Market for Vanpooling in the Baltimore Region

JOHN M. BAILEY

A market-estimation procedure is proposed that is based on computer-simulated work trips that occur in the Baltimore region. It identifies clusters (larger than 60) of long (greater than 10 miles one way) work trips between all 94 planning districts in the region. The number of trips selected is reduced by factors that depend on the percentage of workers at the destination who are employed at establishments that have more than 200 and 100 employees. The number of qualifying trips is increased if they originate in residential districts that have a significant percentage of dwelling units in clusters larger than 200. From the population of trips so selected, a subset of trips for which vanpooling is cheaper than carpooling or driving alone is identified. Trip costs are estimated by using a model that recognizes time as well as travel costs. Vanpooling is less costly, and thus more attractive, for commuting distances longer than an equal-cost distance. Under 1980 conditions, that distance is large enough so that the achievable market is limited to 200 vanpools. However, as perceived driving costs, the price of fuel, or parking costs increase, the equal-cost distance decreases and an estimated market of more than 2,000 vanpools could be achieved.

In the past decade, vanpooling has become a much-discussed mode for commuting to work. A vanpool is defined as a group of 7 to 15 people who ride to work in one vehicle and pay fares to meet driving expenses. In Maryland, where more than 300 vanpools were registered statewide in June 1981, the average number of passengers (plus the driver) is approximately 14 (1).

Because vanpools remove a number of vehicles from the road (5.9 in Maryland), vanpooling constitutes a significant measure for saving fuel, reducing vehicular emissions, and relieving congestion. Vanpools can result in savings not only to the participants but also to employers because they reduce the demand for parking facilities.

Two previous vanpool studies have been conducted in the Baltimore region and yielded market estimates of 2,300 (2) and 3,100 (3) vanpools. The purpose of this study is to reexamine the potential for vanpooling in the Baltimore region by using information from surveys conducted during the intervening years as well as several years' experience with ridesharing programs in Maryland.

Responses to the 1980 Maryland Mass Transit Administration (MTA) vanpool survey (1) showed an average one-way commuting distance of 29 miles for all pools: 19.7 miles for those picking up passengers near their front doors and 30.9 miles for those collecting passengers from a few central points. Round-trip van distance was greater than twice the direct one-way commuting distance because of the need to pick up and distribute passengers. The average daily round-trip distance traveled by vans in the survey was 67.6 miles. Approximately 144 vanpools originated or had destinations in the Baltimore region in 1980.

The market-estimation procedure used here divides the region into 94 districts and identifies clusters of long work trips between the districts. The clusters are then factored by the percentage of employees who work at large establishments in the work district and by the percentage of residences in the residential district in clusters of more than 200. [The Baltimore region is projected to have a population of 2,226,000 and employment of 1,046,000 by 1985 (4).] Trips that do not meet a minimum cluster-size criterion of 60 are rejected. From the population of trips so selected, a subset of trips for which vanpooling is cheaper than carpooling or driving alone is identified. Trip costs are estimated by using a model that recognizes time as well as travel costs (5). In general, vanpooling is less costly, and thus more attractive, beyond an equal-cost distance. The models show this distance to be sensitive to the price of fuel, perceived cost of operating an automobile, financial incentives for the purchase of vans, parking costs, and other factors. If changes in factors combine to reduce the equal-cost distance, then the market for vanpooling enlarges. Because the results are based on Baltimore costs and Maryland vanpool characteristics, it is the relative sensitivity of the market to various cost changes that is of most interest.

