

Analysis of New Orleans Airport Ground Transportation System

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The airport ground access problem is a familiar term to many large airport managers. A portion of an airport ground transportation analysis conducted as part of an overall travel and tourism study for the New Orleans, Louisiana, area is discussed in this report. The objectives of this analysis were to (a) analyze present ground transportation alternatives, (b) recommend curbside priority arrangements, (c) recommend a ground transportation financing plan, and (d) anticipate major future problems that could exist when serving large volumes of tourists and visitors to the area. Research methods used were primarily qualitative in nature, based on existing local consultant reports and available general literature on various aspects of the ground transportation problem. This report should be of general significance and interest to other airport managers and planners due to the methodological approach taken. That is, instead of viewing the airport access problem as one of facility design per se, it was viewed as one of facility management. Emphasis was placed on maximum use of high-occupancy vehicles and a fair and equitable financing plan for all vehicles that use the airport ground access system. The report recommends that all elements of the ground access system—buses, vans, taxis, private automobiles, rental cars, etc.—be included in such an analysis and financing plan to improve the airport ground transportation system. This generalized management and financial approach could be of assistance to other airports faced with an access problem.

Airport ground transportation has typically been overlooked in the physical design and construction of many U.S. airports, only to become a major source of community embarrassment as congestion and curbside confusion result. Visiting businesspeople and vacationers often label a city as a nice place to visit but impossible to get to from the airport, or they may remember their visit primarily for the expensive cab trip taken from the airport. It is in the community's best interest to clearly think through the type of image it wants to portray to visitors. Because the airport ground transportation trip will be the visitors' first impression of their city, major urban areas should seek to give the impression of a clean, well-managed, efficient, low-cost, high-value place to visit through their ground transportation system.

Airport authorities or boards also have a vested interest in the quality of their ground transport providers. The "image" of the airport is also very often the result of the travelers' experience at curbside. Moreover, passengers carried by authorized ground transportation providers represent substantial revenue to the authority. When friends or relatives meet or discharge passengers, they typically use airport roadway and curbside space without paying for the privilege. Such traffic adds greatly to the curbside access problem and costs more through the need for increased capacity while paying none of the incremental costs. Coordinated airport ground transportation providers, on the other hand, significantly reduce the airport vehicular traffic volume and pay handsome revenue to the airport for the privilege.

Many major U.S. airports have experienced serious ground site congestion problems. Typically, this access problem is thought to be caused by inadequate parking or roadway capacity. Stated another way, the problem is perceived to be one of facility capacity. Unfortunately, the typical solution is to build additional parking capacity and add curbside lanes to support additional traffic. The additional capacity is quickly filled by new traffic demands and even-more-monumental traffic jams, tie-ups, and delays result. One needs only to visit the Los

Angeles International Airport or Miami Airport to see the results of such expansion. In reality, it is not the number of vehicles the airport curbside facility can process, but the number of people it can handle with the given facility. Interpreted this way, the problem can be reformulated into one of facility management as opposed to facility capacity. Such thinking encourages more efficient and effective airport facilities.

STUDY OBJECTIVES

This report discusses a segment of a larger travel and tourism study performed for the New Orleans, Louisiana, area. It sought to address present and potential problems the area may have with respect to its airport ground transportation alternatives and the area's general ability to accommodate larger amounts of tourist traffic. Specific attention was given to the opportunity to provide self-supporting, low-cost, efficient, and effective high-occupancy-vehicle transportation from the New Orleans International Airport to points in and about New Orleans. The objectives of the study were to

1. Analyze the present airport ground transportation alternatives at the New Orleans International Airport and their appropriateness for businesspersons, tourists, and conventioners;
2. Recommend curbside priority parking arrangements that emphasize continued preference for high-occupancy vehicles;
3. Recommend a ground transportation financing plan that offers a fair and equitable rate to be paid by airport ground transportation providers; and
4. Analyze the potential future problems connected with serving larger volumes of tourists and visitors to the New Orleans International Airport expected when new hotel and convention facilities are completed in the New Orleans area.

As will be shown, these objectives were combined into a general strategic plan for improved airport ground transportation at the New Orleans International Airport. The recommendations call for a reassessment of current plans to build a high-rise parking garage and a continued commitment to encourage low-cost, high-occupancy-vehicle curbside priority.

CURRENT CONGESTION PROBLEMS

Current traffic problems at the New Orleans International Airport stem from one of the poorest airport roadway access systems ever encountered. Two cardinal rules of airport roadway planning are to avoid at-grade traffic crossovers whenever possible and to decrease the curbside total traffic as much as possible. The present roadway pattern deliberately created an at-grade traffic crossover entering the airport access and routing all traffic in front of the terminal before going on to other destinations, i.e., car rentals, courtesy cars, employees, etc.

PARKING

Parking at the New Orleans International Airport was

Figure 1. Parking spaces provided in relation to enplaning passengers.

