the roadway project. Thus, the installation of the canopy could also be undertaken with minimum interruption to the newly installed roadway operations. The canopy project was awarded in November 1978 and was essentially complete by Easter 1979. Figure 5 shows the newly completed roadways and canopy.

The total construction period took about one year because construction was done on weekends and after normal working hours.

PLAN BENEFITS

Completion of the roadway modifications offered many benefits to both the airlines and air passengers. Although the actual benefits of the project are difficult to measure, a comparison of activity level

Table 3. Comparison of activity at American and United Airlines Terminals.

Item	November 19, 1976		November 21, 1980		Change (%)	
	American	United	American	United	American	United
Traffic volumes, 4:00-5:00 p.m. (vehicles)						
Frontage roads	705	480	875	575	+24	+20
D-road opposite terminal	790	840	1250	950	+58	+13
Traffic volumes, 4:00-7:00 p.m. (vehicles)						
Frontage roads	1620	1185	1850	1525	+14	+29
Inner through road opposite terminal	2300	2075	3100	2300	+35	+11
Passenger volumes—departures, 4:00-7:00 p.m.	1280	1265	1350 ^a	1410 ^a	+6	+12
Vehicle dwell times, private automobile (min)						
Arrival	2.4	2.2	2.3	2.0		
Departure	2.6	3.1	2.6	2.5		

^aEstimated number of passenger departures includes transfer passengers and an estimate of all other passengers served at the terminal.

was undertaken on Friday, November 21, 1980, four years after the original survey. Table 3 presents a summary of comparative activity at the American and United Airlines terminals at Kennedy International Airport. In summary, the table indicates that a greater amount of vehicular and air passenger traffic is accommodated at the two respective terminals. During the peak hour, a 20 percent increase in vehicles that use the curb frontage roadways was observed as compared with 1976 conditions. Of importance, however, is that the roadways that serve the two terminals operated in the absence of delays and provided improved levels of service to the airline passengers. The increased capacity has also enabled the airlines to manage their respective curb frontage roadways better, as indicated in the reduced vehicle dwell times observed. Overall, the plan has been well received by both air carriers, airport officials, and air passengers. Like many planned improvements, however, there are both disadvantages as well as benefits when the planned improvements to the overall airport are weighed. Implementation of this plan has had the following adverse effects at Kennedy International Airport:

1. Travel times between some terminals have increased due to the discontinuation of the through roads;
2. As a result of increased traffic on the inner through road the Port Authority has widened the inner through road in front of the American Airlines terminal, modified the parking lot access-egress operations, and made other minor roadway improvements at other terminals and revised signing; and
3. A slight reduction in short-term parking use

in the central terminal area (parking lot 3) has been noted.

Some of the more noticeable benefits at the terminal roadways that serve the American and United Airlines terminals include the following:

1. Improved vehicle ingress and egress,
2. Substantial increase of curb frontage area,
3. Elimination of the majority of non-American or United Airlines terminal traffic,
4. Better traffic management capabilities,
5. Segregation of private and commercial vehicles at the American Airlines terminal,
6. Separation of arrivals and departures at the United Airlines terminal,
7. Individual taxi queue areas that have direct terminal access to reduce the problem of illegal taxis,
8. Reduced passenger complaints about terminal traffic,
9. Increased area lighting for driver comfort, and
10. Individual terminal VIP parking areas.

Prior to construction of the new roadways and curb frontage areas, during peak periods of activity, terminal traffic congestion caused significant delays. The completion of the project reduced this problem substantially and provided order in traffic operations at the two terminals.

Publication of this paper sponsored by Committee on Airport Landside Operations.

Automating the Delivery of Ground Transportation Information

MARK GORSTEIN AND RICHARD TILLES

This paper introduces the concept of an automated ground transportation information system (AGTIS) for use at major intermodal transportation terminals. The AGTIS uses a touch-sensitive cathode-ray-tube terminal to facilitate input to a computer-based information-retrieval system. The patron uses the touch-screen terminal to indicate an ultimate destination and then receives visual information on the travel time, cost, and availability of transportation services to that destination. After selecting the most appropriate service, the patron then receives detailed printed instructions for its use. A prototype

system has been set up at the Transportation Systems Center. Full working demonstration projects are expected to be installed at Boston's Logan Airport and Washington D.C.'s National and Dulles Airports. These systems will be closely monitored to assess their efficiency in delivering transportation information and to evaluate their impact on the mode choice of air passengers.

The traveler who arrives by plane, train, or bus at a major transportation terminal is often faced with