VANPOOL MARKET ESTIMATE

Potential Market

A 1985 work-trip table, simulated at the level of 94 regional planning districts (RPDs), was examined to find all residence-to-work trip combinations for which (a) the network travel distance was 10 miles or greater and (b) the number of trips was 60 or greater. The number 60 is based on Maryland experience and indicates the number of commuters that must be found with common residence and work locations in order to find 15 who have similar work hours and are able to pool. This corresponds to a potential 25 percent capture rate, but only for work trips longer than 10 miles. According to the district-level simulation, 52 percent of the work trips in the Baltimore region meet that criterion. The 10-mile minimum avoids conflict with regular bus service and agrees with current vanpool experience. Less than 2 percent of the vanpoolers responding to the MTA survey lived less than 10 miles from work. Furthermore, the models used indicate that, as commuting distance is reduced below 10 miles, the passenger pickup and delivery time can exceed 50 percent of total trip time. It is shown later than vanpooling is attractive for distances less than 20 to 30 miles one way, but only under certain conditions.

The trips that meet the two criteria above were further reduced by factors determined by the percentage of workers in the work district employed at establishments that have more than 100, 200, or 500 employees. For example, if a particular district had 75 percent of its employees working at establishments with more than 100 employees, 50 percent working at establishments with more than 200 employees, and 40 percent working at establishments with more than 500 employees, then all work trips that end in that district were multiplied by 0.75, 0.50, or 0.40 to estimate the number of trips destined for establishments larger than 100, 200, or 500 employees.

Residential concentration was recognized by multiplying the surviving trip clusters by $(1 + X)$, where X is the percentage of dwelling units in the residential district located in clusters of 200 or more. This arbitrary factor was used to reflect greater opportunities in areas of dense development.

To obtain the number of potential vanpools, the factored trips remaining were divided by 60. Fractional numbers ending in 0.9 were rounded up to the next whole number; numbers less than 0.9 (54 trips) were rejected. The results are given in the table

below and are arranged so as to show the vanpool market potential within 5-mile intervals:

One-Way Commuting Distance (miles)	Potential Market for Establishments Employing More Than 500	200	100
>35	6	9	9
30-35	38	56	69
25-30	161	231	277
20-25	303	445	532
15-20	481	676	897
10-15	731	1,043	1,306
Total	1,720	2,460	3,090

This table is also arranged to show the market as a function of the size of establishments cooperating in the program. If all of the more than 1,200 establishments in the Baltimore region that employ more than 100 workers were to cooperate, and the market for all commuting trips longer than 10 miles were exploited, then the potential market could be 3,090 vanpools.

The numbers shown in the previous table are an average of potential vans to, as well as from, all RPDs in the region and include vans that would originate or have destinations external to the region. They also recognize residential concentrations and assume that the ridesharing outreach program includes housing complexes as well as employment centers. Recognition of residential concentrations larger than 200 dwelling units contributes approximately 11 percent to the numbers in the previous in-text table.

The potential market has also been subdivided to indicate districts within the region where vanpooling potential exists. The central business district (CBD) in Baltimore is the largest potential attractor of vans, drawing 13 percent of the regional market. This result agrees with an estimate of 14 percent obtained for the Pittsburgh CBD (6).

Reasonably Achievable Market

The potential vanpool market figures presented in the in-text table are based on simulated trip length, clustering, and employment and residential concentration only. They do not recognize any of the other factors that limit the formation of vanpools. In the following section, calculations of a reasonably achievable vanpool market are made, which are based on the premise that vanpooling will occur only for those work trips for which it is less costly than carpooling or driving alone. A model is applied that indicates, for various sets of conditions, an equal-cost distance beyond which vanpooling is the least costly mode of transportation (5). Costs include time as well as driving costs. By applying this distance to the numbers given in the in-text table for the potential vanpool market, an achievable market of vanpool trips can be separated from the potential market. The size of the achievable market is found to be sensitive to various cost and incentive factors.

