Role of Door-to-Door Vans in Airport Ground Transportation

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The characteristics of door-to-door van service in the airport ground transportation system are analyzed. The evolution of airport ground transport is traced; the market niche of door-to-door van service is delineated; and air passenger characteristics favoring door-to-door modes in general and door-to-door vans in particular are reviewed. A detailed intermodal comparison of vehicle kilometers (vehicle miles), person minutes, and user cost for air-traveling parties of various sizes using the six airport ground transport modes is presented. Management issues facing door-to-door van service managers are discussed, and information needs of the industry and future research needs are indicated.

Airports are among the largest generators of people and goods traffic in metropolitan areas. Airport ground traffic is dispersed throughout most of the day, 7 days a week; it originates from, or is destined to, points throughout the metropolitan area. Because the movement of people to and from airports is so diffused in time and space, this traffic is carried mainly in low-occupancy vehicles, thus imposing a significant traffic load on roadways, particularly near the airport. As traffic volumes begin to cause congestion, consolidating person traffic into fewer vehicles becomes especially important.

Of the six major forms of airport ground transportation that handle passenger movement, three use automobiles mainly—self-driver, car passengers, and taxi—and three use larger vehicles—scheduled airport buses, transit (rail or bus), and door-to-door (D/D) vans.

This paper examines the factors affecting the use of D/D vans, the newest airport ground transport mode, and addresses planning and policy questions raised by the growth of that mode. It analyzes the general characteristics of the D/D van market and discusses operational problems. The paper also compares the performance of typical D/D van service with the more traditional modes. Finally, the paper discusses some management issues for both operators and airports in providing D/D van service.

D/D VAN SERVICE

During the past two decades, D/D van service has become available at major airports in the United States. It is now spreading to medium-sized airports and is likely to grow substantially in coming years. With this growth has come a number of problems at some airports, including proliferation of operators, increased curbfront congestion, and wide variation in the quality of service (*1*).

For the inbound trip to the airport, a passenger calls a D/D van carrier in advance to be picked up by a van (typically a van has a 7- to 11-person capacity) at the place requested at an agreed time. The passenger's origin may be any point within the carrier's service area, such as a private residence, hotel, office, factory, or military base. Other passengers may be aboard already or be picked up on the way. The van then takes the group to the airport for passenger drop-off at the respective airline terminals.

On the outbound trip from the airport, the pattern is reversed. That is, the van picks up passengers bound for the same general area at the curb of various airport terminals. Some passengers may have advance reservations; many will be walk-ups. The van takes the group to the destination area, drops each passenger at his or her specific destination, and, after the last drop, repeats the next cycle.

In the spectrum of transportation operations, D/D van service can be classified as a demand-responsive, shared-ride operation: inbound, it follows a few-to-one trip pattern; outbound, a one-to-few trip pattern. Both route and schedule are flexible.

EVOLUTION OF AIRPORT GROUND TRANSPORTATION

Travel Patterns

Early airport ground transport typically involved trips between the central city and an airport on the outskirts. This trip pattern has undergone major changes on both ends. Metropolitan areas have grown in both population and extent; residences, commercial and industrial concentrations, convention facilities, and other activity centers are dispersed throughout the area. The role of the central business district as the end of the trip for air passengers has been reduced. Air passenger origins and destinations have become more widely scattered and more difficult to serve by a fixed route operation.

Major airports have grown from simple landing strips with small terminal buildings into large multiterminal complexes that require several stops by ground transport carriers and often operate their own internal transport systems, such as bus or rail shuttles or moving walkways. Satellite cities with hotels, convention centers, and industrial parks have developed around airports. Many large metropolitan areas now have more than one airport, further adding to the dispersal and complexity of ground transport.

Modal Characteristics

In the early decades of aviation, airport ground travel was primarily by private car or taxi. Air passengers generally had ready access to either one: both provided convenient, almost door-to-aircraft transportation.

As passenger volumes grew, a specialized form of ground transport emerged: the airport "limousine," typically shuttling passen-

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gers between a major downtown hotel and the airport. The name reflected both the type of vehicle used and the connotation of luxury transportation associated with early aviation. As traffic volumes grew, the limousine was replaced by the airport bus, often a 40- to 50-passenger vehicle serving several major hotels or a downtown terminal. (Limousines in the original sense still exist as luxury charter vehicles at many major airports; they are not considered a major ground transport mode and thus are not discussed further in this paper.) Air passengers, except those passengers staying at one of the hotels served directly, need to arrange for their own transportation between an airport bus stop and the actual trip end.

Increasingly, metropolitan areas have attempted to integrate the airport into their transit network in order to serve air passengers as well as the thousands of airport workers and visitors. A number of airports, both in the United States and abroad, not only are served by transit bus routes but also incorporate stations of the rapid transit system or regional rail network.

