The Johns Hopkins University
Center for Metropolitan
Planning and Research
Baltimore-Maryland

"COMMUTER RIDESHARING, AN OVERVIEW"

Christian de Flers
Junior Fellow
- LIST OF ACRONYMS -

- UMTA : Urban Mass Transportation Administration
- HUD : department of Housing and Urban Development
- VMT : Vehicle Miles of Travel
- AOA : Administration on Aging
- DOT : Department of Transportation
- TSM : Transportation System Management
- HOV : High Occupancy Vehicle
- FHWA : Federal Highway Administration
- CBD : Central Business District
- DOE : Department of Energy
- EPA : Environmental Protection Agency
- MPO : Metropolitan Planning Organization
- FLSA : Fair Labor Standard Act
I) INTRODUCTION

Most American cities have witnessed an outward movement of the population from their core areas to the outer edges of the urban system. This is principally due to the development of the automobile as the best way to keep mobility along travel corridors of much lower density (cumulative effects) and to the search for superior low densities residential amenities (environmental, fiscal advantages). See the case of Milwaukee in FIG-I-1 as representative of development trends.

As developmental density was too low to financially support large size transit vehicles, operating on a fixed route and on fixed schedules, in view of the inherent ineffectiveness of conventional transit to serve dispersed travel patterns (and this more and more with the decreasing revenues from the "fare box" together with the increasing operating costs), the automobile appeared to be the long term means of moving people. (see FIG-I-2 about the increasing reliance on auto ownership and utilization since 1910). There is no such thing as perfect bliss and the American love affair with the automobile began to show negative impacts that become more and more recognized: increasing traffic congestion and air pollution levels, fiscal, environmental and social constraints to major highway construction projects, scarce and costly parking in major activity centers, long, costly and stressful commuting trips, the non-availability of the automobile for everyone (the transportation disadvantaged, including the elderly, the young, the handicapped and the poor) and above all, the dangerous dependence on uncertain and expensive foreign fuel resources.

As a result, attention has focused more and more on other ways of transportation and the traditional approach to such problems has been abandoned. Paratransit systems are among alternatives which have proven their ability to induce net savings in vehicle miles through increased highway capacity and to ensure mobility for those who are disadvantaged from a transportation standpoint. This term denotes group travel by any mode including carpooling, vanpooling, buspooling, share ride taxi, jitney, either in mixed flow traffic or on exclusive high-occupancy vehicle facilities, with the vehicles in use being either privately or publicly owned.

According to what has been said previously, we can define paratransit mode as being situated between two extremes prevailing in common means of transportation:
Persons per square mile

- TYPICAL RESIDENTIAL DENSITIES (MILWAUKEE AREA)

FIGURE I-1

City of Milwaukee 8000
Close in suburb - Shorewood 4400

-2-
Automobiles per capita

FIGURE 1-2

NATIONAL AUTOMOBILE OWNERSHIP
At this point, two forms of paratransit seem to emerge: the first is oriented towards efficiency and constitutes the topic of this study while the second is socially oriented and focuses upon the transportation needs of people who can be served by neither the automobile or mass transit.

The later form, although not developed in the next sections, must not be neglected because the transportation disadvantaged represent a large amount of the population of the United States, and few words must be expressed to give a better idea of the present and prospective situation.

A transportation disadvantaged is a person unable to drive an automobile or who is not sufficiently wealthy to purchase and maintain one. This includes:

- The elderly: figures are difficult to establish because of the definition itself of old age. The number of people over age 65 is expected to increase from today's 19 million to 27 million in 1990.
- The handicapped (physically or mentally); here the figures can only be approximate in view of the varying degrees of disability. The number of people unable to use mass transit stands currently at 9 million and is expected to reach 11 million by 1990.
- The poor who are in growing number with transportation consuming an increasing portion of the household budget.
- The young, unauthorized to drive an automobile before a certain age that varies from state to state.

As can be seen, the number of those who are transportation disadvantaged is already of some importance (47-70 million), and is expected to increase with the progress in health care. As previously mentioned, accurate figures cannot be given because of the overlapping of certain categories (e.g., old people and handicapped).

Paratransit, by providing door to door service and a better level of transportation than conventional transit, has the ability to serve a major portion of this market. The Department of Housing and Urban Development (HUD) launched the first use in federal money for this purpose in the mid 1960's when realizing that inadequate transportation to work is a factor leading to high unemployment rates, and supported projects providing door to door service for people working in suburban areas.
Legislation to enhance their mobility has been enacted by the Urban Mass Transportation Administration (UMTA) of the Department of Transportation (DOT) in 1976 and 1979, requiring that 5% of all formula funds to be eligible for capital or operating assistance of mass transit must be used to serve the mobility of the elderly and handicapped by any adequate system. On the other hand, direct transportation subsidies from diverse social welfare, health, employment and education programs (ex: Administration on Aging of the UMTA) have provided more impetus for the emergence of paratransit as a means of assuming social services, either by initiating their own transit systems or by giving capital assistance to private non profit agencies. But because of non coordinated planning and management legislation constraints, administrative requirements (red-tape), eligibility restrictions to many separate sources of federal funds, large scale operations were not able to materialize efficiently. Also, mass transit has always been suspicious of possible competition and even more so as its financial problems have worsened. In actual practice, paratransit acts as a complement of mass transportation (system integration) rather than taking riders from high occupancy vehicles and this is very true for special market's segments as transportation for the disadvantaged where few or no mass transportation options exists. For this complementarity to be achieved, a close collaboration between the providers of transportation must be accomplished to avoid either a repetition or a lack of response to travel needs. In this direction, the role of a broker or coordinator appeared essential to meet potential riders and either public or private providers and will be developed in section III of this study.

Efficiency oriented ridesharing systems are of particular interest in view of increasing automobile operating costs and advantages that are derived from such systems on behalf of the public and of individuals. This interest for energy savings through reducing vehicle-miles of travel (VMT) was particularly acute during the oil embargo of 1973-1974, being in fact the original stimulus of paratransit demonstration programs. Although 2/3 of the programs initiated during this period and accounting for 70% of the total demonstration budget were discontinued, the idea of ridesharing and its advantages was developed and defined. The number of long range and well organized vanpool programs have doubled every year since 1974 as shown in the following table:
<table>
<thead>
<tr>
<th>Year</th>
<th>Number of sponsors</th>
<th>Number of sites</th>
<th>Number of vanpools</th>
</tr>
</thead>
<tbody>
<tr>
<td>1973</td>
<td>1</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>1974</td>
<td>15</td>
<td></td>
<td>125</td>
</tr>
<tr>
<td>1975</td>
<td>25</td>
<td></td>
<td>240</td>
</tr>
<tr>
<td>1976</td>
<td>56</td>
<td></td>
<td>643</td>
</tr>
<tr>
<td>1977</td>
<td>86</td>
<td></td>
<td>1,100</td>
</tr>
<tr>
<td>1978</td>
<td>122</td>
<td>163</td>
<td>1,986</td>
</tr>
<tr>
<td>1979</td>
<td>308</td>
<td>372</td>
<td>4,382</td>
</tr>
<tr>
<td>1980</td>
<td></td>
<td></td>
<td>7,050</td>
</tr>
<tr>
<td>1981</td>
<td>400</td>
<td></td>
<td>20,000</td>
</tr>
</tbody>
</table>

To these figures, must be added the non negligible number of privately owned and operated vanpools and carpools. This number is very difficult to determine and must be approximatively equal or greater than the number of employer and third-party sponsored vanpool programs.

To understand the increase in car occupancy rates, some data related to the automobile must be given to isolate the problem and to define realistic solutions.

- Transportation accounted in 1977 for 26% of all U.S. energy consumption and 54% of petroleum consumption. On this, the private automobile represented 52% of transportation energy use (and 67% of highway use). In 1980, consumption of motor gasoline reached 7.37 Million Barrels/day (approximately 310 Million gallons). Despite a drop of 9.7% in oil consumption during the first five months of 1980, the United States continues to be more and more dependent on foreign resources (42%) as shown by the following figures:
Imported oil consumption in Billion of gallons

<table>
<thead>
<tr>
<th>Years</th>
<th>Dollars spent in $ Billion</th>
<th>Domestic oil consumption in Billion of gallons</th>
<th>Imported oil consumption in Billion of gallons</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1965</td>
<td></td>
<td></td>
<td></td>
<td>59.2</td>
</tr>
<tr>
<td>1970</td>
<td></td>
<td>3.1</td>
<td>184.4</td>
<td>245.6</td>
</tr>
<tr>
<td>1975</td>
<td></td>
<td>26.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td></td>
<td>93</td>
<td>121.6</td>
<td>285.6</td>
</tr>
<tr>
<td>1990 forecast</td>
<td></td>
<td>156.8</td>
<td>93.6</td>
<td>250.4</td>
</tr>
</tbody>
</table>

This resulted in an increase in the price of gasoline on the market:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Price/Gallon</td>
<td>65¢</td>
<td>88¢</td>
<td>$1.2</td>
<td>expected to reach $2 in december</td>
</tr>
</tbody>
</table>

The automobile accounts for 90% of all VMT and this percentage is expected to increase rapidly in the next decade (see FIG-1-3).