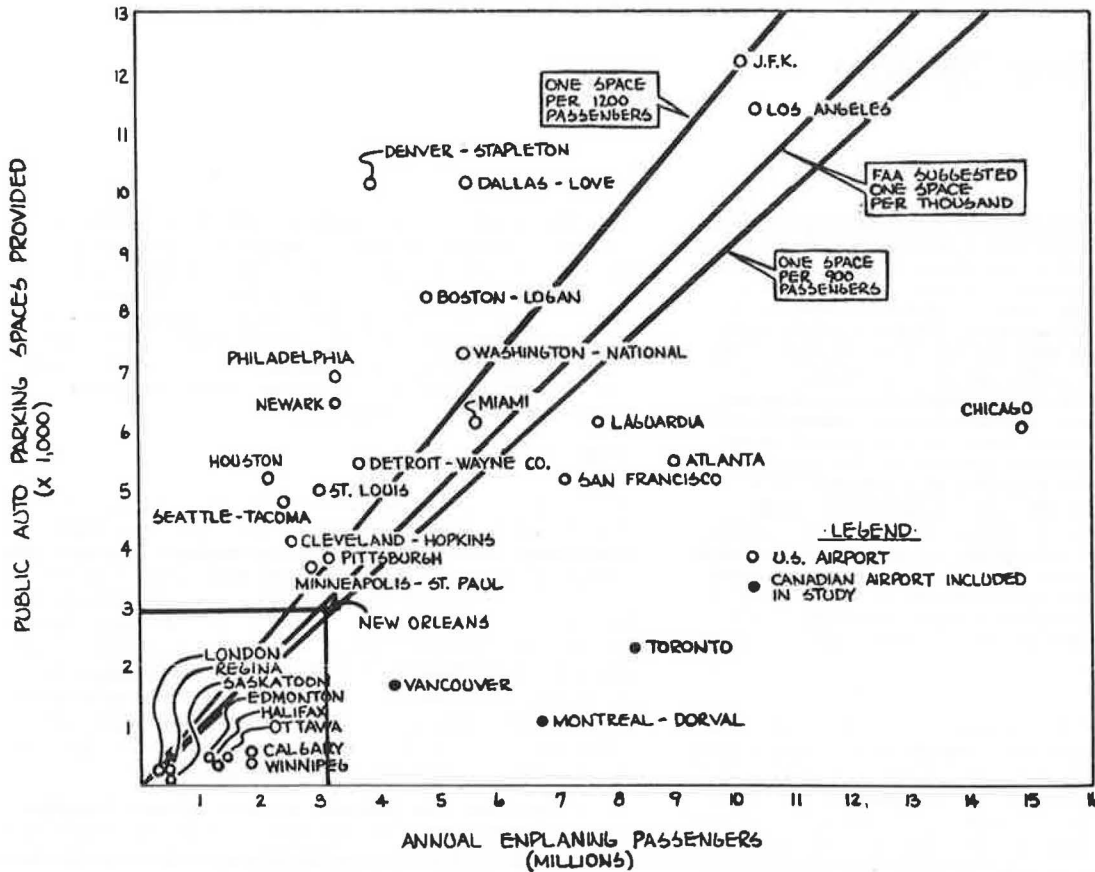


Table 1. New Orleans International Airport parking facility revenues.

Item	Revenues (\$)	
	Long Term ^a	Short Term ^b
Date		
January 1980	152 988.15	111 831.62
February 1980	135 408.60	112 707.58
March 1980	146 174.52	113 023.05
April 1980	143 148.50	111 205.20
May 1980	154 098.90	121 825.11
June 1980	164 321.93	127 961.61
July 1980	158 542.99	133 162.68
August 1980	159 173.50	142 732.05
September 1980	151 428.23	111 654.60
October 1980	168 227.18	120 752.10
November 1980	150 418.87	115 084.26
December 1980	153 022.05	121 428.85
Total	1 836 953.42	1 443 268.71
92.12 percent paid to New Orleans Aviation Board	1 692 201.49	1 329 631.26
Avg revenue per space	58.20	232.29
Avg revenue per vehicle	10.32	1.42

^aNo. of spaces = 2423; total no. of vehicles in lot (May 1979-May 1980) = 163 916.

^bNo. of spaces = 477; total no. of vehicles in lot (May 1979-May 1980) = 935 114.

perceived to be a major problem, and an additional 1539 parking spaces were recommended as necessary by the year 2000. An earlier study by Lambert and Associates (1) depicted parking demand to be saturated; however, in comparison with other major airports of similar size, New Orleans appeared to have adequate parking spaces available (Figure 1). As shown, New Orleans had 2900 parking spaces available for 3.2 million total enplaning passengers. This is

well within the Federal Aviation Administration's recommended range (2).

Further analysis indicated the revenue received from long-term versus short-term spaces to be significantly different (Table 1). Short-term parking spaces generated \$232 per month per space while long-term spaces generated only \$58 per space per month. Given the normal costs associated with building parking structures (Table 2), it was not cost-effective to construct additional long-term parking spaces if parkers were drawn from the short-term lots.

On the other hand, additional short-term spaces, properly constructed, could represent handsome returns to the airport authority. Such additional spaces could be easily obtained by using existing spaces now dedicated to the taxi holding area and/or those currently being used by rental car companies.