In calculating the markets, several initial assumptions or criteria were used:

1. Twenty percent of the vanpools will provide front-door service and 80 percent will pick up passengers at a few central places along the route. [These were the conditions found in 1980 vanpool survey (1).]
2. If vanpooling is less expensive than both driving alone and carpooling, the full vanpool market can be achieved for that trip length.
3. If vanpooling is less expensive than driving alone but more costly than carpooling, one-third of the market potential can be achieved. [This assumes that the demand for carpooling is double that for vanpooling, so that carpooling gets two-thirds of the market. Surveys of several ridesharing programs indicate that overall carpool demand may exceed vanpool demand by 3 or 5 to 1 (7). However, for the longer work trips and large clusters of work trips considered here, a ratio of 2 to 1 appears justified, particularly if vanpooling is fully promoted.]

1980 Base Case

The first reasonably achievable market calculation is based on cost factors that are assumed or derived from 1980 surveys in the region. It assumes that the van is leased (rather than company- or driver-owned), that fuel costs $1.25/gal, and that the perceived value of time of the commuter is $6/hr. From the surveys, the number of passengers per vanpool is taken to be 13.2, and the number of persons per carpool is 2.5. From Maryland vanpool data, 1980 average van leasing costs were $416/month and operating costs were $0.19/mile. In most cases, the vanpool service provided was basic rather than luxurious. Data obtained in the 1980 vanpool survey (1) showed that 20 percent of the vanpool passengers was picked up near their front doors and 80 percent drove an average of 3.6 miles to a pickup point where they joined the pool. The two types of vanpools had considerably different theoretical costs and real operating characteristics (time spent picking up passengers, line-haul times, route diversions), so they are addressed separately in the market calculation.

The tables below present estimates of the vanpool market for the cost conditions described above. The first table gives the achievable vanpool market in the Baltimore region (1980 base case):

Establishments Employing More Than	Estimated Vanpool Market	Actual Vanpools in Region, 1980
200	200	144
100	235	

The second table gives the equal-cost commuting distances (1980 base case):

Service	Calculated One-Way Commuting Distance (miles)
Front-door van versus	
Drive alone	18.8
2.5-person carpool	18.3
Central-pickup van versus	
Drive alone	30.2
2.5-person carpool	29.5

By using the costs given above, the model indicates that a front-door-service vanpool is less costly than driving alone or riding in a 2.5-person carpool for one-way commuting trips longer than 18.3 to 18.8 miles. The small difference between driving alone and carpooling results from the assumption that the solo driver goes directly to work whereas the carpooler goes to a central pickup place, as does the central-pickup vanpooler. Central-pickup vanpools are less costly for trips longer than 29.5 to 30.2 miles. These calculated distances agree with existing commuting distances for the two types of vanpools in Maryland: 19.7 and 30.9 miles.

The market shown in the tables above is calculated on the basis of the two levels of ridesharing promotional effort. One assumes that all

workers at establishments in the region that have more than 200 employees are exposed to the program, but that no effort is extended toward residential complexes. The other calculated level of effort would reach all workers at establishments that have more than 100 employees, as well as all residential complexes that have more than 200 dwelling units. The inclusion of establishments with as few as 100 employees would expand the market from 200 to 235. These are both conservative estimates, which are based on perceived low automobile operating costs. They do not reflect some of the ridesharing incentives (priority parking for pool vehicles and employer subsidy of van expense) that were already occurring in 1980. Nevertheless, the actual level of vanpooling in the Baltimore region in 1980--about 144 registered vans for a promotional effort reaching 45 percent of the employees at large establishments in the region--provides a validity check on the models and the assumptions used in applying them. The vanpool market estimate just made is based on perceived driving costs calculated from responses to a local commuting survey: $0.093/mile for persons driving alone and $0.066/mile/person for members of carpools. The latter figure translates into $0.165/vehicle-mile for a 2.5-person carpool and could reflect an increased awareness of driving costs on the part of carpoolers.

Although the data on perceived driving costs are sketchy, it is reasonable to expect that, with an increased emphasis on fuel-efficient automobiles and increasing insurance and maintenance costs, the average motorist will become more aware of the real costs of driving. With this change, vanpooling might become competitive with carpooling and driving alone over commuting distances that are not as great.

