Pay-and-Ride Carpool: A New Concept in Commuter Ridesharing

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The two prevalent carpooling systems—shared driving and shared riding—require that all program participants should have a common origin and destination and common departure and return times. However, in a situation such as that of a university, where the schedules of students change every three months and the time they spend at the university is not the same each day of the week, matching the time and origin-destination needs of commuters is almost impossible. A "pay-and-ride" carpool concept proposed for use on the campus of the University of Central Florida is described. In the proposed system, carpool pickup stops would be located along the roads within 1 km of commuters' residences. Riders would wait at these stops and drivers passing by bound for the same destination would pick up the waiting riders after adequate verification of their identity. In such a program, both drivers and riders would belong to the same organization. Riders would pay coupons to the driver as their share of the cost of a one-way ride. Each pickup stop would have a number, and matching pickup stops would be located at the destination point for return travel. The results of opinion surveys conducted in the summer of 1979 and the winter of 1980 at the University of Central Florida concerning the acceptability of such a program are reported. Fifty-nine percent of those interviewed stated that, if such a program were instituted, they would be willing to participate in it.

Both of the currently prevalent carpool systems--shared driving and shared riding--require that all participants should have common origins and destinations as well as times of departure and return. These programs also require an agency that can initially match the time and origin-destination needs of those who indicate their willingness to participate in carpools. That agency then keeps updating the time and origin-destination needs of the program participants on a permanent basis. Changes in these needs may be caused by changes in the attitudes of the program participants toward carpooling or changes in working hours, residences, or jobs.

All of the above requirements are best fulfilled in an industry in which employees work in common shifts of 8-9 h and the employer finds that the expense of running carpool programs is more than compensated for by the benefits derived from the higher productivity levels and savings attributable to a reduction in the number of required parking spaces. For these reasons, the more successful carpool programs have often been industry based and employer organized.

However, in the case of an industry such as a university where most of the students, faculty, and staff commute, the following factors make the prevalent carpool programs unsuitable:

1. Class schedules of students change every three months, their quarters change, and the time they spend at the university is not the same each day of the week.
2. There is usually no permanent agency that can organize and run such a program on a continuous basis. The university administration often sees it as a student problem and is not readily willing to allocate the resources necessary to run carpool programs. Efforts organized by student government lack the continuity that is vital to the success of these programs.

Because of these limitations, carpool programs in their current form do not hold much promise in a university situation. At the same time, ridesharing programs, if made more demand-responsive, have much better chances of success in the student community for the following reasons:

1. This relatively younger group may not expect a high level of comfort and convenience.
2. Since most students are not very well off financially, they would be more receptive to any scheme that saves them money.
3. Students can easily change their residential locations to suit a cheaper mode of transportation to and from the university.
4. Students may not feel so great a need for privacy during commuter travel, since members of the student community usually can find some topic of common interest about the university to share with each other. In fact, group travel in this situation would provide an interaction between faculty and students outside the classroom, a concept often advocated as highly desirable by educators.

Considering the various factors given above, a pay-and-ride carpool program has been designed to suit the needs of the commuting students, faculty, and staff of the University of Central Florida (UCF) located at Orlando. A brief outline of the program is given below:

1. UCF carpool stops will be located throughout the Orlando urban area where most commuters live, along the roads leading to the university campus. The designation of each carpool stop will be based on a minimum limit of 10 commuter students living within a 1-km radius of the stop.
2. All riders living in the vicinity of a particular carpool stop will walk to the stop and wait for drivers who are going to the university. Those drivers who want to pick up riders will stop at these designated carpool stops and, after exchange of identification, pick up riders. These riders, before entering the car, will pay university-authorized coupons to the driver as their share of the cost of a one-way ride to the university. The drivers will periodically redeem these coupons for cash at the university.
3. Each carpool stop in the urban area will have a unique number and, for each stop in the urban area, there will be a matching carpool stop at the university campus. Riders will meet drivers at these campus stops for homeward journeys. This driver-riders team for homebound travel will be independent of the one for campus-bound travel.
4. Priority parking and reduced parking fees will be used as additional incentives for participating in the program.

The scheme outlined above has been proposed for implementation at UCF as soon as some institutional and financial problems are solved.

CHARACTERISTICS OF UCF

UCF was established in the central Florida region in 1963 and is a growing educational institution. The autumn 1979 count of students, staff, and faculty was 13 600. This count has been steadily increasing and is expected to increase in the future. In view

of the increase in economic activity foreseen in this region, a university population of 20 000 in the next 10 years would be a conservative estimate. Out of the 13 600 persons who attended the university each day of the week in the autumn of 1979, only 1500 lived in campus housing and in apartments close by. The remaining 12 100 commuted by private automobile from distances ranging from 8 to 32 km or more. The one-way travel distance for all commuters averages 27 km. In a recent survey, the car occupancy rate was found to be 1.17. Future plans envision additional campus housing for 400 students, which is much less than the expected increase in student enrollments. Thus, UCF is expected to retain its identity as a commuter university.