Private cars are still the dominant mode of airport ground transportation. For San Francisco International Airport, an airport with a high proportion of visitors having no access to a private car, a recent survey showed that 51 percent of air passengers used private cars to reach the airport (*2*). At many airports, the ratio is even higher.

Over time, the handling of private cars at the airport has changed. At most major airports, air passengers no longer can park close to the aircraft or even the check-in counter; instead they must use the airport garage or an outlying parking lot and carry or wheel their baggage to a bus or rail shuttle or combine walking, moving walkways, escalators, or elevators to cover a considerable distance. Those passengers using rental cars may park even farther away; however, they usually are transported by the rental company's shuttle van to their airport terminal door.

Thus, most air passengers using airport buses, public transit, or rental cars or parking private vehicles at the airport experience multiseat rides involving one or more transfers to go to and from airport terminals. The air passenger using a taxi or being dropped off or picked up at the airport by a household member, friend, or business associate receives single-seat D/D service, but at a price: the taxi fare or the roundtrip time and cost of the person driving the vehicle in the unaccompanied direction.

By providing direct D/D service at a time that the traveler has chosen, ground transport by taxi or private vehicle offers a significantly higher level of service, although generally at a higher cost, than transit or airport bus. It was to be expected that a form of transport intermediate in both service and cost would emerge. This new form is the niche of the airport van, offering D/D service on a shared-ride basis. D/D vans now have a significant share of ground transport at many major airports. A 1992 survey at San Francisco International Airport indicated a 13 percent share of air passenger trips to the airport, greater than any other mode except private car (*2*).

Table 1 gives a summary of the characteristics of the various ground transport modes, viewed from the perspective of the trip inbound to the airport; symmetrical information would apply to the outbound trip.

CHARACTERISTICS OF D/D VAN MARKETS

To understand the role of D/D van service in the context of airport ground transport, it is essential to first understand the factors that affect the use of the mode.

TABLE 1 Airport Ground Transport Modes: Key Characteristics of Inbound Trips

Characteristic	Airport Ground Transport Mode					
	Transit	Airport Bus	D/D Van	Taxi	Car Psgr (a)	Self Driver
Trip Configuration						
Door-to-Door Service	no	no (b)	**yes**	yes	yes	no
Type of Line Haul Ride	shared	shared	**shared**	exclusive	exclusive	exclusive
Pickup/Access Trip (c)	yes	yes	**yes**	yes	no (d)	no
Trip Components						
Pickup at Origin Door	no	no	**yes**	yes	yes	yes
Transfer(s) Required	yes	yes	**no**	no	no	yes (e)
Delivery at Airport Door	no (f)	yes (g)	**yes**	yes	yes	no
Parking Required	no	no	**no**	no	no	yes
Other						
For-hire Carrier	yes	yes	**yes**	yes	no	no
Fare Level	low	low intermediate	**intermediate**	high	n/a	n/a

(a) refers to drop off (or pickup) of air passenger by a companion in a private vehicle; companion drives vehicle away from (brings vehicle to) airport
(b) except for passengers staying at hotels served directly by airport bus. See also note (g).
(c) refers to trip by van or taxi to pick up passenger, or trip by passenger to transit or airport bus stop
(d) assuming ride given by someone at air traveler's home, workplace, or other origin; if driver located elsewhere, a pickup trip to air traveler's location becomes necessary
(e) assuming air passenger uses airport area transport (bus or rail shuttle)
(f) except for passengers destined to that part of airport in immediate vicinity of transit stop(s)
(g) typically closer to desired door than transit but not as close as other modes

Characteristics Favoring D/D Modes

Modal split analysis information for airport ground transport modes is sparse; consequently, a list of characteristics affecting demand for the various modes has been developed (Table 2). Characteristics are grouped into three sets relating to the individual passenger, to the ground trip, or to each mode; factors likely to favor the various D/D modes are shown in boldface. They include the following:

- Relatively short time available to travel to or from the airport (e.g., departing on an early morning flight, arriving on a flight with short lead time for an appointment, or arriving late at night),
- Arrival after a long flight,
- Limited mobility of one or more persons in the travel party (e.g., small children, the aged, or handicapped persons),
- Difficult baggage (heavy, bulky, or many pieces), and
- Adverse weather (heat, cold, or precipitation).

Many passengers to whom these characteristics apply will choose D/D vans, especially if one or more of the following conditions are present:

- Private automobile not available;
- Trip duration of many days, resulting in high airport parking costs;
- Travel costs or taxi use not reimbursed by others;
- No need for rental car during stay;
- Unfamiliarity with the geography of the region or with alternative public transportation options; and
- Familiarity with D/D van service through one or more of the following:
  - –Traveler's own past experience;
  - –Hotel, employer, or client established D/D van user; or
  - –Information on D/D van service readily available.