Technical progress has been made to increase the fuel efficiency of automobiles; this gain of 5% in urban driving has been offset by a decrease in vehicle-occupancy by 4% to reach the actual rate of 1.33p/car. With all the figures mentioned previously, we can see that a little change in the use of automobile (technical progress toward fuel efficiency, reduction in VMT, increase in car occupancy rate) involves drastic transformations in the total amount of oil consumption. From this
### FIGURE I-3

<table>
<thead>
<tr>
<th>1990 Population group in thousands</th>
<th>Number of Urban Areas</th>
<th>Population in Millions 1968</th>
<th>Population in Millions 1990</th>
<th>percentage of increase</th>
<th>Annual VMT in Millions 1968</th>
<th>Annual VMT in Millions 1990</th>
<th>percentage of increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 to 100</td>
<td>95</td>
<td>4.66</td>
<td>6.93</td>
<td>48.7</td>
<td>16,100</td>
<td>28,300</td>
<td>75.8</td>
</tr>
<tr>
<td>100 to 250</td>
<td>98</td>
<td>10.18</td>
<td>15.82</td>
<td>55.4</td>
<td>35,700</td>
<td>66,400</td>
<td>86.0</td>
</tr>
<tr>
<td>250 to 500</td>
<td>54</td>
<td>11.69</td>
<td>19.22</td>
<td>64.4</td>
<td>40,800</td>
<td>79,100</td>
<td>93.9</td>
</tr>
<tr>
<td>500 to 1,000</td>
<td>30</td>
<td>13.09</td>
<td>21.82</td>
<td>66.7</td>
<td>46,500</td>
<td>91,100</td>
<td>97.0</td>
</tr>
<tr>
<td>Over 1,000</td>
<td>40</td>
<td>81.48</td>
<td>126.39</td>
<td>55.1</td>
<td>294,300</td>
<td>530,500</td>
<td>80.3</td>
</tr>
<tr>
<td>Total</td>
<td>317</td>
<td>121.10</td>
<td>190.18</td>
<td>57.0</td>
<td>433,400</td>
<td>795,900</td>
<td>83.6</td>
</tr>
</tbody>
</table>

- POPULATION AND VEHICLE MILES OF TRAVEL IN UNITED STATES -

-8-
to be among the principal means of achieving this goal and others which will be reviewed in the next section (more efficient land use, etc...).

But the system represented by the automobile includes different travel patterns and ridesharing, by its evident requirements (join the people together), cannot serve all segments of this vast market. The most cumulative appealing segment is commuter ridesharing (home-work roundtrips) and the following data will support such a choice:

- Commuting accounts for nearly 40% of all automobile trips and consumes 34% (1.8 Million barrels/working day or 75.6 Million gallons/working day) of the daily automotive gasoline consumption.

- The average commuter car occupancy rate is 1.4 (28% occupancy rate) with 74% of commuters driving alone.

- 27% of all automobile commuters travel more than 10 miles to work accounting for 68% of commuter VMT and for more than 20% of all VMT (32.5% if we consider all work trips).

Therefore, this commuter market represents numerous advantages: 1) It is easiest to catch because of cost, boredom and time involved in this kind of trips (70% of all work trips occur in metropolitan areas where congestion and environmental factors make automobile operation especially inefficient and undesirable), and because of the inability of mass transit to serve widely dispersed travel patterns; 2) The market is very prestructured in terms of origins-destinations and time tables for riders; 3) The advantages are of great concern for employees, employers or the community as a whole. (see FIG-I-4 for the repartition of work trips in the day)

A lot has been done already to serve this market and 47% of the nation's automobile commuters ride in private multioccupant cars, carrying about 2.8p/car, the current average occupancy of new carpool being 2.85 instead of an earlier figure of 1.2.

Greater emphasis has been given to the carpool system within paratransit of less formal organization required in comparison to vanpool programs involving more passengers, and because of the travel patterns inside the commuter market. In effect, 51.8% of work trips are 5 miles or less, 71.9% are 10 miles or less (13.8% are 20 miles or more) with an average home-work roundtrip of 19.4 miles. On the other hand, fuel efficiency is easier to achieve through carpool (3 persons in a 40 mile/gallon car represents the same fuel efficiency/passenger as 12 persons in a 10 mile/gallon van).

An evaluation of the principal means of transportation used for work trips in 1979
Percentage of 24-hour trip

- REPARTITION OF WORK TRIPS IN THE DAY -
and which can be compared to the data available from vanpool programs for the same year (7,050 vanpools representing approximately 85,000 persons) makes clear the importance of carpooling within the paratransit system.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Number of people</th>
<th>Percentage of the total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single occupant cars</td>
<td>52,294,000</td>
<td>67.4</td>
</tr>
<tr>
<td>Carpools</td>
<td>15,575,000</td>
<td>20.1</td>
</tr>
<tr>
<td>Mass transit</td>
<td>4,684,000</td>
<td>6</td>
</tr>
<tr>
<td>Others</td>
<td>4,986,000</td>
<td>6.5</td>
</tr>
</tbody>
</table>

More can be done to reduce the 156 Million empty seats travelling every working day and representing a reduction in existing highways efficiency. Incentives to rideshare are directly derived from the advantages inherent to paratransit and particularly from financial returns; but others can be added to accelerate the shift to higher occupancy vehicles. Among them:

- Reducing or eliminating tolls for carpools, vanpools or buspools which offers two advantages for the commuter: 1) financial in the few cases where access to highways require the payment of tolls; 2) time savings by avoiding lines of single-occupant cars (example of implementation: San-Francisco-Oakland Bay-Bridge).
- Construction of preferential or exclusive lanes for high occupancy vehicles (HOV) which is a part of the Transportation System Management (TSM) projects to be federally supported. Two types of implementation exist, each having certain disadvantages: 1) by the construction of one additional lane involving high costs; 2) by closing one existing lane to general use consequently raising public disapproval and the overall number of infractions (50%). In addition, an increase in the quantity and severity of accidents can be perceived in view of greater speed difference between vehicles in the two categories. Already, 50 separate traffic lanes for buspools, vanpools and carpools have been established in 33 cities (Los Angeles,
Honolulu, Miami, Boston, Minneapolis, Washington, etc...

- Floating working hours allowing the employee the option of permanently shifting hours to adjust to buspool, vanpool or carpool schedules.
- Priority commuter parking, allowing ridesharing commuters to park free near the place of employment (already implemented within numerous states). Price incentives in this direction have limited impact because less than 10% of employees pay for parking at work.

All these incentives and the advantages of ridesharing are necessary to change people's approach to the system of commuting. The comfort and privacy of driving to and from work has become deeply ingrained in their mind, and overcoming this habit will require a considerable shift in attitude. Studies conducted by the Department of Transportation (DOT) show that 60% of the people driving alone to work considered themselves unlikely poolers, the resistance to carpooling being most predominant among older, higher income employees. In any case, if the remaining 40% changed their opinion, more savings would result and the actual percentage would decrease in the time, in view of the more and more negative impact of the automobile.
II) ADVANTAGES OF COMMUTER RIDESHARING

Many advantages, direct or indirect and of varying importance, benefit the community as well as the individual. The impact of ridesharing is of great concern for 3 groups which in turn play a role in the existence of the system:

1) The community and therefore the government which assumes some responsibility for the implementation and continued operation of the system.
2) Employers or brokers who bear some degree of responsibility in the viability of the system.
3) Individuals who, by adopting or rejecting the system, play a significant role.

The direct or indirect profits represented by ridesharing are channelled towards each of these groups and tend to have a cumulative as well as interrelated effect. However, a study of these benefits in terms of each individual group is made worthwhile by the distinct positions occupied by each element contributing to the paratransit system.