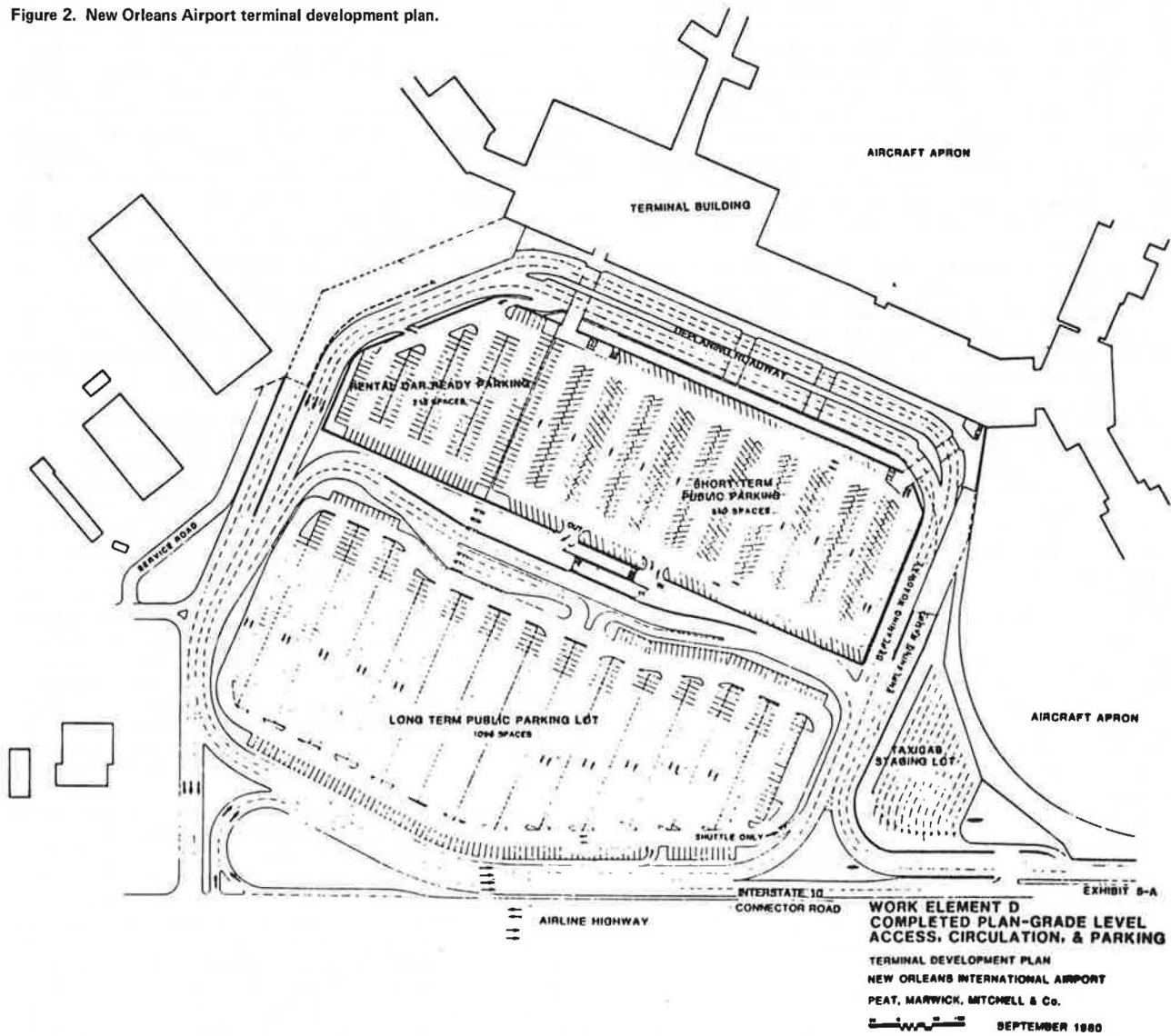
The taxicab holding area could easily be moved to the southeast side of the airport just off the main approach highway from New Orleans' Highway I-10 Connector (Figure 2). An equal or greater number of spaces for taxicab parking could be created with the same priority system granting two or three taxicabs at the designated airport curb. A simple green-light device would be used to signal cabs in the waiting area when additional cabs are needed. Most major airports have moved their cab holding area away from the terminal area in order to more effectively use these close-in spaces. While the taxicabs pay a fee to provide service at the airport, the fee (\$200/year) should not entail them to occupy a close-in parking space that has the potential of generating \$2784/year in revenue. Due to needed roadway space, not all 175 spaces used currently for the taxi holding area would be available for short-

Table 2. Surface parking costs.

Land (\$/ft ²)	Cost per Stall (\$)	Construction ^a (\$)	Annual Amortization ^b (\$)	Annual Taxes ^c (\$)	Annual Maintenance ^d (\$)	Annual (\$)	Monthly (\$)
1	330	330	66	19.80	19.80	105.60	8.80
2	660	330	99	29.70	19.80	148.50	12.38
5	1650	330	198	59.40	19.80	148.50	12.38
10	3300	330	363	108.90	19.80	491.70	40.98
15	4950	330	528	158.40	19.80	706.20	58.85
20	6600	330	693	207.90	19.80	920.70	76.73
30	9900	330	1023	306.90	19.80	1349.70	111.48

^a\$1/ft². ^b10 percent of land cost plus construction cost. ^c\$12/\$100 of assessed valuation at 25 percent of actual. ^d\$0.06/ft².

Figure 2. New Orleans Airport terminal development plan.



term parking. However, if only 100 spaces were available, this would represent a potential revenue of \$278 400/year in additional short-term parking fares.

Spaces currently occupied by rental car companies for close-in parking were also candidates for conversion to short-term parking. The new airport terminal traffic pattern (see Figure 2) recommended in a Peat, Marwick, and Mitchell report (1980) would encompass some of the area now used for rental car parking. Given the need to add parking availability without substantially adding to the cost, there is no reason why this valuable space should be used for

rental car agencies at an airport the size of New Orleans International. As airports have grown and become more crowded, logical response is to move some nonessential functions out of the airport terminal if possible. In a large number of cases, this has meant, at first, the close-in parking for rental car agencies and, in cases of extreme congestion, such as at Los Angeles Airport and others, even the rental car agency booths were moved out of the main terminal. Such a move has a double positive effect on ground transportation traffic in that (a) it frees up valuable close-in parking spaces for more revenue producing activity (short-term parking) and

(b) it eliminates return rental car traffic inside the terminal area.

New Orleans International Airport travelers rented automobiles between 9 and 15 percent of the time. Thus, a significant amount of present amount of terminal area traffic would be eliminated if their return lots were removed from the immediate terminal area.

Rental car agencies paid the New Orleans Aviation Board 10 percent of their gross for the right to do business in the airport terminal building and park their vehicles on airport property. Removal of these automobiles to the remote lots currently used for storage of rental cars and shuttling passengers to and from the terminal building would not add significantly to the costs and is an acceptable mode of operation at major airports. The anticipated reduction in airport fees paid by the rental car firms should not be expected to be more than the increased cost of providing the shuttle service similar to that provided for employee parking in these remote lots. The 200 close-in short-term parking spaces currently occupied by the rental car companies represented a potential \$556 800 in annual revenue with no additional costs once the new traffic plan had been implemented.

It was also suggested that the Aviation Board take a very pragmatic view toward long-term parking. Currently, it is generating \$66.15 per space per month, with a current fee of \$4/24 h. (It is suspected that rates may be held at this level to keep par with off-airport parking rates.) Given the average number of long-term parkers of 13 659/month, this represents an average of \$10.32/parked vehicle in 1980 and 1981 or an average stay of 2.75 days. Pressure for more and more long-term parking will be brought to the Aviation Board. However, a proper balance between long- and short-term availability must be maintained. Because the Aviation Board derives more than \$10/automobile in the long-term lot, as opposed to only \$1.42/automobile in the short-term lot, there is no reason to rush into more long-term space availability. Providing this space may actually decrease the \$232 average revenue currently derived from the short-term parking spaces. Clearly, the logical approach would be to expand short-term parking availability at present rates (i.e., maximizing revenue per space) and provide remote long-term parking with shuttle service that would draw present off-airport long-term parkers--not present short-term parkers.