What might be the result if an educational campaign succeeded in changing driving costs as perceived by commuters to higher, more realistic levels? Two cost levels will be considered (5): (a) $0.13/mile (fuel, tires, oil, maintenance, and mileage-dependent insurance), and (b) $0.20/mile (the above plus mileage-dependent depreciation). The depreciation or wear term is based on an initial cost minus salvage value of $7,000 spread over 100,000 miles. Other ownership costs could be included, but it is assumed that the car left at home by the vanpoolers is not sold and is used for other types of trips.

Vanpool costs, which are real and must be paid for with fares, will be assumed to remain at the 1980 level of $0.19/mile. For vanpools, wear is covered by the monthly leasing cost of $416.

Table 1 gives the marked expansion of the vanpool market (from 200-235 to 1,200-1,650) that could result if the average commuter were to perceive realistic automobile operating costs, compare them with vanpooling costs, and behave economically. Because carpoolers already perceive automobile operating costs to be $0.165/mile, the carpooling share of the market is unchanged for a perceived cost of $0.13/mile. However, at $0.20/mile, vanpooling gains on carpooling because it costs less for one-way trips longer than 17 or 20.5 miles, depending on the type of vanpool service. The vanpool market is expanded accordingly.

Changes in Price of Fuel

Consider now a market in which a commuter's cost perceptions remain at the 1980 base level, but the price of fuel in 1980 dollars per gallon increases. For fuel that costs $1.25/gal (as in 1980) and an average automobile that gets 17 miles/gal, fuel costs are $0.073/mile. Thus, the solo driver's perceived cost of $0.093/mile would correspond to the cost of fuel plus $0.02/mile. By the same reasoning, the carpooler's $0.165/vehicle-mile corresponds to the cost of fuel plus $0.092/mile. For a 10-mile/gal van, the 1980 real van operating cost of $0.19/mile corresponds to the cost of fuel plus $0.065/mile. With these numbers, new costs that correspond to more expensive fuel can be calculated.

Fixed costs for both automobiles and vans will be held at 1980 levels. If the price of fuel were to increase to $2 (in 1980 dollars), the perceived drive-alone, perceived carpool, and real vanpool operating costs per mile would increase to $0.138, $0.21, and $0.265, respectively. With fuel at $3/gal, the three costs become $0.196, $0.268, and $0.365/mile. As indicated in Table 1, $2 for fuel could expand the reasonably available vanpool market to 1,075 to 1,490. If the price of fuel were to increase to $3 and all other cost conditions remained as in 1980, the vanpool market could expand to 1,680 to 2,330, depending on the size of employers cooperating.

The market estimates are based on competition between vans with 10 miles/gal efficiency and cars with 17 miles/gal efficiency. If the efficiency of the car is doubled to 35 miles/gal, the vanpool market estimate drops by 27 to 29 percent.

Financial Incentives for Vanpooling

Two barriers that have limited the growth of vanpooling are the fact that the pool must be self-supporting in real cash terms and that a capital expenditure must be made for a vehicle whose use is largely limited to commuting. In view of all of the overall fuel savings and vehicular emissions reductions that result from vanpooling, it is reasonable to consider several subsidy measures that would reduce the cost of vanpooling relative to other commuting modes (8).

The first to be considered is company ownership of the vans. Vanpool experience indicates that passengers in company-sponsored vans pay less fare. (In

Table 1. 1985 reasonably achievable vanpool market in Baltimore region for various real or perceived costs.

Item	Equal-Cost Commuting Distance (miles, one-way)				Market, Including All Establishments Employing More than	
	Front-Door Vanpool versus		Central-Pickup Vanpool versus			
	Drive Alone	Carpool	Drive Alone	Carpool	200	100
1980 base case	18.8	18.3	30.2	29.5	200	235
Perceived automobile operating costs						
$0.13/mile	13.6	18.3	13	29.5	675	960
$0.20/mile	<10	17	<10	20.5	1,200	1,650
Price of fuel						
$2/gal	13.4	16.3	11	21.2	1,075	1,490
$3/gal	10.5	14.2	<10	15.2	1,680	2,330

Table 2. 1985 reasonably achievable vanpool market in Baltimore region for effect of incentives and disincentives.