TABLE 2 Characteristics Affecting Choice of Airport Ground Transport Mode

CHARACTERISTIC	ALTERNATIVES (**bold** alternatives likely to favor one of the D/D modes)
PASSENGER-RELATED	
Passenger home location	resident visitor
Time available for trip to/from airport	**short** ample
Trip purpose	work-related (includes school) personal business social/recreational
Size of Ground Transport party	1 **>1**
Walking ability	not limited **limited (small child; aged; handicapped)**
Baggage	handled conveniently by air traveler **not handled conveniently by air traveler** (heavy and/or bulky and/or many pieces)
TRIP-RELATED	
Ground trip direction	to airport **from airport : after long trip, e.g. > 6 hrs (a)** after trip < 6 hrs (a)
Ground trip end	non-hotel locations **hotels/motels : served directly by airport bus (b)** **airport area (c)** other
Flight Arrival or Departure Time	**early, e.g.< 07 (a)** midday **late, e.g. > 21 (a)**
Weather	favorable (moderate, dry) **adverse (heat, cold, precipitation)**
MODE-RELATED	
Time between airport and O or D	(depend on specific location)
Cost (Fare; vehicle operating cost; parking; etc.)	(depend on airport, carrier, trip duration, etc.)
User Information (For-hire Carriers only - start time, duration, fare, etc.)	**readily accessible** difficult to obtain
Comfort (waiting, riding)	comfortable uncomfortable

(a) Approximate indication of 'long', 'early', 'late'
(b) Airport Bus serves as D/D mode
(c) Hotel Shuttle serves as D/D mode

Classification developed by the authors.

Concentrations of Demand

The wide dispersal in space and time of the regional origins and destinations of air travelers poses problems for the D/D van operator. For D/D vans to offer the economy of shared rides, there must be rides to share. Individual residences and businesses are likely to generate only one air-party trip at a time. A greater concentration of demand can be found at large hotels.

Typically, a few leading hotels will be served directly by scheduled airport buses. For competitive reasons, other hotels and motels often wish to provide a direct connection for trips to and from the airport. Hotels near the airport generally provide their own shuttle services. Many of the hotels farther away will use a selected D/D van operator regularly. This arrangement offers advantages to both the hotel guest and carrier: the hotel guest has convenient access to D/D van service information, and the carrier has a greater likelihood of picking up several passengers at one stop and of short distances between stops in the hotel district.

An equally important aspect of demand concentration is the problem of providing service to areas with low rates of air trip generation. In typical suburban or rural areas, it may be necessary to combine trips from locations many miles apart. Doing so increases the circuity involved in driving between pick-up or drop-off locations, which in turn increases the travel time for all users except the last to be picked up or the first to be dropped off. This problem is exacerbated if the market is divided among several carriers.

INTERMODAL COMPARISONS OF FARES AND SERVICE

The market for airport ground transport is highly competitive. Each mode offers a different mix of fare and service characteristics that needs to be considered in comparing modes.

Fares

D/D van operators typically charge fares that are intermediate between airport bus and taxi, with the fares being much closer to those of the bus. Taxi fares, however, are *per party* whereas airport bus and D/D van fares are *per person*; for multiperson parties, many D/D van carriers charge a reduced fare for the additional persons.

Fares generally vary with distance, but the relationship is not consistent in all cases. Other factors may enter: load factor (one-way and roundtrip), bridge tolls, fares charged by competitors, and market density.

Comparative Performance

The various ground transport modes differ in many performance characteristics: access to line haul, vehicle capacity, routing, and others. Comparisons based on actual performance are difficult. To examine how D/D van service compares with other modes, a hypothetical comparison between six major modes was designed that would make the modes commensurate. The comparison is based on the scenario that follows.

Twelve air passengers, clustered in the same community within a metropolitan area, are traveling to the airport at approximately the same time. They are considered to be traveling first as 12 separate individuals, then as parties of 2, 3, and 4 persons. Trips consist mainly of two segments—access and line haul. Parameters for the trips are specified in Table 3.

The performance of each mode is estimated in three measures:

- Vehicle kilometers (vehicle miles) traveled (VKT): indicator of contribution to congestion, air pollution, and energy consumption;
- Person minutes required: total time used by the air passengers as well as those transporting them; and
- User costs incurred: fares paid to common carriers and cost of operating private vehicles.

Each of these measures represents a form of input or cost to be constrained or minimized for optimal operation. VKT is only an indirect measure of emissions, energy consumption, and contribution to congestion but is useful as a broad indicator of relative performance; it should be recognized that impacts per vehicle-kilometer not only vary from mode to mode but also can vary with specific situations, such as availability of high-occupancy vehicle (HOV) lanes. Detailed analysis is likely to be necessary to understand the trade-offs in a given situation.