A final note on airport parking suggested that the present long-term rate of \$4/day for close-in, long-term parking is low in comparison with other airports of comparable size. Immediate consideration should be given to a three-tiered rate with (a) shuttle long term at \$4/day, (b) adjacent long-term \$6-8/day, and (c) existing short-term rates.

AIRPORT GROUND TRANSPORTATION SYSTEMS

Airport ground transportation at the New Orleans International Airport is provided by a number of private and public transportation providers, including taxicabs, private limousine and bus companies, private hotels and off-terminal parking courtesy cars, limited public transit service from the New Orleans Public Transit Operators, and, of course, the private automobile. A breakdown of entering passenger vehicle mode use is shown in Table 3. As shown, 23 percent of the airport travelers were carried in either buses or limousines that represented only 2 percent of the traffic. Taxicabs transported another 23 percent but represented only 10 percent of the vehicular traffic. Finally, it should be noted that private automobiles, while

representing 87 percent of the vehicles on the roadway system, transported only 31 percent of the passengers for a ratio of 0.17 actual air passengers to every private automobile entering the terminal area. This is significantly below the national average for airports the size of New Orleans (Table 4). Ironically, the ratio of all air passengers to entering vehicles is exactly what it could be expected to be (0.48) or 2 vehicles entering for every one passenger. At the New Orleans International Airport, however, the average is being arrived at by a much higher than average number of arriving air passengers on bus, limousine, taxi, and shuttle vehicles, and a low number of actual air passengers arriving by private automobile. Clearly, there is an enormous amount of airport vehicular traffic that has no purpose in being routed through the terminal area. The recommended traffic plan should eliminate much of this unnecessary traffic and it should be understood that the New Orleans International Airport currently has an excellent ratio of public passenger vehicles use. Compared with airports larger than itself, New Orleans is much more effective in high-occupancy-vehicle use (Table 4). As shown, New Orleans International has 23 percent of arrivals in airport limousine or bus. This is matched only by Miami (25 percent), but nearly 42 percent of Miami arrivals come in private automobiles, while only 31 percent of New Orleans' arrivals come by private automobile--the difference being made by taxicab arrivals, 22 percent of Miami International versus 37 percent for New Orleans International.

Clearly, in any revamping and enlargement of the airport ground transportation access system, this historic good balance of airport passengers on public transportation vehicles should be maintained and encouraged. The present high use rate is the result of several factors--some planned such as frequent airport limousine and bus service and some not planned--buses cannot travel any other lane on the lower deplaning level other than the inside curb lane that dictates to them the premium curb space. In essence, the arriving passenger must consciously walk by the least expensive ground transportation modes (limousine and bus) before reaching taxicabs and private automobiles on lanes farther out. Thus, the curb prioritization currently provided for public high-occupancy vehicles is crucial in any recommendation for good future ground transportation systems.

At present, the authorized ground transportation provider--Orleans Transportation Service, Inc.--pays the highest percentage of any mode, 23.6 percent of revenue for the use of the highest priority curb lane, i.e., the one closest to the terminal. This represents the total amount of revenue of \$300 000 annually to the airport (Table 5). Taxicabs are given second level and lane priority and represent a potential revenue of nearly \$500 000/year at \$200/cab with nearly 2500 permits authorized. (Only \$110 000 has been collected, however.) It should be pointed out that total revenues (if collected) may be misleading. As a dollar amount per passenger, the authorized limousine and bus provider pays \$1.18/passenger carried (23.6 percent of the \$5 fare) to the airport, but taxicabs, handling 37 percent of the passengers or 1 184 000 passengers, pay only \$500 000 (if collected) or 42 cents/passenger on a \$14 fare to downtown, or 3 percent of the revenue.

Charter vans and limousines, not authorized for general pickup at the airport by agreement with airport authority, are assigned a level three lane priority and charged \$400/year per charter van or limousine and \$1/trip. Parking lot courtesy vehicles

Table 3. 1979 passenger distribution by mode of vehicle entrance per day.

Mode	No. of Vehicles	No. of Air Passengers	Percentage of Air Passengers	Air Passenger to Vehicle Ratio
Passenger car	11 550	1 972	31	0.17
Taxicab	1 340	2 385	37	1.78
Limousine and buses	200	1 500	23	7.50
Off-airport parking shuttles	215	590	9	2.74
Total	13 305	6 447		0.48

Table 4. Average observed modal choice patterns at Miami, Denver, LaGuardia, and New Orleans Airports.

Mode of Arrival	Airport (%)				
	Miami	Denver	LaGuardia	John F. Kennedy/ American Airlines	New Orleans
Private automobile	42	56	25	46	31
Car rental bus	11	14	9	3	
Taxi	22	13	46	35	37
Airport limousine	10	5	13	7	23
Bus	15	3	5	9	
Other		9	2		9

Note: Data exclude transfer passengers, based on 6-h surveys conducted by Wilbur Smith and Associates at Miami; March 17 and 18, 1978; Denver, April 20 and 21, 1978; LaGuardia, May 24 and 25, 1978; and John F. Kennedy/American Airlines, January 27, 1978; and data for New Orleans taken from Surface Transportation and Parking Study, Lambert and Associates, 1979.

Table 5. New Orleans Airport vehicle traffic fees.