II-1) The national level

Ridesharing owes its existence to the savings in energy consumption that are derived from a more efficient use of transportation facilities. In fact, the advantages are related and mutually dependent. The following data are for April 1, 1980:

<table>
<thead>
<tr>
<th>Million Barrels</th>
<th>/day</th>
<th>/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Million Gallons</td>
<td>0.31</td>
<td>112</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Million Barrels</th>
<th>/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Billion Gallons</td>
<td>0.014</td>
</tr>
</tbody>
</table>

- General consumption -

- Energy savings through ridesharing -

<table>
<thead>
<tr>
<th>Million Barrels</th>
<th>/working day</th>
<th>/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Billion Gallons</td>
<td>0.31</td>
<td>79</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Million dollars</th>
<th>/working day</th>
<th>/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Billion dollars</td>
<td>0.014</td>
<td>3.326</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Million dollars</th>
<th>/working day</th>
<th>/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Million dollars</td>
<td>114</td>
<td>27,360</td>
</tr>
</tbody>
</table>
This saving through ridesharing represents approximately 3% of the general consumption of the United States. The increase in the car occupancy rate contributes to fuel reduction in two ways: directly by the decrease in VMT and indirectly by the fact that having a more efficiency oriented use of highways, less congestion results and the remaining one occupant cars can increase their speed in congested corridors.

The consumption curve of a car, as shown in FIG-II-1, indicates that better fuel efficiency occurs when the vehicle is travelling at uniform speeds, between 30 and 40 miles per hour. As traffic flow becomes less dense, another benefit occurs namely in the reduction of automotive costs reflected by lesser wear on brakes and tires (less interruption in traffic flow).

It is also of interest to determine the potential savings of ridesharing in the future in terms of increases in the national occupancy rate, increases in the commuter VMT saved or increases in the number of people joining a carpool or vanpool. The following figures will provide more detail concerning any shift toward ridesharing:

- For an upward shift of 0.1 in the national occupancy rate, 1.8 Million gallons/working day are saved (432 Million gallons/year equivalent to 604.8 Million dollars if we consider a stable price of $1.4/gallon which minimizes the positive financial impact of the shift).

- Value of saving 1% commuter VMT: with an average operating cost of $0.17/mile for a roundtrip of 19.4 miles involving 68,000,000 cars with an average occupancy rate of 1.4, for 240 working days/year, we have the saving of:

\[
\frac{0.17 \times 19.4 \times 68,000,000 \times 240}{1.4} \times 0.01 = 385 \text{ $ Million}
\]

An idea of the potential VMT saving attributed to ridesharing progress as a function of the city size is given in FIG-II-2. Also, these savings can be translated in gallons or dollars (assuming that 1 gallon=$1.4) to obtain the curve denoted by FIG-II-3.

The sprawl of American cities having created low and medium density areas where conventional mass transit is not of sufficient flexibility or financial efficiency, para-transit appeared to be a new, more convenient and rapid service that is tailored to working hours of the people. Labor costs range 65 to 85% of the total annual operating of mass transportation systems and grow faster than revenues, contributing to a more and more important percentage in the annual deficit of mass transit. Generally these costs are avoided in most vanpool programs. In effect, the driver is one of the riders, his compensation consisting of a free ride and the availability of the van during
Fuel economy (m/g)

Average speed on congested highways, moving toward a zone of better fuel efficiency

- FUEL ECONOMY VS VEHICLE SPEED -

-15-
FIGURE II-2

Total annual VMT reduction (Million)

- VMT SAVINGS ATTRIBUTED TO COMMUTER RIDESHARING -
  PROGRESS AS A FUNCTION OF THE CITY SIZE
FIGURE II-3

- TOTAL ANNUAL FUEL CONSUMPTION REDUCTION -
non work hours, at a charge/mile determined by contract. In few cases, the driver receives part time compensation involving wages that are not as significant and work regulations not as stringent as those prevailing in conventional transit systems. The improvement of environmental conditions is another important aspect of ridesharing and can be divided into 3 groups of advantages:

-1- Deferral of highway additions, road constructions or fixed rail systems in congested corridors due to a higher efficiency of transportation related facilities. FIG-11-4 shows the optimal freeway capacity increasing with the car occupancy rate in peak hour traffic flow. Therefore, less transit subsidies would be required for new and costly constructions, and could be released for other purposes.

-2- Reduction in parking space requirements in view of better approaches to land use, a lesser amount of land being needed for a same number of riders after an increase in the car occupancy rate. This advantage, directly perceived by the employer will be reviewed in more details later.

-3- Pollution abatement through a reduction in carbon monoxide (CO) and hydrocarbon emissions (HC), due to a small increase in the average speed (see FIG-11-5). Reduction in air pollutants are estimated to be 8,000 tons/year (17,640,000 pounds). Pollution and noise abatement will also help neighborhood revitalization by improving their attractiveness and safety, particularly on high density travel corridors (example: South-End in Boston).

On the other hand, the percentage of accidents on highways is a direct function of their degree of congestion (see FIG-11-6). FIG-11-7 shows the approximate reduction in highway accident costs, depending on the percentage of shift to carpooling.

To summarize chapter 11-1, we may state that environmental improvements and energy savings constitute the two fundamental advantages derived from ridesharing systems.

II-2) The employees

One of the strongest incentives for an individual to join a paratransit system is the potential reduction in transportation costs. TABLE II-8 gives an idea of the different costs applied to the different modes of transportation available to the commuter. The figure in this table are from 1975 and since that date all operating and capital costs of transportation modes have increased, further altering their specific accuracy in relation to any general observations that may be drawn from the
<table>
<thead>
<tr>
<th>Persons per vehicle</th>
<th>Percentage of the total</th>
<th>2.5% carpool shift</th>
<th>5% carpool shift</th>
<th>10% carpool shift</th>
<th>20% carpool shift</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>73.4</td>
<td>71.4</td>
<td>69.4</td>
<td>65.4</td>
<td>57.4</td>
</tr>
<tr>
<td>2</td>
<td>23.0</td>
<td>22.5</td>
<td>22.0</td>
<td>21.0</td>
<td>19.0</td>
</tr>
<tr>
<td>3</td>
<td>2.6</td>
<td>4.2</td>
<td>5.8</td>
<td>9.0</td>
<td>15.4</td>
</tr>
<tr>
<td>4</td>
<td>0.7</td>
<td>1.3</td>
<td>1.9</td>
<td>3.1</td>
<td>5.5</td>
</tr>
<tr>
<td>5 or more</td>
<td>0.3</td>
<td>0.6</td>
<td>0.9</td>
<td>1.5</td>
<td>2.7</td>
</tr>
</tbody>
</table>

Vehicle Occupancy Rate

Idealized Freeway Capacity (p/h/lane)

<table>
<thead>
<tr>
<th></th>
<th>1.31</th>
<th>1.37</th>
<th>1.43</th>
<th>1.54</th>
<th>1.77</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,600</td>
<td>2,740</td>
<td>2,860</td>
<td>3,540</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In this table, we assume that carpools include cars with 3, 4, 5 persons or more.

- DIFFERENTIAL SHIFTS IN PEAK HOUR COMMUTER TRIP VEHICLE OCCUPANCIES -
  AFFECTING HIGHWAY LANE CAPACITIES -
- PERCENTAGE OF ACCIDENTS AS A FUNCTION OF TIME OF DAY -
- REDUCTION IN HIGHWAY ACCIDENT COSTS -

City population (thousands)

Savings in $
Automobiles with an occupancy rate greater than 3 as well as vans appeared, by far, to be the least expensive means of travel. The driving commuter often perceives only the out of pocket costs in evaluating commuting expenses. Insurance, maintenance and depreciation costs represent a level of underestimation which can amount to as much as 2/3 of the total cost, the other 1/3 representing operating costs. On the other hand, substantial subsidies to buses and fixed rail systems through taxes (property, sales, income and a variety of excise taxes) make the cost of mass transit seem smaller, contributing to misleading conclusions in the evaluation of commuting expenses. This underestimation can be substantial in small cities with low residential and employment densities where mass transit involves higher costs than those mentioned in TABLE-II-8 for larger urban areas.

Thè costs shown in TABLE-II-8 are indirect costs. They include:

- For the automobile: capital and operating costs of the automobile itself, and of parking facilities, prorated costs to build, maintain and operate highway facilities.
- For the bus system: capital and operating costs of the bus itself, prorated costs to build, maintain and operate highway facilities.
- For the rail system: capital and operating costs of the rail line, costs represented by equipment and stations.