UCF is located 21 km east of downtown Orlando, within the Orlando urban area. Three two-lane, two-way roads--University Boulevard (FL-436-A) and the Alafaya Trail (FL-520) sections south and north of University Boulevard--connect the campus with the outside communities and serve as access roads to UCF (see Figure 1).

Currently, there is no means of mass transportation to and from UCF; all students, staff, and faculty commute by private automobile. This has resulted in the following problems, which will become worse as student enrollments increase.

1. During peak hours, the various intersections on the access roads get congested and the traffic on intersection approaches flows at creep speeds. This results in lost time and excess fuel consumption.
2. The various parking lots within the campus have a total capacity of 2865 spaces. The 1979 count of vehicles parked on the campus, at 10:00 a.m. on a Wednesday, was 5500. Thus, 2635 vehicles were parked in temporary lots and at roadside curbs after the commuters failed to find parking spaces in the existing lots. Existing parking spaces are thus grossly inadequate. Construction of 3000 additional parking spaces will cost $2.1 million at current rates and will convert about 8 km^2 of green area into concrete surface.
3. Two or three fatal accidents occur every year during commuter travel, and about three property-damage accidents occur every week on campus. Most property-damage accidents on campus involve vehicles parked in temporary lots. The future increase in student enrollments would mean an increase in the number of accidents.
4. About 9640 automobiles travel to UCF each day of the week during the academic year, and about half this number do so during the summer quarter. For an average one-way daily trip length of 27 km, for a standard-sized car that gets 5.32 km/L, 19.6 million L of gasoline are consumed every year in the 200 working days. The total expense of operating and owning these vehicles amounts to $9.1 million/year at $0.093/km.
5. Orange County, Florida, in which the university is located, has been listed as a nonattainment area by the U.S. Environmental Protection Agency. Since there is no major manufacturing industry in the area, automobiles constitute the major source of air pollution. Currently, and for the near future, no non-attainment-related studies on the alternatives available to students commuting to UCF are being conducted or planned.
6. Students have to miss classes when their cars break down en route to UCF. Formal data on the frequency of such incidents are not available.
7. Many poor students cannot attend UCF because no mass transportation system is available from the various city areas to the UCF campus.

In view of these problems, a plan for some sort of mass transportation program that would be acceptable to university commuters, simple to organize and monitor, and financially self-supporting was felt to be necessary.

SELECTION OF A SUITABLE PROGRAM

Of all the available means of mass transportation, two methods were selected for consideration: bus transportation and carpooling.

Bus Transportation

To study the feasibility of bus transportation, traffic surveys were made on the various roads leading to the university. Typical weekday travel flows in and out of the UCF campus are shown in Figures 2 and 3. These figures show that about 2400 commuters enter the university at the morning peak hour and about 1500 commuters leave the university at the evening peak hour. Assuming that half of the commuters would ride buses if buses were made available, thirty to forty 40-seat buses would be required. Since these buses would have low load factors during the rest of the day, bus programs would have to be heavily subsidized.

Forty-two buses are currently operating in the Orlando urban area. The possibility of extending the present bus routes to the UCF campus was examined and discussed with the local operator, who felt strongly that bus transportation to UCF would not attract enough ridership. This option, therefore, could not be pursued further.

The residential locations of all commuters attending the university during the summer quarter of 1979 were plotted on a map of the Orlando urban area, a portion of which is shown in Figure 4. These plots showed that, at the present time, student densities are so dispersed that a fixed-route bus system would not be a workable mode of mass transportation in terms of walking distances, geographic coverage, and frequency of service. Besides, the financial and management resources needed for such a system are beyond the resources available to the university and the student government.