Mode of Traffic	Revenue (%)	Rate per Vehicle	Lane Assignment Priority	Total per Year (\$)
Charter limousine/bus	23.6		1	300 000
Other charter limousines and vans		1/trip	1	400 ^a
Other charter buses		2/trip	1	600 ^a
Taxis	3.0		2	500 000
Hotel courtesy cars/limousines			3	400 ^a
Off-airport parking shuttles			3	400 ^a
Airport rental courtesy vehicles			3	400 ^a

^aPer vehicle.

are charged \$400/year plus \$10 for each parking space available at the parking lot operator's location. Thus, an off-airport parking facility with 100 spaces might pay the Aviation Board \$1000/year for the 100 spaces and another \$800 for two shuttle vehicles. Referring to the earlier discussion on long-term parking revenues, these 100 spaces for long-term parking have a yearly potential of \$69 600 (\$58/space per month times 12 months). If the off-airport parking facility operates at similar occupancy levels as does on-airport long-term parking, then the operator would be paying only 2.6 percent (1800 ÷ 69 600) of revenue for the right to provide the service.

Hotel and motel courtesy vehicles are also charged \$400/vehicle used per year plus \$2.50/year per room in each hotel or motel. Assuming a 100-room motel with a single courtesy vehicle, it would pay \$400 plus \$250 or \$650 for using the outermost lane. If one-half of the motel's average room occupancy (typically, 70 percent) are airport passengers, this 35 percent of 100 rooms time 350 days would mean 12 600 motel guests generated by airport

travelers. In other words, the motel would pay 5 cents/passenger to the airport for the right to pick up passengers on the outermost lane.

Private automobiles including rental cars pay no per-vehicle fee to use the outer lane priority unless they park their vehicles in short-term parking. In summary, the present airport ground transportation providers paid a wide range of fees to pick up arriving passengers from zero to \$1.18/individual.

It should be pointed out that the majority of the analysis concentrated on deplaning or arriving passengers to the airport. This is so for several reasons. Initially, this is where the major airport congestion problems have occurred. Many vehicles vie for the limited curb space to await arriving passengers on the lower deck near the baggage claim areas. Enplaning passengers and traffic generally have no such problem. Even without lane prioritization there are seldom any traffic problems. All arriving vehicles are permitted to drop off at priority curb side lanes on a first-come, first-served basis. Because people are normally just being dropped off and no parking is permitted, there is seldom a congestion problem. As the curb length is expanded, as was currently being recommended in New Orleans and other major airports, there should be no future congestion in the enplaning level. It should further be mentioned, however, that this condition is highly dependent on policy enforcement of the no parking or standing rules at curbside. These must be maintained or a congestion problem will definitely ensue. Also, as with many two-level airport structures, policing arriving vehicles, taxis, limousines, vans, etc., that drop off passengers for the proper permit and use of a prioritized lane would be expensive and hardly worth the benefit.

Finally, there is the general public's feeling (right or wrong) that anyone should be permitted to drop off passengers without having to pay a fee. This popular view was apparently upheld in a local court action, Toye Brothers v. the City of New Orleans, where the plaintiff argued there should be no fee for discharging passengers at the public airport. The case is being challenged by the Aviation Board and its outcome is not yet known. Therefore, the analysis, with its emphasis on deplaning curb space prioritization, suggested to the Aviation Board that it retire from the concept that all for-hire vehicles entering the terminal area pay a fee to do so and, instead, charge for the right to stop and pick up passengers at one of their curb lanes, thereby eliminating the issue of the right to discharge passengers. In effect, the Aviation Board would be saying that anyone may drop off at the airport, but only those willing to pay a fair and equitable fee for the privilege will be able to stop and pick up passengers. Others may stop (including private automobiles) when they wish to pay the minimum short-term parking fee.

CURB PRIORITIZATION

It was recommended that curbside prioritization at the newly designed facility be developed to maintain or improve the present balance of passengers using public transportation modes. Special emphasis needed to be placed on the encouragement of high-occupancy-vehicle bus and limousine service at the airport. As previously shown, this mode represented the highest return per passenger for the Aviation Board (\$1.18 versus 42 cents for the next highest return--taxi), while being the least-cost mode to the arriving passengers. The high-occupancy-vehicle capacity was definitely needed as New Orleans was adding significant hotel and convention capacity and

planning to host the 1984 World's Fair. Also, it was noted that the high level of limousine and bus transportation being recommended in no way would deter from the parking revenue potential at the airport. In reality, there are two separate markets--parking primarily aimed at local residents going to the airport and bus and limousine transportation aimed at arriving visitors, businesspersons, and tourists. The objective is to maximize the potential revenue for the airport on a fair and equitable basis for the traveling airline public. Toward this end, a lane and fee prioritization recommendation was made for the New Orleans International Airport Aviation Board.

RECOMMENDED PLAN

The newly designed deplaning roadway system consisted of six lanes of traffic for both enplaning and deplaning passengers. (As previously noted, deplaning passengers, by far, need careful planning for their ground transportation. Therefore, a much more refined analysis of enplaning passengers needs was undertaken.) The six enplaning lanes were to be separated by a single divider creating an inner roadway of three lanes and an outer roadway of three lanes. At present, there are approximately 720 ft of curbside; however, expansion to more than 1000 ft was planned. For purposes of this study, it was assumed that usable curb space, i.e., that which one could effectively use without constructing new entrances to the terminal building, would be approximately 800 ft. It should be noted that, at present, only one-half of the existing inner curb space was effectively used. Due to the curvature of the terminal roadway, much of the ends of the valuable curb were used for official parking. Considering just the potential revenue from short-term parking and not the use value of this expensive curbside frontage, some individuals were receiving a very expensive parking fringe benefit. The new roadway design would eliminate most of this dead space and make it available for high-occupancy-vehicle curbside use.

It was recommended that lane prioritization not differ greatly from the present pattern. After all, present curbside prioritization had made the New Orleans International Airport one of the nation's most efficient in the use of high-occupancy-vehicle public transportation. Therefore, it was recommended that future lane prioritization continue to result in the authorized bus and limousine airport ground transportation providers possessing the premium inner lane closest to the terminal building. Widening of the curb width on this area would remove any present problems of pedestrian or baggage handling congestion.

Given the current revenue per rider of \$1.18 or 23.6 percent of revenue, it was important also that the authorized carriers be permitted to allow these vehicles to remain at the priority curb until departure time.