According to a recent survey in Knoxville (Tennessee), a division of cost/mile for the utilization of a standard car would present the following configuration:

Vehicle cost depreciated ($4.5) + Maintenance and accessories ($3.7) + Gasoline and oil ($5.5) + Insurance ($1.7) + State and federal taxes ($1.6) = $17/mile

TABLE-II-9 has been built on this basis to point out the daily, weekly and annual commuting cost in dollars and their share vis-à-vis average incomes. To be more precise in defining a more adequate market in terms of home-work distances, and with the purpose of obtaining substantial savings, it is important to conduct a comparison of commuting costs involved in automobile and ridesharing systems. FIG-III-10 provides a reply to this question by reflecting the monthly costs involved in the utilization of automobiles on the basis of single occupancy and triple occupancy as well as vans carrying 8 paying riders, over different round trip distances between home and work. The annual savings, expressed in dollars, resulting from 3 prevailing ridesharing systems over one way home to work distances, are represented by FIG-III-11. Some informations must be added to further explain this figure: travel is on the basis
<table>
<thead>
<tr>
<th>Travel mode</th>
<th>Cost/person in $ for a one way trip of:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 miles</td>
</tr>
<tr>
<td>Automobile 1 occupant</td>
<td>2.53</td>
</tr>
<tr>
<td>Rail transit</td>
<td>1.37</td>
</tr>
<tr>
<td>Automobile 1.4 average occupancy</td>
<td>1.81</td>
</tr>
<tr>
<td>Rail transit with park and ride access; half trip on arterial street</td>
<td>1.42</td>
</tr>
<tr>
<td>Busway with park and ride access; half trip on arterial street</td>
<td>1.26</td>
</tr>
<tr>
<td>Rail transit with bus access; half trip on busway</td>
<td>1.12</td>
</tr>
<tr>
<td>Automobile 2 occupants</td>
<td>1.26</td>
</tr>
<tr>
<td>Bus with all trip on arterial streets</td>
<td>0.88</td>
</tr>
<tr>
<td>Automobile 3 occupants</td>
<td>0.84</td>
</tr>
<tr>
<td>Automobile 4 occupants</td>
<td>0.64</td>
</tr>
<tr>
<td>Automobile 6 occupants</td>
<td>0.42</td>
</tr>
<tr>
<td>Van 8 occupants</td>
<td>0.36</td>
</tr>
<tr>
<td>Percentage of commuter involved in each group of trip</td>
<td>52.1</td>
</tr>
</tbody>
</table>

- ECONOMIC COST OF ONE WAY CBD COMMUTER TRIPS FOR URBAN AREA GREATER THAN 1,000,000 INHABITANTS
### Table II-9

<table>
<thead>
<tr>
<th>Distance (one way mileage)</th>
<th>Commuting Cost ($)</th>
<th>Percentage of average annual incomes in $ spent in commuting to work</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily (5 days)</td>
<td>Weekly (50 weeks)</td>
</tr>
<tr>
<td>5</td>
<td>1.7</td>
<td>8.5</td>
</tr>
<tr>
<td>10</td>
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<td>25.5</td>
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<tr>
<td>20</td>
<td>6.8</td>
<td>34</td>
</tr>
<tr>
<td>25</td>
<td>8.5</td>
<td>42.5</td>
</tr>
<tr>
<td>30</td>
<td>10.2</td>
<td>51</td>
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<tr>
<td>35</td>
<td>11.9</td>
<td>59.5</td>
</tr>
<tr>
<td>40</td>
<td>13.6</td>
<td>68</td>
</tr>
<tr>
<td>45</td>
<td>15.3</td>
<td>76.5</td>
</tr>
<tr>
<td>50</td>
<td>17</td>
<td>85</td>
</tr>
</tbody>
</table>

- Cost of commuting to work -
MONTHLY COMMUTING COSTS PER RIDER

- FIGURE II-10 -

Monthly commuting cost per rider ( $ )

Round trip distances ( miles )

$200 $190 $180 $170 $160 $150 $140 $130 $120 $110 $100 $90 $80 $70 $60 $50 $40 $30 $20 $10 $0

$0 $20 $40 $60 $80 $100 $120 $140 $160 $180 $200

Δ = One car, 1 driver
○ = Carpool, 3 members
□ = Vanpool, 8 paying riders+driver

- MONTHLY COMMUTING COSTS PER RIDER -
Annual savings over driving alone per carpooler ($)

- FIGURE II-11 -

One way distances (miles)

\[ \begin{align*}
\Delta &= 3 \text{ member carpool} \\
\bigcirc &= 5 \text{ member carpool} \\
\Box &= 12 \text{ member vanpool}
\end{align*} \]

- ANNUAL SAVINGS BY CARPOOling PER CARPOOler -
of $1.14/mile exclusive of parking charges at the place of employment, volunteer driver receiving no compensation, the costs being shared by the carpoolers or vanpoolers, and without any increases in insurance costs as the result of ridesharing.

In a behavioral study made by the Federal Highway Administration (FHWA) of the DOT in August 1978 in the metropolitan area of Washington DC for 800 commuters, it appears that, contrary to common opinion, cost is not the major factor in an individual's decision about carpooling. Carpoolers tend to have a higher income level than solo drivers and when asked why they have joined a pool, 41.8% cited socializing as a reason, 31.5% cited financial savings, 14.6% find carpooling more convenient than driving alone and the remaining 13% stated that no other option was available to them for commuting purposes.

Other advantages directly perceived by the commuter and of varying degrees of interest come into play:

- The need to own two or more cars per family may be eliminated, resulting in significant savings. The substantial increase in the cost of car ownership as compared to all consumer items add more value to this assertion, as indicated by the following data:

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</thead>
<tbody>
<tr>
<td>Price</td>
<td>1.01</td>
<td>1.08</td>
<td>1.07</td>
<td>1.39</td>
</tr>
</tbody>
</table>

The Washington survey seems to disprove this possibility, the average number of cars per household being the same (1.9) in the case of solo drivers as well as carpoolers.

- Indirect financial savings by the reduction in car insurance premiums by 10-20% together with a lesser wear on the car, due to a less frequent utilization of the vehicle.

- Possibility of priority parking and carpool lanes causing a gain in time by avoiding traffic congestion that is of great concern for commuters.

- The convenience of the system in comparison with the automobile for different reasons: 1) No fatigue and tension of driving or coping with rush hour traffic providing the opportunity to read, work or sleep during travel time; 2) Door to door service avoiding the need to walk long distances; 3) Reliable means of transportation, particularly in the case of vans where maintenance is carefully assumed by the leasing company or by the driver himself.
But because of the door to door service provided, solo drivers feel that carpooling is slower than driving alone in view of the extra time involved in picking-up or dropping-off passengers.

- Carpooling provides the opportunity of social exchange, according to the Washington survey; social factors constitute the primary consideration in decision-making in favor of ridesharing. But 85% of the people surveyed said they wanted preliminary contacts with prospective carpool members before making any arrangement, and not to be thrown in a carpool by chance. The intimacy created by carpooling can provoke conflicts or disagreements among the riders because they do not want to impose their own rules to the group or because they prefer the anonymous situation of the automobile or even mass transit. The matching programs that bring together prospective carpoolers should adopt more depersonalizing approaches than those used in the computerized systems that are currently employed. Prospective carpoolers prefer to share ride with people having the same professional status. The most prevalent barrier in the acceptance of the system is the lack of independence caused by ridesharing, eliminating for the carpooler the option of leaving home or work at any time (and particularly at lunch hours). This loss of flexibility is also felt by the numerous people who do not know in advance if they will work late or overtime (representing 50% of the employees in Knoxville, Tennessee, for example)

- Carpooling provides the satisfaction of alleviating the country's energy, traffic congestion and air pollution problems which, in fact, is of very little concern for potential carpoolers.

- Vanpooling offers the opportunity to ride free to and from work for the driver and to enjoy the use of the van on a low cost per mile basis during non-work hours.

Ridesharing cannot break so easily the image of independence attached to the single-occupant automobile, even if substantial financial savings occur. This balancing between lost of independence and financial gains differs among people depending on backgrounds, attitudes, social levels and population pressures.

II-3) The employers

The most important advantage drawn from ridesharing and which was the original stimulus for the involvement of numerous firms in the promotion and implementation of the
in the paratransit system, is the saving in the construction and maintenance of parking lots. Because zoning ordinances were designed to ensure that adequate parking facilities were available to each office, many employers were confronted with the consequent costs attached to business expansion. As for highway facilities, we find here again the idea of more efficient land use. Parking space costs can involve very high expenses, the approximate figures being $1,000 for the parking space itself and $15,000 per space for the parking structure in a multistory garage. An evaluation of the reduction in commuter parking spaces in the Central Business District (CBD) area within cities of varying population, as a function of a certain shift to carpooling, is given by the curves of FIG II-12. This reduction in commuter parking spaces can be translated in a resultant financial saving, assuming that 50% of the facilities involve the construction of structures. Savings will be less important in most cases where firms locate outside the CBD and therefore no special structure are required. For example, the 3M company in Saint Paul (Minnesota) saved $2.5 Million by eliminating the need for 1,500 additional parking spaces (approximately $1,700/space).