Item	Equal-Cost Commuting Distance (miles)				Market, Including All Establishments Employing More than	
	Front-Door Van versus		Central-Pickup Van versus			
	Drive Alone	Carpool	Drive Alone	Carpool	100	200
1980 base case	18.8	18.3	30.2	29.5	200	235
22 percent company subsidy	16	16	21	21	680	920
15 percent federal income tax rebate	16.3	16.3	19	21	720	970
Interest-free van loans	15.2	15.2	18	17.4	1,010	1,375
Priority parking	16.4	18.3	25	29.5	290	380
$2 parking fee for commuting vehicles	<10	15.3	<10	15.9	1,520	2,080

1980, 19 perecent of the vanpools in Maryland were company-sponsored, with the passengers paying 22 percent less fare, on average.) The subsidy that is involved can be the result of lower insurance rates for fleet vehicles, preferred interest rates on loans, or a simple picking up of expenses that would have to be paid by passengers in a leased van.

If company sponsorship of vans, accompanied by a 22 percent reduction in van operating and capital costs, were to cover the region, the vanpool market could more than triple [from 220-235 to 680-920 (see Table 2)].

Two measures that could ease the purchase of vans for pooling are federal income tax relief [as proposed by Senator David Durenberger (IR-Minnesota) in Bill S239 (Congressional Record, January 22, 1981)] and low-interest loans. For purposes of illustration, a tax rebate (amounting to 15 percent of the purchase price to individuals who purchase vans) and interest-free van loans are considered. These two measures could reduce monthly fixed costs (5), and with them equal-cost commuting distances, so as to increase the vanpool market to 720-970 and 1,010-1,375 vans in the region (Table 2). According to the cost model used, the effect of these subsidies on the estimated market is less than increasing the price of fuel (Table 1).

Parking Management

Control of the parking space available for commuting vehicles can be a potent factor in the encouragement of ridesharing (9). In this section, the impact of two parking measures on the vanpool market are considered. The first, already in common use in the Baltimore region, is the reserving of preferred parking spaces for pool vehicles. Assuming that all commuters who drive alone must walk an extra 2.5 min from their parking places to the work entrance, a daily time penalty of $0.50 is being imposed (5 min/day at $6/hr). The effect of even this small time penalty could increase the vanpool market by half (from 200-235 to 290-380).

A more severe measure, which is still not feasible in most areas, would be to eliminate all free commuter parking and charge each vehicle a $2/day parking fee. Seventy-five percent of the commuters in the Baltimore region currently park free (10). The effect of a $2 fee would be to encourage vanpooling at the expense of both carpooling and driving alone. Table 2 indicates that imposition of such a parking charge (in all employment areas, not just in the CBD) could expand the vanpool market by a factor of eight. The impact could be similar to that of $3 fuel (Table 1).

Three Levels of Vanpool Marketing Effort

The preceding sections have estimated the market impact of a number of cost changes taken one at a time. If, instead, several strategies are applied simultaneously, the results could be as given in the table below, which describes three levels of vanpool promotional effort:

Level of Effort	Description	Vanpool Market
A	All employers larger than 200 employees and priority for pool vehicles	290
B	A plus all residential complexes larger than 200 dwelling units, 15 percent federal tax rebate, or interest-free van loans	780
C	B plus all employers larger than 100 employees, $2 parking fee for all commuting vehicles, or education to perceive automobile operating cost as $0.20/mile	2,100-2,575

Level A continues the current effort in the Baltimore region. Level B features outreach to residential clusters and some financial incentives, and level C is an all-out or contingency effort that involves a combination of the single measures discussed previously.