Assumptions

The following is assumed:

- *Public transit.* Each party is brought separately by private vehicle to the trunk line transit stop, an average distance of 3 km (1.9 mi); passenger and driver wait 10 min for an express bus. Air passengers then travel approximately 40 km (25 mi) to the airport (the line haul segment), mainly by freeway, transferring once en route to another express bus. The private vehicle driver returns to the point of origin. Bus driver time is included in total person minutes required, based on an average load of 12 persons per bus.
- *Airport bus.* The access trip to the airport bus stop is longer and includes some freeway travel. The line haul trip therefore is somewhat shorter; it has fewer stops and no transfer. Bus driver time is included, based on an average load of 12 persons per bus.
- *D/D van service.* Vans are limited to four stops and eight passengers; three vans are needed for the single passengers, two for multiperson parties. The second and additional members of the party get a 25 percent fare reduction. The van travels a 6-km (3.7-mi) deadhead to pick up the first passenger. After completing the pickups, the van travels another access distance of 2 km (1.2 mi) on local streets and then nonstop on the freeway to the airport. The times of the van drivers are included.

Information for the other three modes was developed similarly: taxis, private cars dropping air passengers off at the airport ("car passengers"), and private cars parked at the airport by the air passengers ("self-drivers"). Taxi VKT includes a 6-km (3.7-mi) deadhead to pick up the passenger. Times of taxi drivers and companions are included, as is the self-driver's time to park. Self-driver parking cost is based on an average trip lasting 2.5 days and is divided equally between trips to and from the airport.

Results

Performance measures for the 12 air passengers traveling individually are given in Table 4 for various trip elements:

TABLE 3 Specifications for Hypothetical Comparison

Variable and Trip Element	Unit	Airport Ground Transportation Mode					
		Transit	Airport Bus	D/D Van	Taxi	Car Psgr	Self Driver
Distance							
Pickup Trip	km			6	6		
Access to Line Haul	km	3	5	2	3	3	3
Line Haul	km	40	38	40	40	40	40
Terminal to Parking	km						2
Between Pickup Stops	km			1.5			
Speed							
Pickup Trip	km/hr			25	25		
Access to Line Haul	km/hr	25	30	25	25	25	25
Line Haul	km/hr	65	70	80	80	80	80
Terminal to Parking	km/hr						25
Time							
Transfer Time							
Access to mode	min/trfr	10	10				5 (a)
En Route	min/trfr	10					
Stop Time - pickup (b)	min/stop			3; 3.3; 3.7; 4			
Trip Duration - Average	days						2.5
Cost							
Private Vehicle	$/km	0.15	0.15			0.15	0.15
Fare	$/psgr	4	10	20			
	$/party				50		
Parking	$/car/day						9

(a) car to parking shuttle
(b) varies with party size

TABLE 4 Hypothetical Comparison: Performance Measures for 12 Parties of One Person Each

		Airport Ground Transport Mode					
Unit	Trip Element	Transit	Airport Bus	D/D Van	Taxi	Car Psgr	Self Driver
Vehicle kilometers	Pickup trip	0	0	32	72	0	0
	Access to line haul	72	120	6	36	72	36
	Line haul	40	38	120	480	960	480
	Parking	0	0	0	0	0	28
	Total	112	158	158	588	1032	544
	Per air passenger	9.3	13.2	13.1	49.0	86.0	45.3
Person minutes	Pickup trip	0	0	230	173	0	0
	Access to line haul	259	360	72	173	259	86
	Transfer	360	240	0	0	0	60
	Line haul	480	423	450	720	1080	360
	Parking	0	0	0	0	0	115
	Total	1099	1023	752	1066	1339	622
	Per air passenger	92	85	63	89	112	52
User cost ($)	Pickup trip	0	0	0	0	0	0
	Access to line haul	11	18	0	0	11	5
	Line haul	48	120	240	600	144	72
	Parking	0	0	0	0	0	135
	Total	59	138	240	600	155	212
	Per air passenger	4.90	11.50	20.00	50.00	12.90	17.70

- Pickup trip by a D/D vehicle (van or taxi) to the passenger's point of origin,
- Access trip via local streets to the freeway,
- Line haul trip along the freeway route to the airport, and
- Transfers and parking as required.

Results are aggregated for all trip elements and displayed on a per-passenger basis in Table 4 and Figure 1. As can be seen from the table and the figure,

- The shared-ride modes (transit, airport bus, and D/D van) require far fewer VKT than the exclusive-ride modes of taxi, car passenger, and self-drive.
- Person minutes reflect labor intensity: self-drivers require the least time; D/D vans, the next least; those passengers dropped off at the airport by a driver who must make the entire roundtrip, the most. The other modes require fairly similar amounts of time.
- Taxi is by far the most expensive mode, and public transit is the least expensive; the other modes are grouped quite closely. Person minutes are broken down between air passenger time and time for the person driving the air passenger in Figure 2. Driver time varies from zero in the self-driver mode to twice the air passenger time in the car passenger mode.

The same categories of results were developed for party sizes of two, three, and four persons. They are summarized in Table 5 per passenger and per party; results for parties of one and four are compared in Figures 3 through 5. The table and figures indicate the sensitivity of each mode to economy of scale. In general, transit and airport bus reflect some savings in vehicle kilometers and person minutes per passenger with increasing party size, primarily due to economy of scale in the access segment. The automobile-based modes of taxi, car passenger, and self-driver show much greater decreases in VKT and user cost per passenger; taxi and car passenger also decrease in person minutes because fewer drivers are required.