Others advantages of less importance benefit the employer:

- Larger potential labor due to the improvement of plant accessibility (ridesharing as a means of transportation if no other option exists, reduction in traffic congestion near the plant). The accessibility to worksite is of great concern for lower salaried employees having problems with car's availability. This improvement can be the stimulus for initiating carpooling or vanpooling as the Erving Paper Mills did in Brattleboro (Vermont) to prevent the loss of highly skilled employees when it moved 25 miles from a previous worksite.

- Improvement in workers punctuality and reductions in absenteeism. On the other hand, employees arrive more relaxed at the place of employment by avoiding tension of driving. However, according to a survey conducted in Knoxville (Tennessee), ridesharing does not seem to affect the rate of absenteeism.

- Ridesharing enhances the image of the firm because of its actions to conserve energy, reduce pollution and traffic congestion (can benefits of local newspapers or TV coverage).

Three sorts of drawbacks can hinder the existence of employer sponsored vanpool programs (or carpool programs):

- Need for capital outlay to start the program (matching, promotion, etc...). This disadvantage is insignificant when comparing to the returns caused by the reduction
CBD parking spaces devoted to commuter...

REDUCTION IN CBD COMMUTER PARKING SPACE WITH RIDESHARING

Savings ($)
in parking facilities. Some start-up costs for company sponsored vanpools follow and can be compared to FIG-II-12 to obtain an approximate evaluation of the possible benefits to the employer.

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Start-up costs ($)</th>
<th>Annual cost/van for maintaining the program</th>
<th>Number of Vans</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 M Company St Paul, Minnesota</td>
<td>26,100</td>
<td>229</td>
<td>80</td>
</tr>
<tr>
<td>Tennessee Valley Authority Knoxville, Tennessee</td>
<td>10,600</td>
<td>326</td>
<td>480</td>
</tr>
<tr>
<td>Chrysler Corporation Detroit, Michigan</td>
<td>16,100</td>
<td>256</td>
<td>78</td>
</tr>
<tr>
<td>Continental Oil Company Houston, Texas</td>
<td>40,700</td>
<td>303</td>
<td>37</td>
</tr>
</tbody>
</table>

- Difficulty of assessing liability exposure. This institutional consideration varies among states and shall be reviewed in the next section.
- Possible union pressure to extend vanpooling benefits, leading the employer to lose the overall control of the program.

It emerges from this section that employers receive a substantial return on start-up costs. These costs tend to be reduced by some fiscal advantages that are conceded by the DOT and that will be reviewed in the next section.
III) INSTITUTIONAL CONSIDERATION

III-1) Foreword

With time, impediments to ridesharing pale slowly in the face of incentives, that vary in degree from state to state, initiated at each level of the government. On one hand, regional transportation agencies, by their protectionist attitude towards their transit operations, stemming from a fear of competition by paratransit, do not play the role of brokers for overall transportation needs. This is reflected by the fragmentation and uncoordination of small scale paratransit systems, owned by people more preoccupied by their own operations and short term problems than by issues of long range organization. Conflicting, inconsistent and overlapping regulations as well as institutional obstacles, hinder all forms of commuter ridesharing organization, where restrictive regulations and work rule arrangements of mass transit cannot be applied. On the other hand, after the energy crisis and oil embargo of 1973, the DOT, the Department of Energy (DOE) and the Environmental Protection Agency (EPA) placed commuter ridesharing among the most efficient tools to achieve abatement in pollution and congestion levels as well as enhancing energy conservation. Ridesharing activities belong to the 6 eligible projects that are financially supported within the TSM program. TSM encompasses a broad range of low capital cost improvement strategies whose goals are to have a better utilization and efficiency of highway and transit facilities as well as to achieve many other transportation related goals. In addition, the construction of exclusive traffic lanes for HOVs is one of TOPICS (Traffic Operations Program to Increase Capacity and Safety)-type actions within TSM planning and therefore can be eligible for financial aid.

Institutional considerations play a predominant role in the ridesharing system, at every level, and their impact on service and cost efficiency is not negligible.

III-2) Legislative history of ridesharing activities. Funding.

-1974- The Emergency Highway Energy Conservation Act. Authorized federal urban system funds to be used at a 90% federal share to fund carpool demonstration projects within $1 Million/year, in urban areas. This act was amended in 1976 to include vanpool demonstration projects and the acquisition of vehicles.
-1974- The Federal-Aid Highway Amendment. Authorized a $7.5 Million carpool demonstration grant program.

-1975- The Energy Policy and Conservation Act. Provides grant funds to states, through the DOE, to implement energy conservation. The funds are divided among all state energy offices based on a formula which includes population and expected energy savings. In March 1980, the DOE, by classifying vanpool as a priority number one vehicle with transit and emergency vehicles, permitted them to obtain gasoline at any time of the day in case of energy shortages. The DOE will probably disappear with the Reagan administration, 1/3 of its employees will be transferred at the DOT.

-1977- The Clean Air Act. Requires that all areas with serious air quality problems, consider vanpooling as an element to attain air quality standards. Funds for planning, developing and implementing ridesharing activities but not capital expenditures are available through the EPA.

-1978- The Surface Transportation Assistance Act. In comparison with The Emergency Highway Energy Conservation Act, it authorized the use of more funds, removed the "demonstration" feature from these projects but reduced the federal share from 90% to 75%. According to the Act, all efforts to promote carpooling and vanpooling programs must not adversely affect conventional mass transportation. Those which can receive federal Primary, Secondary and Urban system funds are:

- manual or computerized systems for matching purposes.
- work necessary to designate highway lanes as HOV lanes.
- preferential parking for carpools.
- public information and promotion expenditures.
- acquisition of vanpool vehicles for a vanpool program.

Although nothing has yet been implemented by the Reagan administration in this area, cuts in various sources of funding affecting particularly Secondary and Urban system funds are being anticipated. A specific budget, clearly defined for specific period, would be allocated for each state according to population density and for the purpose of promoting ridesharing.

-1978- The Energy Tax Act. Allows the employer a 10% investment tax credit on the purchase price of new vans in the event that the employer sponsors a vanpooling program.

-1979- The formation of The National Task Force on Ridesharing, on former President Carter's initiative, resulting in:
- The establishment of the national ridesharing information center within the DOT to provide information to the public and private sectors.
- The formation of a team of ridesharing experts from the private and public sectors to share their expertise and to continue the dialogue between the two parties.
- The submission to Congress of an Auto Use Management Plan providing funds for the construction of exclusive highway lanes for HOVs.
- The establishment of an Executive Loan Program to help organizations start or expand ridesharing activities through an interest free loan program for the purchase of vans.
- The preparation of a "Model Ridesharing Law" for state legislators to help overcome regulatory barriers that restrict formation of carpools and vanpools in such areas as licensing, registration, inspection, safety and insurance requirements as well as fares, number of passengers, etc...
- The administration of a $5 Million ridesharing demonstration program including 17 projects in 16 states and the training as well as the provision of technical assistance to states and local ridesharing agencies.

1980 - A bill to be enacted by the Senate has the objective of creating a National Office of Ridesharing. The purpose of this office would be to develop a national ridesharing program to assist states, counties, municipalities, Metropolitan Planning Organizations (MPOs) and providers of ridesharing services, publicly or privately owned, in developing and implementing ridesharing systems. The National Office would also coordinate these programs with other ridesharing activities within the DOT, the DOE and other branches of the federal government to ensure the integration and complementarity of ridesharing with conventional mass transit systems.

1980 - The Commuter Transportation Energy Efficiency Act. It encompasses:
- A tax incentive to the individual who buys a van for ridesharing purposes (15% tax credit based on the cost of the van).
- The exclusion from the taxable income of the employee, in case of an employer sponsored program, of any payment made by an employer to the employee as a subsidy for the cost of vanpooling or carpooling.
- The exclusion from taxable income of the fees collected by the driver from the riders.
- The increase of the tax incentive for businesses purchasing or leasing vans for use in employer sponsored ridesharing programs, from the actual 10% to 20% and
the extension of this tax incentive to third parties, as well as the inclusion of administrative overhead costs (personnel, adjustable working hours, parking, etc...).

- the exclusion from the 80/20 rule (80% of the van's mileage must be used for ridesharing, the remaining 20% can be used by the driver) of the driver incentive mileage and its replacement by a 50/50 rule.

- a gasoline tax deduction for the gasoline used in ridesharing vehicles.

A National Association of Vanpool Operators (NAVPO) was also created to represent the majority of employer and third party sponsored vanpool programs and to provide information and assistance for ridesharing programs.