CONCLUSIONS

Under 1980 conditions, the cost of vanpooling, including time costs associated with pickup and delivery of passengers, was such that vanpooling was attractive only for long commuting trips. However, as various real or perceived driving costs are altered, the length of trip for which vanpooling is cost competitive will decrease markedly, and the estimated achievable vanpool market could increase to an even greater extent.

It should be understood, however, that this market can be reached only if every possible means of assisting the formation of vanpools and finding drivers is applied. These could include

1. Provision of computerized match lists that contain 50 to 75 names to persons interested in vanpooling;
2. Provision of more incentives for vanpool drivers than are currently available, such as free use of the van during weekends and, for leased vans, assistance in getting the vehicle to and from the garage for maintenance;
3. Preferred insurance rates for pool vans;
4. Exemption from portions of license fees or sales tax for pool vans;
5. Zero down-payment loans for purchase of pool vans;

6. Priority treatment of pool vehicles at toll booths;
7. Provision of safe, convenient, and well-signed park-and-ride lots;
8. Changes in zoning ordinances to discourage the use of large areas for employee parking;
9. Tax credits for employers, as well as employees, who participate in carpooling;
10. Priority access to fuel for pool vehicles in time of fuel scarcity;
11. Encouragement of alternative work schedules to permit pooling by employees who previously could not pool because of differences in work hours;
12. Provision of ideas to employers on use of vans during work hours as well as for commuting;
13. Provision of information on employee travel allowances to employers; and
14. Promotional efforts with employee labor unions or credit unions.

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Community-Based Ridesharing: An Overlooked Option

JOANNA M. BRUNSO AND DAVID T. HARTGEN

The neighborhood ridesharing demonstration, which took place in four residential communities in the Albany, New York, area, is described. The project tested whether personalized coordinator techniques could be used at the home end because residential areas offer homogeneous neighborhoods with established social networks. Careful test design and internal recording allowed for a rigorous evaluation and comparison with other approaches. The neighborhood ridesharing coordinator program was shown to be a viable concept. Coordinators were successful in organizing ridesharing from the home end. The advertising methods found to be most successful were word-of-mouth, newspaper articles about the program, and community group meetings. In comparison with employer-based coordinators, neighborhood coordinators were equally effective in the number of placements and in cost-effectiveness measures. Given that employer ridesharing programs gradually rise to a saturation point, a neighborhood program, which has a larger population base and continuous changeover in residents, has possibilities for cost-effective expansion.

Government-sponsored carpooling programs began during the 1973-1974 energy crisis and focused largely on computerized matching services. The main thrust of these early programs was the savings in gasoline and money to be achieved (1,2). Interest fell off sharply as the crisis abated, and two-thirds of the programs initiated were discontinued. For those programs that were continued, promotional campaigns were expanded and the focus was on economic savings. Interest again increased sharply during the 1979 fuel crisis but then subsided as the crisis abated. Review and evaluation of these programs has been difficult. Rarely have such programs accounted for more than 1 percent of areawide work vehicle miles of travel (VMT). Clearly these programs are not having the effect intended by their promoters.

Additional evidence also suggests that the problem of increasing carpooling is far more difficult than first surmised. First, carpooling already involves 19 to 23 percent of work travel in many metropolitan areas (3) and has been stable at that level since at least 1970; these levels are confirmed in the 1980 census (4). Second, research into carpooling behavior (5-8) has disclosed that long-term ridesharing is often a social phenomenon rather than an economic one. Most people are reluctant to contact nonacquaintances to initiate carpools except in the face of a major crisis. Economically oriented carpools are a much smaller group and more transitory than the first group. The emerging picture is that carpooling is a social phenomenon that is largely impervious to government pressure.

One suggested approach to dealing with the reluctance of people to carpool is the use of a carpool coordinator. The coordinator works out of an employment or neighborhood site by using personalized methods to promote ridesharing, match participants, perform introductions, and resolve ridesharing problems. In this way many carpooling difficulties can (in theory) be overcome.