User cost variation indicates the nature of the cost to the passenger: if cost is variable, that is, based on individual fares as in the shared-ride modes, there is little economy of scale as party size increases. If cost is fixed, as in the modes using automobiles, distribution over larger party sizes results in sharp decreases in cost per passenger.

D/D vans occupy an intermediate position in the performance measures, reflecting their role as a consolidator able to achieve some economy of scale even with a few passengers. Person minutes are low for all party sizes because less driver labor is required in the access segment than for transit and airport bus, and less labor is required in the line haul segment than for taxis and car passengers; parking is not necessary. VKT are low for single passengers and do not decrease greatly with party size. User costs are significantly lower than taxi for single-person parties, but, under the assumptions of this comparison, D/D vans gradually lose that advantage as party size increases.

A survey of air travel parties at San Francisco International Airport (*3*) indicated an average party size of about 1.5; whereas more than half of all air travel parties consisted of only one person, more than half of all air passengers were in multiperson parties (mostly of two to four persons). Ground transport parties are not necessarily identical in size to air travel parties: they may include greeters and well-wishers; different members of the same air party may travel in different vehicles; and a single vehicle may carry several air parties. The survey addressed the number of greeters and well-wishers but not the other aspects of ground transport party size.

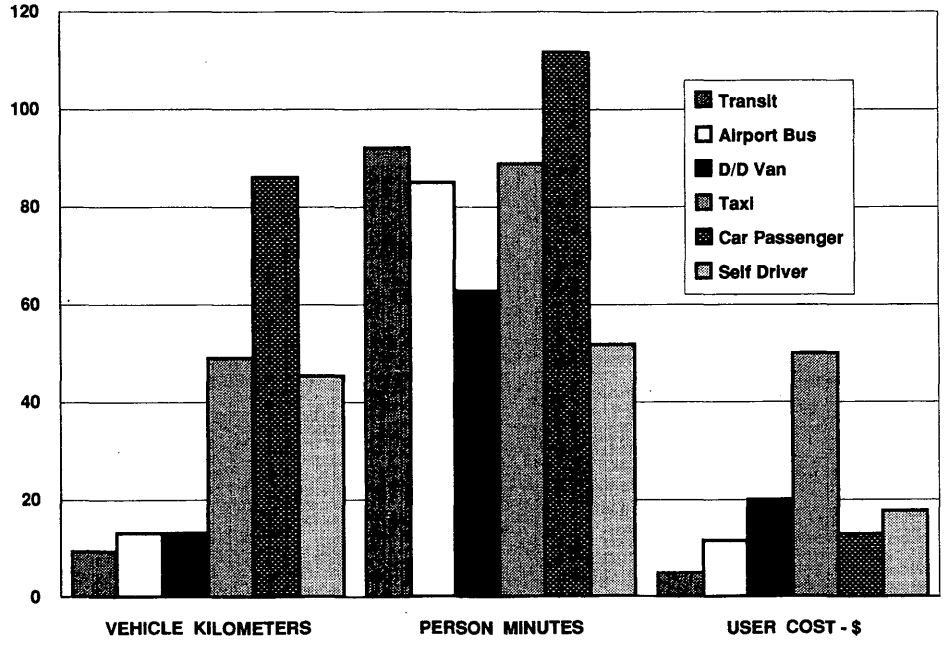

FIGURE 1 Performance characteristics per passenger, one-person parties traveling to airport.

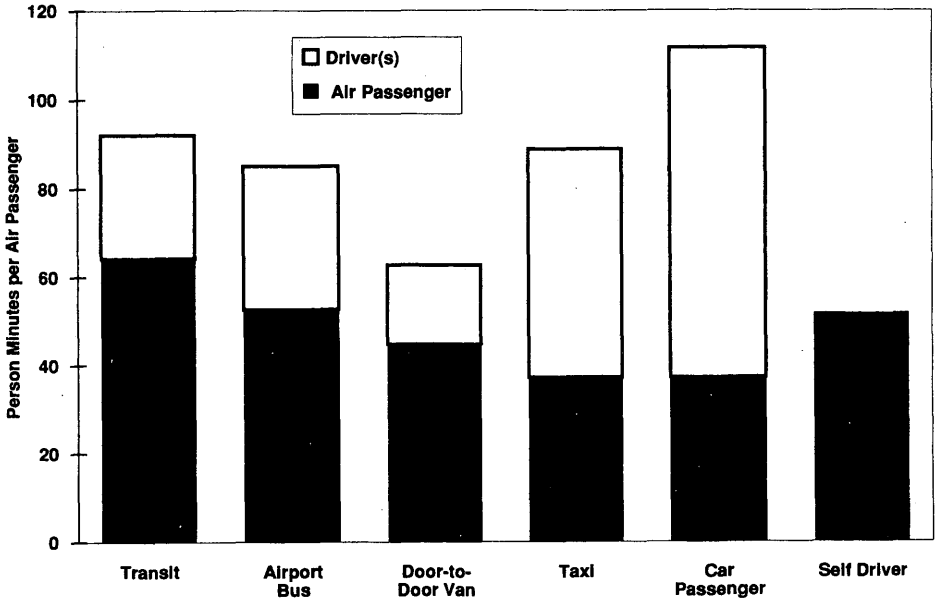

FIGURE 2 Person minutes required, single air passengers and drivers.