In 1975, metropolitan areas were asked, before receiving funds for any local transportation activity, to examine their existing urban transportation needs and resources and to develop a plan of low-cost transportation improving the effectiveness of existing facilities. The plan has to be approved by the UMTA and the FHWA to receive Federal Primary, Secondary or Urban System Highway funds. According to what has been said previously, the funds can be used with a federal share of 75%, the remaining 25% coming from the States. But highway revenues have grown at a much slower rate than highway construction, maintenance and operation costs, resulting in a budget squeeze that constrained the allocation of monies to many new functions such as ridesharing. Since 1974, approximately $68.3 Million in federal highway funds have been spent by States and urban areas for ridesharing projects and the repartition is as follows:

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<tbody>
<tr>
<td>$</td>
<td>6,467,657</td>
<td>2,815,005</td>
<td>1,301,557</td>
<td>2,740,496</td>
<td>13,397,778</td>
<td>41,530,752</td>
</tr>
</tbody>
</table>

A survey to evaluate the effectiveness of federally funded carpool demonstration projects give the following results:

- An annual travel reduction of 12,673,000 VMT or 1.2% of areawide total worktrip VMT
- An annual energy conservation of 986,000 gallons
- An annual vehicle operation cost reduction of $1,087,000
- A reduction in demand for commuter parking by 1,009 emplacements.

The major source of funding is the FHWA, closely followed by State, local and UMTA sources. Funds from the DOE, the EPA and other financial sources combined, constitute 16% of the program budget.
III) Legal impediments to ridesharing activities

Numerous institutional obstacles have impeded all forms of commuter ridesharing for years and still constitute major negative factors in the decision making by prospective poolers as well as ridesharing sponsors. With the preparation of a "Model Ridesharing Law" in October of 1979 as a part of the "National Task Force on Ridesharing" program established in order to help State legislators in dealing with the problems inherent to the creation of pooling programs, a great step forward has been taken. Laws vary with States and sometimes within the State when judicial branches of the government can exempt certain ridesharing arrangements even though the legislature had not acted in this way. If the government hopes to encourage massive commuter ridesharing, regulations must be modernized, simplified, easily accessible to the public and generalized as far as possible.

The problems emerging with any pooling arrangement encompass a broad range of subjects: charge acceptable by the driver, insurance, workmen's compensation, interstate regulations, tax status, classification of commuter service, driver liability, zoning regulations, etc...

It is not very easy to explain the procedure by which the problems are treated because of the varying positions held by the States vis-a-vis ridesharing arrangements. In spite of this complexity, we can have a better understanding of the different approaches adopted by State courts through a rapid review of their different positions with the help of TABLE-III-1 and its appendages.

Income-Tax status- Before speaking of the tax liabilities affecting fees collected by the driver from the riders, we have to specify that, in some States, the pooling arrangement must be "non-profit" (2" of TABLE). Within that category, the interpretation of the term "non-profit" differs: some maintain that payment up to $20/mile is non-profit while others stipulate that compensation must be "reasonable" more or less allowing for depreciation costs on the vehicle. Sharing only operating costs is not very equitable when we know that they can represent 2/3 of the total cost. For States allowing the driver to receive an income, regardless of the expenses associated with the ridesharing arrangement, the question of tax treatment emerges and leads to three possible configurations:

1) Some States do not levy a tax on such ridesharing income if the pooling arrangement does not result in profit (6 of TABLE).

The other States do impose a tax on personal income but no tax treatment of ridesharing arrangements has been enacted by any State legislature. All depends on the State defini-
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<td>Iowa</td>
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<td>**</td>
<td>***</td>
<td>10/c</td>
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<tr>
<td>Kentucky</td>
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1) * States with no exemptions for ridesharing arrangements if motor carrier laws do not apply (the trip must be to and from work and this does not constitute a problem for commuter ridesharing arrangements).
** States whose sole exemption is the requirement that the riders share of trip expenses do not exceed the operating costs of the van.

2) States with specific criteria for ridesharing arrangements such as:

2') Number(s) The pool must not exceed a specific number of passengers.
2'') * Trips are restricted to home-work round trips.
2''') ** The ridesharing system must be non-profit.
2'''' Miscellaneous criteria such as:

NCC There must be no competition with conventional mass transit.
NBO The driver must be a volunteer and not a full time worker.
1/D One trip per day allowed.
ESR Employer must not own or lease the ridesharing system.
AOC Approval by the motor carrier regulatory agency is required.
ESP Employee must not own the ridesharing system.

3) Type of insurance:
* States with guest statutes.
** States with guest statutes that have been declared invalid by the courts.
*** States with no fault laws "following the vehicle".
**** States with no fault laws "following people".

4) States defining a bus as a motor vehicle with the adjunctions following: the vehicle transports more than a certain number of passengers (number), with compensation (C), on a regular route (RR), or it has a certain length (L) or receives or discharges passengers (RDP). The States which are not mentioned in the TABLE do not have any definition for buses.

5) Fair Labor Standard Laws and ridesharing:
* States that exempt commuting time.
** States that empower an administrative agency to promulgate rules.
*** States that do not exempt commuting time.
**** States that conform entirely to FLSA.

6) State Income tax laws:
   0 States that do not impose a tax on personal income derived from ridesharing.
   00 States that follow or adapt the Internal Revenue Code statutes.
   000 States having statutes defining income that differ substantially with Internal Revenue Code statutes.
tion of "taxable income". In other words, it is important to know if they follow the one adopted by the Internal Revenue Code. The Internal Revenue Code states that income received by the driver in the case of a non-profit, to and from work, ridesharing arrangement does not constitute a taxable income. Therefore, two other categories are added:

2) States that adopt or follow the Internal Revenue Code's definition as the basis for calculating personal income taxes (6 of TABLE)

3) States that do not follow the Internal Revenue Code's definition (6 of TABLE).

Another problem appears when the ridesharing arrangement has been certified as a common carrier because, at this time, rates may be accordingly regulated (4 of TABLE for the definition of common carrier).

Insurance - 4 types of positions can be held by the States in what concerns insurance categories applied to ridesharing arrangements (3 of TABLE):

1) States with guest statutes that involve a liability policy compensating persons injured as a result of vanpool owner's or driver's negligence.

2) States with guest statutes that have been declared invalid by the courts. In this case the courts decide on the validity of insurance arrangements for each specific case.

3) States with a no fault policy "that follows people" where the carpooler who does not own the vehicle is covered by his insurance company regardless of fault.

4) States with a no fault policy "that follows the vehicle" where the carpooler who does not own the vehicle is covered by a policy covering the vehicle regardless of fault.

If the ridesharing arrangement has been certified as a common carrier (4 of TABLE), expensive insurance requirements could be applied. At this time, small employee or employer sponsored programs are unfavourably affected in comparison to large scale employer sponsored programs where companies can afford to be self-insurers. In another direction, State laws have not addressed the issue of providing workmen's compensation for employees involved in ridesharing while courts have done so. The problem of workmen's compensation involves the liability of the employer vis-a-vis his employees who are injured when ridesharing to or from the worksite. States adopted a law exempting of compensation any driver or passenger in a voluntary vanpool or carpool program even though they ask the employer to provide minimum levels of compensation to employees injured out of, while or in the course of employment.

Labor standards - The complexity of institutional problems appears clearly in the resolution of the following question: must commuting time by drivers or riders be counted as compensable hours of work, and at this point be calculated at overtime rates? The Federal Fair Labor Standard Act (FLSA) stated that vanpools would not be engaged in compensable
work time when the driving is purely voluntary and the employer gains no profit from the pooling arrangement. But many employers are not covered by FLSA, and on the other hand, the courts are not obliged to follow the Fair Labor Standard laws. 4 categories can be drawn at this point (5 of TABLE):

1) States that expressly exempt commuting time. In this case, transportation to and from work does not constitute any part of the employee's work hours, even if the employer is covered by FLSA.

2) States that empower an administrative agency to promulgate rules for employee compensation, even if the employer is covered by FLSA.

3) States that require employers to pay vanpool drivers for commuting times, the employer being covered by FLSA or not.

4) States that conform entirely to Fair Labor Standard laws.

A myriad of other miscellaneous institutional obstacles can hinder ridesharing arrangements. The following may create obstacles (4 of TABLE):

- transportation on a route that is served by mass transit, being either bus transit or rail transit (no competition with mass transportation).

- the regulation of schedules, high registration fees as well as the requirement of special records and special equipment if the ridesharing program is certified as a common carrier.

- the definition of the number of passengers to be transported, of a route to be followed (home-work roundtrip) and of the number of trips per day.

- the special licensing required for van operation in the case of transportation services involving compensation, resulting in lost time and expenses.