There were two authorized carriers--Orleans Transportation, Inc., and Mississippi Gulf Coast. Orleans Transportation was by far the larger of the two carriers, offering high-frequency service to the French Quarter and all downtown hotels. Due to the need for smaller vehicles in the French Quarter, Orleans Transportation required curbside parking for both limousines and buses. Since limousines and buses carry an estimated 23 percent of the traffic with only 1.5 percent of the vehicles, it was recommended that their spaces be located as conveniently as possible for deplaning passengers. If possible, new curb assignments should not attempt to confuse existing users of these ground transportation ser-

vices. Since most who use Mississippi Gulf expected to find their vans located immediately to the west side of the terminal building, it was recommended their new curb assignment be in the same general area. Specifically, it was recommended that Mississippi Gulf Lines be reserved 40 ft on the innermost lane. This provided space for two vehicles to enter and leave at the western edge of the newly designed terminal roadway between the crosswalk and the end of the inner lane and would leave the crosswalk free for passengers to leave and enter the terminal area. It was recommended that Orleans Transportation, Inc., be assigned the entire curb between the planned sidewalks, or approximately 350 ft. This permitted space for several vans and buses to load residents, as well as visitors and tourists who could be expected to have more baggage than businesspersons. It was further recommended that the 350-ft curb area be designated as the public transportation terminal area with greatly improved signing to instruct travelers as to their options and costs. Consideration needed to be given to creating a ground transportation booth within the terminal area to assist passengers. There was a wall between the major baggage claim areas that prevented a single ground transportation information center. Removal of this barrier would make it possible to move the present information and ticket booth from the outside curb area inside, thereby permitting arriving passengers to make their ground transportation arrangements before getting their luggage. At present, arriving passengers must obtain information at the curbside booth after they have gathered their luggage if they are traveling downtown to the French Quarter. Current fees paid by the authorized ground transportation carriers more than justified their inner-lane priority and waiting privileges.

The remaining 350 ft of inner lane curb space was suggested for parking lot shuttles, charters, and other high-occupancy-vehicle users that wish to pay for the privilege of priority curbside parking. These vehicles would be picking up passengers by call or advance registration and, hence, should be able to comply with the 4-min suggested loading time. Charter buses would be the only exception, and these were to be made to comply with a 10-min maximum loading time recommendation.

In all likelihood, it was felt there would be a strong public attempt to open up the inner roadway curb lane to automobile traffic on the grounds that the new design provided for adequate traffic flow. Unfortunately, this rationale is severely deficient during peak loading times for deplaning passengers. That is, the theoretical capacity of the three-lane inner roadway would appear to be able to handle personal automobiles if the 4-min maximum wait were enforced. Seldom, however, will the airport operate at an average passenger load--especially with the introduction of newer wide-bodied aircraft and the increasing competitive desire of airlines to get travelers to their destinations at convenient times that are also peak travel times. Unless personal automobiles were kept from entering this inner roadway, even greater traffic tie-ups than those that existed would be the eventual result as business and tourism traffic grew, requiring additional policing efforts to keep traffic moving. Also, the center lane of the inner roadway was recommended to be kept open at all times--never permitting double parking or stopping to pick up passengers. Thus, it was recommended that a solid yellow center lane 8 ft wide be drawn on the pavement to connote its status as a fire lane. Strict enforcement of this no stopping or standing center lane needed to be undertaken at all times.

The outer lane of the inner roadway was recom-

Table 6. Recommended fee schedule for airport ground transportation vehicles.

Mode of Traffic	Revenue (%)	Rate per Vehicle	Lane Assignment Priority	Total per Year (\$)	Recommended Fee Structure per Vehicle per Year (\$)
Charter limousine/bus	23.6		1	300 000	No change
Other charter limousines and vans		1/trip	1	400 ^a	1200
Other charter buses		2/trip	1	600 ^a	1800
Taxis	3.0		2	500 000	600
Hotel courtesy cars/limousines			3	400 ^a	1200 and 600 ^b
Off-airport parking shuttles			3	400 ^a	1200 and 600 ^b
Airport rental courtesy vehicles			3	400 ^a	1200 ^c

^a Per vehicle.

^b \$1200 for inner roadway curb lane; \$600 for outer roadway curb lane.

^c Plus \$10/parking space per month.

mended for the exclusive use of taxicabs. Their current level of ridership, 37 percent, dictated a premium position and dedication of the entire third lane. Care was suggested to ensure that arriving passengers were properly informed of the existing taxi fares to common destinations for one, two, or three individuals. Finally, access from the remote taxi staging area recommended earlier was simplified by the recommendation of an electronic eye that determined whether or not vehicles were in the cab lane at the curb. As spaces were vacated by cabs, an electronic signal would transmit this information to the holding area and request additional cabs. In all probability, the present cab starter could not be eliminated, however; a human override control would be necessary to handle loads at peak times. The starter, it was felt, would also be necessary to prevent cabbies from leaving their vehicles to solicit passengers in the terminal area. Such soliciting is a common nuisance at many airports and should be eliminated if at all possible.

In this general plan, the major emphasis was on permitting only high-occupancy vehicles and public transportation (taxicabs) on the inner roadway. The outer roadway's three lanes were recommended for automobile traffic with pickup on the separating curb only and strict enforcement of the 4-min wait period. Obviously, it was in the best interest of the Aviation Board to have as many pick-up automobiles as possible park in the short-term parking lot at the \$1 minimum. Therefore, parking in the outermost lane even for the 4-min minimum was not recommended. Double parking to pick up passengers waiting on the center curb would invariably take place. Only by keeping the outermost lane free from parking would continuous traffic flow be maintained. At peak times, therefore, it was recommended that this lane also be painted a solid yellow to connote its fire lane status.