The intermodal comparison is sensitive to several parameters in addition to party size; among them are

- Air trip duration, which affects the parking cost of self-driver parties at the airport;
- Access mode to airport bus (or transit): sharp cost increases if taxi were used instead of private car;
- Access distance to airport bus and transit stops; and
- For D/D vans, average distance between pickup stops and the relationship between pickup distance and total distance to the airport.

Many issues arise in the design of this kind of comparison; among them are

- *Allocation of common costs.* Such common cost allocation includes the following:
  - –Transit and airport bus driver time are shared by passengers outside the sample group, and
  - –D/D van and taxi have waits of varying lengths between revenue trips.
- *Accounting for the cost of driver time.* If the air passenger is driven to the airport by a common carrier (transit, airporter, van, or

TABLE 5 Performance Measures for Ground Transport Parties of Various Sizes

	Airport Ground Transport Mode							
	Unit	Party Size	Transit	Airport Bus	D/D Van	Taxi	Car Psgr	Self Driver
Per air passenger	Vehicle kilometers	1	9.3	13.2	13.1	49.0	86.0	45.3
		2	6.3	8.2	8.5	24.5	43.0	22.8
		3	5.3	6.5	8.5	16.3	28.7	15.3
		4	4.8	5.7	8.4	12.3	21.5	11.6
	Person minutes	1	92	85	63	89	112	52
		2	79	70	53	63	74	52
		3	75	65	48	54	62	52
		4	73	63	47	50	56	52
	User cost ($)	1	4.90	11.50	20.00	50.00	12.90	17.70
		2	4.45	10.75	17.50	25.00	6.45	8.85
		3	4.30	10.50	16.67	16.67	4.30	5.90
		4	4.23	10.38	16.25	12.50	3.23	4.43
Per party	Vehicle kilometers	1	9.3	13.2	13.1	49.0	86.0	45.3
		2	12.7	16.3	17.0	49.0	86.0	45.7
		3	16.0	19.5	25.5	49.0	86.0	46.0
		4	19.3	22.7	33.5	49.0	86.0	46.3
	Person minutes	1	92	85	63	89	112	52
		2	158	140	106	126	149	104
		3	225	195	145	163	186	155
		4	292	252	187	200	223	207
	User cost ($)	1	4.90	11.50	20.00	50.00	12.90	17.70
		2	8.90	21.50	35.00	50.00	12.90	17.70
		3	12.90	31.50	50.00	50.00	12.90	17.70
		4	16.90	41.50	65.00	50.00	12.90	17.70

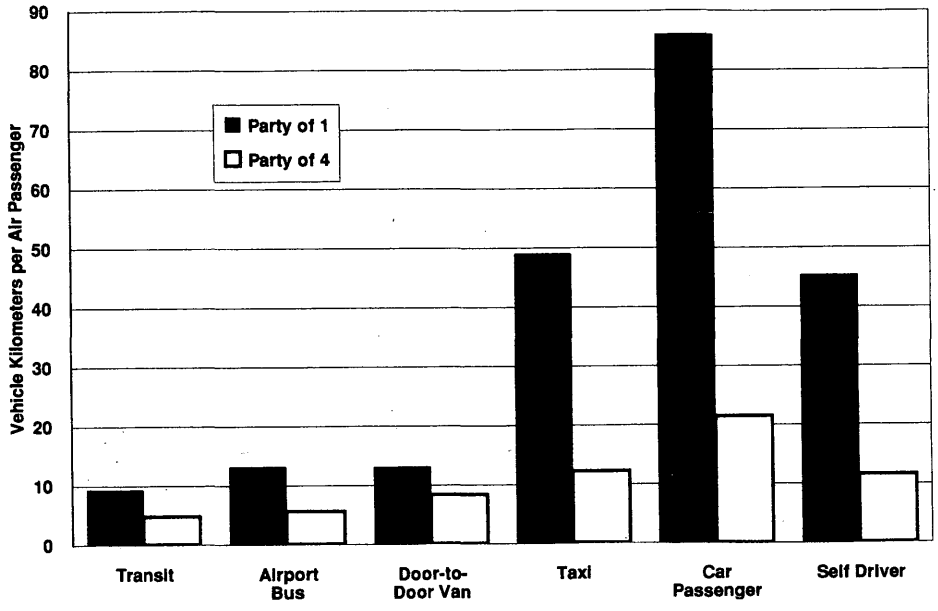

FIGURE 3 Vehicle distances for parties of one and four.