- the interdiction for the driver to operate the van for part time or full time compensation.

Ridesharing involves numerous institutional problems which must be approached, but simplification and easy accessibility to the public are needed to promote the system. The lack of position concerning specific questions by the courts, the rigour of certain laws, the confusion created by the complexity of certain procedures have beset all forms of ridesharing activities. Progress, of varying degrees depending on the States, has been made, but still, institutional problems can constitute significant obstacles for the initiation of ridesharing programs.

III-4) Operating modes for ridesharing systems- The brokerage approach

Before defining the different approaches to ridesharing activities, common requirements can
be developed to have a better understanding of the pooling infrastructure. We can order the different and essential steps to be taken during the program in the following way:

-1- Coordination and management must be assumed by someone to permit the achievement of the next steps in the program as well as to formally represent the pooling arrangement.

-2- Promotion and information are undertaken to associate a maximum number of people in the system for purposes of higher efficiency.

-3- The prospective poolers, after having manifested their interest in the system, are gathered to give to the coordinator complete information about place of employment, residence, working hours, preferences concerning the types of people with whom they would like to share the ride and if they are available to drive the vehicle.

-4- Matching is then necessary to avoid excessive travel time that will occur if pick up or delivery emplacements are too distant as well as to take the preferences of the prospective poolers into account. Depending on the scale of the program, matching systems can either be manual or computerized.

-5- Another meeting of the commuters interested in the program is necessary to get their final decisions after preliminary conversations between those involved in the same pool. In this meeting, fares as well as the rules to be observed within each pool (rider agreement) will be discussed and established.

-6- Then, the vehicle to be shared will be bought or leased depending on the results of the arrangements between the coordinator and the poolers.

-7- At this point, the system is initiated and its continuation must be achieved. For that, the driver keeps records of the fares collected from the riders, of the expenses involved in maintaining the vehicle, of the number of persons leaving or joining the system, etc... Information and promotion never stop in order to fill places by those leaving the pool, and to complete or create other pooling arrangements.

The scale of the ridesharing program determines the importance to be given to each step. For example, a spontaneous carpool, because it generally involves friends or neighbours, does not require an organization as formal as vanpool organized on the initiative of an employer.

Ridesharing programs fall into 3 major operating modes, depending on the sponsor of the pooling arrangement:
-1- Employer sponsored programs.
In this mode, the process followed is the one that approximate most closely the model previously discribed. Promotion and information do not constitute a problem in this case because of the concentration of potential poolers in the same place, having the same requirements in terms of schedules and destination and because of the numerous possibilities of information available in a firm. The expenses involved in the initiation and continuation of the program can be financed under the Surface Transportation Assistance Act (see chapter III-2). Because of the many advantages drawn from ridesharing by the employer, as reviewed in the previous section, the employer sponsored mode was adopted at the outset of ridesharing activities with the 3M Company in St Paul, Minnesota (130 vans). The Tennessee Valley Authority (TVA) in Knoxville, Tennessee (399 vans) and the Continental Oil Company (CONOCO) in Houston, Texas (189 vans) are among the most important on a list that encompasses a growing number of such arrangements since 1973.

-2- Driver owned and operated programs.
This type of program often applies to small scale informal organizations involving generally friends or neighbours, making it possible to attach less importance to the different steps of the model. Word of month is the predominant means of promotion and information in spite of the availability of the means a firm can provide. Some States energy offices or regional transit authorities provide computerized matching systems to help individuals in the realization of the program, but in most cases, simple manual matching is sufficient. The major drawback with this type of organization lies in the purchase or leasing of vehicles requiring, either a subsequent capital outlay or an increase in the fares due to high interest rates charged by banks or credit unions. This disadvantage is avoided in cases of spontaneous carpools where the vehicle generally belongs to one of the poolers. The fact that a few people, knowing each other, decide to organize and manage a small scale ridesharing system, serves to diminish the chance of failure within a short term period.

-3- Third-party sponsored programs.
The third-party or broker's responsibility is to identify the specific travel needs of various market segments and to match them with the appropriate and lowest cost resources available. This neutral organization can be a new organization, public or private, profit or non-profit or a regional transportation authority that ensures the coordination of transportation services (integration) in order to avoid any competition. Therefore, the broker's role is to take all the steps of the model previously
discribed, in the formal way prescribed by their profession. In other words, they will take care of promotion, ridematching, driver selection and training, record keeping, accounting, van purchase or leasing, insurance and etc... The pooler will only have to give the informations needed to this organization and to pay a certain amount per month in return for the service provided. The advantages of the brokerage mechanism which saw its first implementation in Knoxville, Tennessee in 1976, go far beyond the few drawbacks that can be drawn and can be described as follows:

- The corporation, by identifying individuals with similar travel needs in terms of destination and work times, can influence their travel choice by providing motivation and incentives inherent to ridesharing systems. In a certain way, this increases the number of prospective poolers because of a good promotion and well founded information.

- Many employers or individuals cannot afford to organize, initiate and ensure the continuation of ridesharing programs because of the time and capital outlay required. On the other hand, 25% of the labor force works in a firm with at least 500 employees per site, the remaining 75% must be served by a transportation broker if they want to rideshare because of the lesser probability that their employer would be able to organize viable programs. The brokerage mechanism permits the employer to avoid the administration of a service he cannot afford and in which he is not a professional. Through this way, multi employer locations can be served by para-transit services where otherwise difficulties would exist.

- By ensuring the coordination of transportation services, matching "needs" with resources and administering as far as possible travel demands, the broker can help social agencies in recovering disparate sources of funding and decreasing their administrative task to meet the travel needs of the transportation disadvantaged. A State created agency, the Delaware Authority for Specialized Transportation (DAST) and an organization of 40 service providers in Chattanooga, Tennessee illustrate a brokerage approach more oriented towards human services.

The major drawback that can be drawn from this system is the increase in rider fares in comparison to those involved in employer or employee sponsored programs. More complex organization leading to higher overhead costs, possible higher insurance premiums, more state and federal regulation constraints, constitute the prevalent reasons for this increase. In spite of this, the numerous advantages inherent to ridesharing systems and benefiting the individual, still exceed the costs involved with such type of organization. In addition, the brokerage system can permit the creation of more rides-
haring arrangements that would never appear otherwise.
Most third-party programs operating today are managed by private, non-profit organizations such as RIDES in San Francisco, California or the Knoxville Commuter Pool in Tennessee. But the government has also promoted the brokerage concept by creating agencies in Chicago or Pittsburg for example as well as financially supporting non-profit organizations such as the one in St Paul, Minnesota. As mentioned in section II of this study, the nation as a whole draws consequent advantages from ridesharing systems which leads the government to take some responsibilities in the promotion of the brokerage system in order to procure travel options for everyone or, at least to respond to travel needs.
IV ) Ridesharing and its application to France

Although neither marketing nor specialized studies have been developed to analyze the attitude of people towards an implementation of ridesharing activities in France, some remarks concerning the differences between the two contexts and the way they will affect any possible application will be discussed. The following remarks will clarify some influencing factors inherent to the French context:

- A different configuration of cities as well as a more developed mass transit system leading to more travel needs satisfied in less dispersed travel patterns, have created a better image of conventional mass transportation among the public that the one existing in the United States. A wider utilization of mass transit has resulted in the generation of more competition vis-a-vis ridesharing systems although, in the United States, potential poolers and public mass transit riders do not belong to the same market segment. It is difficult to assume in the absence of previous surveys that, in France, ridesharing activities will not divert riders from high occupancy means of transportation. To reap advantage from the American experience in the field, paratransit will have a better chance of success if applied to wide metropolitan areas not adequately served by mass transit and where problems of traffic congestion remain unresolved. The latter requirement has appeared to constitute a predominant stimulus for American solo drivers to shift to more convenient and less stressful carpooling or vanpooling programs.

- The more centralized character of the means of public information in France will not facilitate the promotion of ridesharing. In effect, pin point advertising campaigns, as those appearing in local newspapers or TV broadcasting, play an important role in commuter decision making. Some nation wide operations, like those involving driving techniques leading to greater fuel efficiency, are made possible by the large number of people to be addressed. Specific incentives, advantages and problems inherent to a certain type of organization in a certain area, will be difficult to broadcast through the French media and even if such broadcasts were to be made, the impact on the population is likely to be less marked. The degree of centralization to be found within the system of information diffusion in France would also manifested itself at the level of any prospective regulations pertaining to ridesharing systems. In terms of regulatory constraints as well as funding, potential ridesharing activities in France are likely to be less complex. Consequently, promotion campaigns would not be as area specific as those in the United States.