GROUND TRANSPORTATION FINANCIAL PLAN

It was recommended to the New Orleans Aviation Board that a new ground transportation financial plan be developed and passed by the City Council as an ordinance aimed at equalizing the existing confused and highly discriminatory structure. As shown earlier, the least-cost mode, authorized bus and limousine, paid the highest percentage of revenue (23.6 percent of a \$5 fare) and, by contracting obligation, agrees to provide service on a 24-h basis to common carrier airline passengers. Other fees ranged from 3 percent of revenue (taxis) to 2.3 percent for off-airport parking vans and less than 1 percent for hotel and motel courtesy vehicles. Finally, the current ruling in Toye Brothers, which prohibited the Aviation Board from assessing a fee for loading and unloading charter and courtesy vehicles, created a confusing situation that must be resolved. The right and responsibility of the Aviation Board to regulate airport ground transportation had to be affirmed. Such affirmation was necessary to both

maintain the Aviation Board's ability to generate appropriate revenues from those who use the airport terminal and access facilities and avoid curbside congestion.

Recommendations for new ground transportation financial plans include the need to develop more short-term parking from existing spaces now dedicated to taxicabs and rental cars and a general increase in long-term parking rates. The plan also recognized that airport parking, for the most part, is an unrelated market to those out-of-town visitors, businesspersons, tourists, relatives, etc., that need airport ground transportation. The emphasis for out-of-town visitors was to be on maximizing a fair and equitable fee while encouraging low-cost high-occupancy vehicle public transportation. The current fees required by the different ground transportation providers and recommendations for new fees that would equalize the financial burden are given in Table 6.

As shown, the contract limousine and bus providers are maintained at their current 23.6 percent of revenue from deplaning passengers. This percentage was arrived at through a competitive bidding process and, although it is one of the highest in the United States, its rate could not be changed until the end of the current contract. This high percentage does, however, present a ceiling for all other fees to be paid.

Charter vans and limousines would be required to pay a one-time yearly fee of \$1200, and no \$1-per-trip costs to and from the airport. This recommendation was made for two reasons. Initially, the charter vans and limousines would be gaining a great improvement in their curb prioritization from what they now have, and the \$1-per-trip charge elimination. The \$1/trip is an administrative nightmare that is probably more expensive to collect than it is worth. Also, the \$1200 fee would act to separate smaller "fly-by-night" operators that operate a sometime service from those who are attempting to build a larger volume of charter business. It was felt that the Aviation Board would have fewer charter companies to deal with but have as much or more service being offered by these strong charter carriers.

Charter bus fees would also be increased by \$1200 to \$1800/year with no \$2-per-trip charge being assessed. As noted above, the per-trip charge is administratively difficult and expensive to administer. The increase in bus fees would also eliminate the casual provider and develop a few strong charter bus carriers that do business at the airport.

It should be noted that curb space is very valuable and, unless some mechanism such as a per-vehicle fee is used, curbside congestion and confusion can easily result. By charging significantly higher fees for charter limousine, van, and bus, it is felt that more-professional, high-quality service will result and, hence, better and more public transportation services. Also, the Aviation Board would begin to look on these carriers as significant

revenue generators over those being picked up by a friend or relative and attempt to assist their development whenever possible.

Taxicabs currently pay an airport fee of \$200 and were supposed to pay 25 cents/pick-up trip but there were some questions as to whether the 25 cents was ever collected. As previously noted, the taxi trip pays a substantially smaller amount per rider for the use of the inner roadway. Given the need to make their payment more equitable and eliminate the confusion over the 25-cent charge, a one-time annual permit fee of \$600 was recommended. The average cab can easily generate between \$150 and \$200/day, so the \$400 increase would be less than 0.005 of anticipated revenues and should not materially affect current cab fares. It would, however, act as a barrier to fly-by-night firms that provide less-than-adequate services.

Also, there appeared to be an oversight in the city ordinance that did not specify minimum insurance coverage required by taxicabs to serve the New Orleans International Airport. Just as charter vans or courtesy vehicles must have minimum insurance of 100/300/500, so should all taxicabs wishing to pick up at the airport. The public liability of the Aviation Board is greatly increased whenever they require a permit to provide services. If an airline passenger is unable to sue a fly-by-night taxi operator due to lack of financial assets for injuries incurred while traveling from the airport, the Aviation Board might be second in line because it had certified the taxi operator through its permit system. Clearly, whatever minimum public liability insurance is required of van, limousine, and bus operators on a per-person-accident basis should also be required of taxi operators. Such would greatly improve the overall quality of taxi service and guarantee a higher level of service to airline traveling passengers as well as provide the necessary protection for the Aviation Board.

Parking lot courtesy vehicles were currently paying only \$400/year per courtesy vehicle and \$10/year for each parking space available. Given the large amount of potential airport revenue that is being siphoned away by such operations, a \$1200/year fee per courtesy vehicle was recommended and a \$10/month fee for each parking space available at the operator's place of business. As new parking space is added by the Aviation Board, it would be necessary to protect the construction investment in these new facilities--especially if plans for the new high-rise parking structure were implemented. It might be necessary to raise such fees even higher if projected demand for these new parking spaces per number of airline passengers currently appeared to be adequate according to Federal Aviation Administration guidelines.

Hotel and motel courtesy vehicles, along with automobile rental courtesy vehicles, are typically a major source of congestion at airport deplaning curbs. Therefore, a two-tiered fee system was recommended for these vehicles. For those wishing to use the available inner roadway space for pickups, their permit fee would triple to \$1200. However, if only the outer roadway lanes were used, their fee would be only \$600/year per vehicle. In both fee structures, however, the \$2.50 charge/year per room for assigned airport customer vehicles would remain. The \$200 increase in present fees without improvement in prioritization would reflect the need of the Aviation Board to recover some portion of the new terminal roadway costs.

The recommended fee structure for airport ground transportation described above should greatly improve the flow of traffic from its present confused state and be a framework for continuing the high-

occupancy-vehicle public transportation. It should also act as a catalyst for the present ground transportation providers to use larger equipment--buses versus vans in order to maintain the present low fare (\$5) into the City of New Orleans. The need to provide an atmosphere where large vehicles are used cannot be understated. As more New Orleans convention and hotel capacity is added, more peak-time vehicles, i.e., buses, will be needed to transport passengers from the airport and around town. Through encouragement of frequent, high-occupancy vehicles at the airport, these vehicles will be in place when they are needed, thereby foregoing the expense of having to import buses to the New Orleans area during peak tourist times.