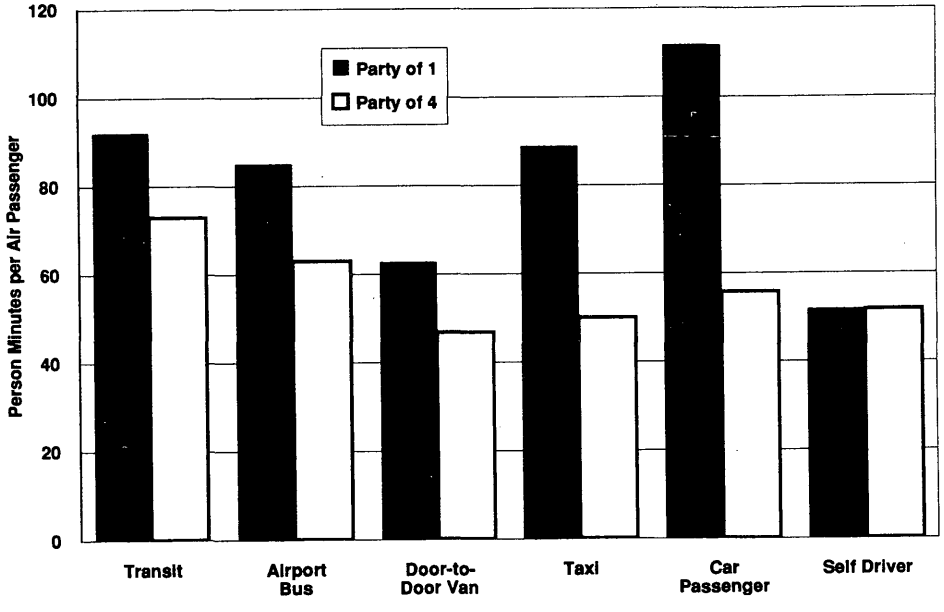

FIGURE 4 Person minutes for parties of one.

taxi), the cost of the driver's time is reflected in the fare, although public transit fares typically cover only a fraction of operating costs. In the car passenger mode, the driver time is included in person minutes, but no cost is included in user costs.

- *Accounting for the cost of air passenger time.* Should the ground transport time of air passengers be assigned a cost? If so, how should that cost relate to that of drivers?

Although there is some artificiality to the basic scenario and many of the values shown are greatly simplified, the comparison helps to understand the dynamics of the airport ground transport market. It should be recognized, however, that the results are sensitive to the assumptions made in the analysis; they should not be used as a basis for formulating policies without checking whether the assumptions match the situation in question.

MANAGEMENT ISSUES IN D/D VAN SERVICE

Various parties are involved in D/D van service operations; their objectives differ, as follows:

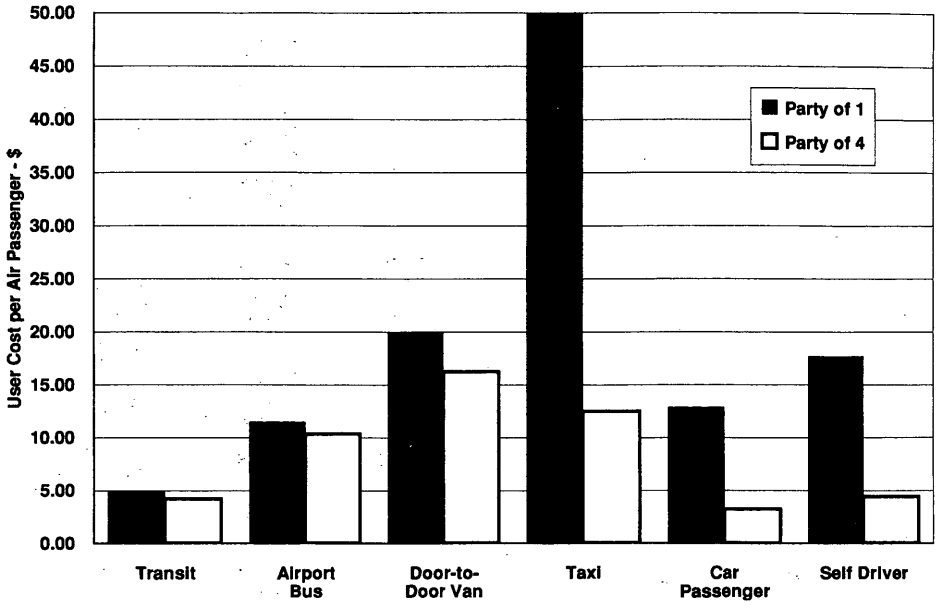

FIGURE 5 User costs for parties of one and four.