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The behavioral study conducted in Washington DC in 1978 by the FHWA of the DOT has shown the importance attached to social factors in ridesharing. According to that study, 41.8% of prospective poolers cited socializing as a reason to join a pool whereas only 31.5% cited financial savings. Although there are good reasons to think that French people will be more sensitive to financial savings than American currently are, the question of personal contacts will remain predominant. It is current knowledge that first contacts are more formal and less relaxed in France, resulting in two considerations: 1) Inhibition of that kind will not favor the public acceptance of such arrangements and 2) special care will have to be devoted to the ride-matching system as well as to preliminary meetings between poolers.

Ridesharing systems have a better chance of success if applied to large scale firms in view of the more important number of potential poolers to be found in the same emplacement and with the same working hours. In France, many large firms already possess their own network of transportation for the picking up and dropping off of their labor force. In such a context, ridesharing will come up against existing systems where, in addition, transportation costs are chargeable to the employer. Unions may not well perceive a new system involving expense to workers while presenting no interest.

On the other hand, while in the United States the success of the experience depends on the cooperation of employers, in France, the acceptance of the unions would be required. In effect, unions have the power to mobilize numerous workers if the participation was not to appear as a collaboration with the body of employers. A dialogue will have to be established between unions and the government, the employer being more or less swept along by the movement. The commitment of labor unions to this dialogue would be facilitated by their perception of possibilities for self management in problems of worker transportation. It is important to note however that such arrangements would not, in the view point of unions, substitute for transportation policies addressing travel needs at all levels of society. At the present time, unions have extended their involvement to areas beyond the field of professional problems.

To summarize this paragraph, we can state that two factors will influence ridesharing activities at the level of the firm:

1) The existence of well established and appreciated commuting systems among firms hinders appreciably the addition of a new organization at an experimental stage.
2) The unions through their capacity to mobilize the workers and by the extension
of their field of intervention, play an important role in the acceptance of the system.

- Financial savings are expected to weigh substantially on the side of ridesharing, in France, for several reasons:
  * The percentage of the average income spent on commuting is higher because of several factors including:
    1) a lower standard of living
    2) higher operating costs for vehicles (approximately 2 times greater) due to the price of gasoline (around $3/gallon) even if the greater fuel efficiency of French cars is taken into account
    3) a higher capital cost for vehicles due to higher purchase prices (the ratio being approximately 1.5 in comparison to the U.S.), higher insurance premiums and taxes ("vignette")
  A less important commuting distance constitutes the only factor that could reduce the share of income devoted to such expenses.
  * A lower standard of living together with a higher capital cost of automobiles reduces the availability of vehicles. This has contributed to a wider utilization of mass transit without satisfying all travel needs because of the impossibility for HOVs to serve all travel patterns even if they are less dispersed in France.
  * When considering the depreciation of a vehicle, French people attach more importance to the mileage while, in the United States, the age of the car prevails. Therefore, this saving in the market value of the car due to a lesser utilization can be more perceived in France.
  * Although many efforts have been made by the French government to acquire a certain energy independence vis-a-vis foreign crude oil through the development of nuclear energy, 56% of French energy consumption is still imported. Any decrease in this percentage will reduce the negative impact (unemployment, inflation, etc...) that results from this excessive and costly dependence.

Two important points based on an existing configuration and not on studies of prospective attitudes emerge from the previous remarks:

- The shape of cities (less sprawled) together with a better network of transportation means provided either by mass transit or by specialized transportation for commuters working in large firms constitutes a major negative factor in decision making about ridesharing systems.
- A low standard of living together with high operating and capital costs for vehicles
increase substantially the financial interests of ridesharing activities. Therefore, it is difficult to forecast precisely the behavior that French commuters will adopt in the face of paratransit and particularly in the absence of more extensive research. Marketing, promotion techniques, behavioral studies, dialogues with unions and employers, etc... are necessary to evaluate the importance to be attached to ridesharing systems in France.
V ) Conclusion

One of the predominant reasons for the encouragement of ridesharing systems lies in the potential energy savings to the nation. In spite of a reduction of 3% in energy consumption in 1980 with an 8% decrease in petroleum consumption, Americans still continue to consume 1/3 of the world energy and do not believe in long term shortages. They focus their attention more on the development of new energy sources as well as on a more extensive working of actual oil and coal fields than on means of reducing consumption. The important coal resources of the American subsoil (Merker and Rifle), the possibility of great hydrogen production through the electrolysis of water that can be combined with coal to produce a synthetic fuel more efficient and less polluting than gasoline, the working of oil fields considered as depleted and now optimized by the development of computerized techniques, and the development of new energies and particularly of solar energy have enforced this state of mind. But commuting expenses can still represent a large share of average income and on the other hand, any means to reduce even moderately the consumption of energy should be considered, encouraged and organized, especially if other substantial advantages can be derived from such means.

Given these forecasts, the shape of cities and the independence derived from private low occupancy vehicles, the automobile is expected to continue to be the basic mode of transportation in the United States. 3 principal ways of reducing fuel consumption are currently in process of development: technical improvements in engine efficiency, speed limit and ridesharing systems. The estimate energy savings by 1985 from these selected conservation measures are as follows:

<table>
<thead>
<tr>
<th>Conservation measures</th>
<th>Savings (barrels/day)</th>
<th>Savings (% of actual total fuel consumption)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automobile fuel economy standards</td>
<td>1,595,000</td>
<td>21.70</td>
</tr>
<tr>
<td>55 miles/hour speed limit</td>
<td>302,000</td>
<td>4.23</td>
</tr>
<tr>
<td>Ridesharing</td>
<td>262,000</td>
<td>3.55</td>
</tr>
</tbody>
</table>
The Reagan administration has indicated a willingness to restore the speed limit to 70 miles/hour. This would negatively influence fuel economy even if a greater traffic fluidity was to be achieved, and bring about a rise in auto accidents. As been said previously, ridesharing contributes by approximatively 3% (or $ 27.36 Billion) in fuel conservation at the present time and this figure is expected to reach 3.55% by 1985.

Therefore, it is important to have a better understanding of the forces that influence ridesharing for purposes of adopting adequate strategies that will encourage the development of paratransit. Although there is no best way to structure a ridesharing program, each situation being unique, the existence of an organization that will ensure the integration of system and service components as well as remove the obstacles that may impede pooling activities, seems to be required. At the present time, authorities for managing transportation services are dispersed among a number of public and private agencies that operate in most cases independently, depending on States. In connection with this, different sources of funding are available to ridesharing activities where different regulation constraints apply. A region wide multimodal transportation agency would be more able to make the most efficient use of transportation resources to ensure mobility for the widest number of population segments. 4 types of organizations emerge: volunteer, non profit, profit making and governmental. Several factors including the possibility of a regular source of funding, the facility of obtaining legislative changes as well as the possibility of full participation in the transportation planning process, place governmental agencies in the best position to ensure mobility within a wide range of modal options.

The most important goals to be achieved by this governmental broker are as follows:

- To provide a wide range of different service alternatives to satisfy numerous travel demands. Population densities and vehicle occupancy rates are mutually dependent: high occupancy modes for high density travel corridors and demand responsive services in low density areas.

- To ensure the coordination of the different modes to avoid overlapping. This is more easily achieved by a public organization given the search for profit maximization by private agencies that operate in a competitive environment.

- To encourage any form of pooling arrangement by protecting passengers in terms of liability exposure, safety, fares as well as protecting drivers in terms of working conditions, and to take into consideration the forces that influence positively the development of ridesharing. A well founded information system, a personalized mat-
ching system as well as the development of incentives and the simplification or suppression of certain regulation constraints are among the key points this agency will have to deal with.

In what concerns the commuter market, requisites for success are 3 in number:
1) Size of the firm (important number of employees required).
2) Regularity of work schedule.
3) Geographic distribution of the labor force (residential concentration of employees required).

Spontaneous carpooling captures 1/3 of the commuter market because of its less formal organization and its financial advantages for short home-work round trips in comparison to vanpooling. This percentage may decrease with the measures taken in vehicle construction to improve fuel economy. In effect, the propensity towards ridesharing is expected to decrease as the result of vehicle downsizing and reduction in operating costs. Ridesharing has proven its ability to reduce by 3% the total fuel consumption of the United States as well as to diminish parking space requirements, defer transportation facilities additions, abate pollution levels, provide the opportunity for social exchanges between employees, increase the potential labor force for employers and above all permit financial savings. On the other hand, the increasing deficit of conventional mass transit together with the importance attached to the automobile in spite of growing operating costs as well as the common desire to simplify the legislation and the organization of pooling arrangements, lead to think that ridesharing will continue to make an increasing contribution to fuel economy.
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