PEAK-TIME TOURIST PROBLEM AREAS

Most recommended plans are made for the normal operating capacity of a system, including airport ground transportation access systems. The recommended curb prioritization ensures that the bulk of premium curb space will be dedicated to high-occupancy vehicles that carry more than 60 percent of the airline passengers. However, New Orleans is a major tourist city with unusual visitor peaks for Mardi Gras and Superdome events, etc. Therefore, some attention had to be given to these travel peaks. When such peaks occur, the Aviation Board should have a ground transportation plan able to handle the load without confusion and needless congestion. It was suggested that the peak-travel plan call for an additional number of baggage handlers to be assigned and prioritized parking for high-occupancy vehicles. Although the appropriate number of baggage handlers needed was beyond the focus of this project, it was obvious that some attention be given to this since the increased number of baggage handlers vastly decreases the amount of wait time each vehicle will experience in loading passengers.

Two additional ground transportation recommendations were made specifically that will ease anticipated congestion problems. It was recommended that the eastern half of the third lane normally reserved for taxis would be temporarily dedicated to pick-up areas for parking lot, rental car, and hotel or motel courtesy vehicles and the entire inner lane (number 1) be reserved for authorized buses and limousines as well as charters. In addition, a staging area for high-occupancy vehicles waiting on arriving flights should be constructed away from the terminal area adjacent to the taxi staging area. These vehicles could then be called up by the groundside coordinator assigned to manage airport ground transportation during these peak times. Given the recommended plan and fee structure, it was felt that this would be the most efficient and equitable method of handling peak tourist times and yet maintain a reasonable traffic flow of the airport.

SUMMARY

This paper addresses the major airport ground transportation access problems and suggests recommendations for the New Orleans area. The major thrust has been to suggest ways in which more high-quality, high-occupancy-vehicle public transportation can be provided to handle the increase in tourist and business traffic expected in the future. Above all, the approach sought to make ground transportation options financially attractive to the Airport Aviation Board so that good operating relations will continue. The New Orleans International Airport has one of the best U.S. experiences in high-occupancy-

vehicle transportation. Tourists and businesspersons from this country and others often remark how easy it is to get into the City with the alternatives of bus, limousine, cab, and rental cars readily available. It would be unfortunate if this reputation and high-occupancy-vehicle capacity were lost in the new airport roadway terminal system just when an influx of new business, tourist, and visitor traffic can be expected in the area. All should work together to see that an even better record in airport ground transportation is achieved here and elsewhere.

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Time-Series Analysis of Intercity Air Travel Volume

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This research develops a useful model from which to analyze intercity air travel demand and to produce short-term forecasts. Traditional techniques are presented and technical issues associated with these techniques are discussed. An alternative procedure developed by Box and Jenkins is then introduced. This procedure can be used to develop univariate models that account for monthly as well as seasonal patterns in a time series of historical data. Explanatory variables may also be added to form multivariate models. The technique involves four stages: identification, estimation, diagnostic checking, and forecasting. The Box and Jenkins methodology is applied to a monthly time series of visitor air travel from mainland North America to Hawaii. A univariate model is developed with monthly data from 1971 through 1978, and variations of the model are statistically compared. Forecasts based on the "best" univariate model are then computed for 1979 and 1980 and compared with actual data. Results show that the univariate model selected produced reasonably accurate short-term forecasts. Some 17 of 23 forecasts are not significantly different from the actual observations. When updated, these forecasts are even more accurate. Finally, a bivariate time-series model incorporating air fare as an explanatory variable is estimated. It does not produce a significantly better fit of the data in this case. However, these models are potentially useful from a management standpoint because elasticities can be derived and alternative strategies analyzed. In the Hawaii air travel market, additional research is needed to refine the underlying variable relations and their influence on demand.

The commercial air transportation industry has experienced tremendous growth since the middle of this century. However, current and potential carriers are faced with decisions in the 1980s that will determine their future prosperity if not survival. Recent developments in the industry, including deregulation and increasing fuel prices, are forcing carriers to make critical decisions with regard to fare pricing, fleet expansion, route structure, and flight scheduling. In the public sector, air terminal authorities are faced with serious problems resulting from the rapid growth of commercial and private air transportation in their communities. From these perspectives, decisionmakers need to understand the dynamics of the public demand for air transportation and, it is hoped, how their decisions interact with that demand.

This research is concerned with the analysis and forecasting of intercity air travel demand. The particular market chosen for study is that of visitor travel from mainland North America to the Hawaiian Islands. The importance of such a study goes beyond the frame of reference of air carrier or airport management. The notion of transportation as

a derived demand is particularly clear in this market, where a vacation in Hawaii is the dominant trip purpose. From this perspective, travel demand patterns are also of major concern to those involved with the entire Hawaii visitor industry, including hotel, entertainment, and other service establishments.

AIR TRAVEL FORECASTING BACKGROUND

There are several ways to categorize air travel forecasting methods. One of the more general distinctions is between purely judgmental approaches and mathematical modeling.

Judgmental methods elicit the personal opinions and predictions of experts in the various fields of air transportation. A popular technique used to obtain information in this way is the Delphi method, where several experts respond independently to several questions pertaining to future air travel demand (1). After seeing their fellow experts' predictions and reasoning, participants are given the opportunity to change their estimates. The intention is that some consensus will eventually be reached and that this consensus will be a good estimator of future demand. Problems with this method include the determination of consensus criteria and the possibility that responses will polarize rather than come together.

The other general procedure used to predict air travel is based on the use of mathematical models. The five-step procedure used to develop these models for prediction is well-established and it includes the following:

1. Variable specification,
2. Variable measurement,
3. Model formulation,
4. Model estimation, and
5. Policy analysis and forecasting.

One of the simplest types of air travel forecasting models relates the amount of travel observed to time. Models of this type are called trend extrapolation models and only one variable, namely the amount of travel, needs to be measured. An histor-