- Passenger—minimize wait time, travel time en route, intermediate stops, and circuity;
- Carrier—maximize passengers and net revenue per trip; and
- Airport—provide high-quality service to the airport user, avoid curbfront congestion, and minimize enforcement requirements.

In attempting to achieve its own objectives while considering those of the other parties, management of the D/D van operation faces a number of difficult trade-offs and optimization issues.

Service Standards

For the key attributes of D/D van service—demand responsive, flexible schedule, and flexible route—to benefit the passenger, some limits must be set so that the passenger completes the trip without excessive delay due to waiting time and detours caused by serving too many other passengers with trip ends that are dispersed too widely. Management needs to set service standards in order to compete successfully against other modes and other D/D van carriers. Standards may apply to such parameters as the following:

- Maximum passenger waiting time before departure from the airport,
- Maximum passenger en route time for a destination point or zone, and
- Minimum lead time before flight departure to arrive at the airport.

In an attempt to improve the quality of service offered to airport passengers, San Francisco International Airport has proposed a D/D van service agreement that specifies maximum passenger waiting times and headways (*4*). The challenge to management is to set a standard high enough to attract passengers, yet not so high that it dilutes load factor and leads to unprofitable operation.

Dispatching

Dispatching D/D vans is a difficult problem in either direction. Dispatching vans outbound *from* the airport may be constrained by service standards on maximum waiting time and headways, as well as by limitations on airport curb space and efforts to minimize airport roadway use in picking up passengers at the various terminal locations.

Dispatching the vans for trips *to* the airport is even more difficult. Pickup times for trips to the airport should deliver the passenger to the airport with sufficient time before flight departure (typically 1 hr, unless the passenger requests a different lead time). However, reservations are made at different times by passengers headed for different flights and do not come in any particular order. Yet a pickup time must be assigned to each party when the reservation is made, without knowing what reservations will be made later and where those pickups will occur. Service standards for maximum pickup time and minimum arrival time before flight departure establish a time window within which a pickup must take place. As reservations come in, they can be assigned pickup times within their window, based on their location in the service zone, to create reasonable sequence of pickup locations and times. The challenge is to combine the reservations and dispatching functions effectively. With multiple carriers the traveler wishes to know which carrier has a van that can take him or her to or from the airport with the least inconvenience. This, however, is a function of dispatching logic. Emerging information technologies, such as interactive cable or computer services, eventually may allow travelers to select the most appropriate carrier in real time, with significant gains in efficiency for both travelers and carriers.

User Information

The flexibility of D/D van service generates uncertainties for the potential passenger, particularly on trips outbound from the airport.

For example, when will the van arrive? when will it leave? when will the passenger reach his or her destination? These uncertainties are much smaller in the competing modes of public transit and airport bus. The challenge to D/D van managers is to provide readily accessible, clear, and accurate answers to these basic questions. Variable message signs and other technologies are available. An ultimate goal would be to provide landside user information of the same quality, completeness, and convenience as the flight information provided by the airlines to passengers at the airport.

CONCLUSIONS

During the past two decades, D/D van service has moved from early experimentation to the role of a major mode in airport ground transportation. It appears to have the potential for considerable additional growth. The long-term trend in transportation policy to emphasize HOVs is likely to favor D/D vans. The same trend will require airport managers to reexamine the allocation of scarce curb space among the various modes and the role of parking revenues, both now characterized by the traditional dominance of the private automobile in airport ground transport.

Airports cannot expect to achieve major gains in average vehicle occupancy *and* maintain existing revenue streams from parking and ground transportation concession fees. Whereas the full implications of this go well beyond the scope of this paper, it is imperative that airport policies toward the different modes be based on a careful analysis of their relative contribution toward policy concerns and objectives, including congestion, emissions, curb occupancy, and revenues, on a per-passenger (not per-vehicle) basis.

D/D van service is well suited to the needs of certain segments of the air traveling public; as long as reasonable passenger loads can be maintained, it compares well to other ground transport modes in requirements for vehicle kilometers (vehicle miles) and user time and cost.

Carrier management is faced with a number of complex issues in the effort to run an operation that provides both a high level of service to the public and a return to its owners. Carrier management as well as airport management would benefit from additions to the relatively small body of information on D/D van operations now available. The modal comparisons presented in this paper illustrate a potential framework for establishing policy toward the different modes. These comparisons can be extended to better reflect distributions of party size, trip duration, and other parameters according to the actual situation at a given airport. Likewise, the setting of service standards can be aided by data from actual experience. These and other steps can lead to the formulation of improved models of D/D van operations and of modal choice in airport ground transport.

Particularly needed are studies of the effect of trip end density on the performance of D/D van service. In low-density markets, circuity and waiting time involved in combining enough air parties to achieve successful load factors may significantly reduce the attractiveness of this mode. In such a situation, carriers must give careful consideration to charging higher fares in order to reduce the break-even load factor and hence the circuity and waiting time involved. Better models should help management of carriers and airports to take the steps needed for D/D van service to achieve its full potential.

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