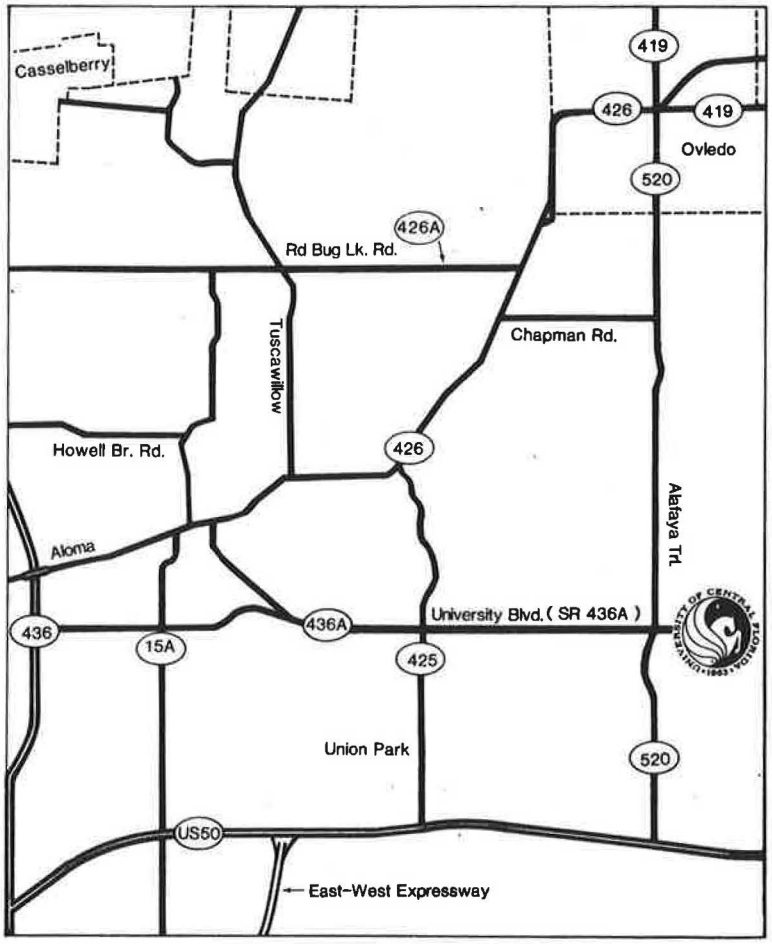
Carpooling

In studying the feasibility of a carpool program, it was found that, to suit the present needs of commuters, the most desirable carpool program would have to have the following features:

1. It should not require an agency to match the time and origin-destination needs of the commuters.
2. Flexibility should be built into the program so that carpool membership can change with the change in schedules every quarter.
3. The driver should not waste time picking up riders at their residences.
4. The number of cars available at any time of the day should be in proportion to the number of commuters who want to travel.

A pay-and-ride carpool concept was tailored to include all of these features. In this program, carpool pickup stops would be located along the roads leading to the UCF campus. Commuters residing near these carpool stops would walk and wait at these stops. Drivers passing by these stops and going to the UCF campus would pick up the waiting riders after verification of each other's identity. Riders would pay coupons to the driver as their share of the cost of a one-way ride. The drivers

Figure 1. Location of UCF in the Orlando urban area.



would cash these coupons at an office located on the UCF campus. Each such pickup stop would have a number, and matching pickup stops would be located at the destination for return travel.

The pay-and-ride carpool program, as outlined above, was selected for implementation.

PREIMPLEMENTATION OPINION SURVEYS

Opinion surveys were conducted in the summer quarter of 1979 and the winter quarter of 1980 to determine whether UCF commuters saw any problems in participating in the proposed carpool program. The numbers of commuters who participated in the surveys during the summer and winter quarters were, respectively, 450 (5.4 percent of the population) and 1226 (9.0 percent of the population). The findings of the survey conducted during the winter quarter are summarized in Table 1. Both of the surveys included members of both sexes and all classes of commuters. The one-way travel distance for the sampled commuters averaged 27 km.

Ninety-three percent of those interviewed during the winter quarter stated that a transportation problem did exist for UCF commuters. Fifty-two percent of this group attributed the problem to parking, 16 percent to cost, and 26 percent to congestion. When asked to indicate their views on the proposed carpool program, 47 percent thought that the program would be a workable solution to the UCF transportation problem, and 61 percent indicated their willingness to participate in the proposed pay-and-ride carpool program. Some interviewees viewed the program as "organized hitch-hiking", whereas some called it "a self-managed minibus service".

During the implementation phase of the program, most interviewees and some university officials pointed out three major problem areas: (a) changes in car insurance premiums to cover riders' liability, (b) the possibility of crime, and (c) reliability.

Car Insurance

Discussions with the local insurance companies concluded that, since the state of Florida is a "no-fault" state, the liability of a rider is covered by his or her automobile insurance and the driver who chooses to give a ride is not responsible for any damages done to the rider during the ride. A question was also raised about whether a driver who accepts payment from riders would be reqired to have a chauffeur's license. The local insurance companies advised that, if the drivers did not use their automobiles for profit during the rest of the day, they would not be required to have a chauffeur's license to charge ridesharing costs from riders during commuter travel. The question of a chauffeur's license has been referred to the Florida Public Service Commission for clarification.

Crimes

A majority of female students interviewed noted the possibility of crime, mostly sex-related crime, in travel with strangers. The success of the program will depend heavily on the safety of riders and

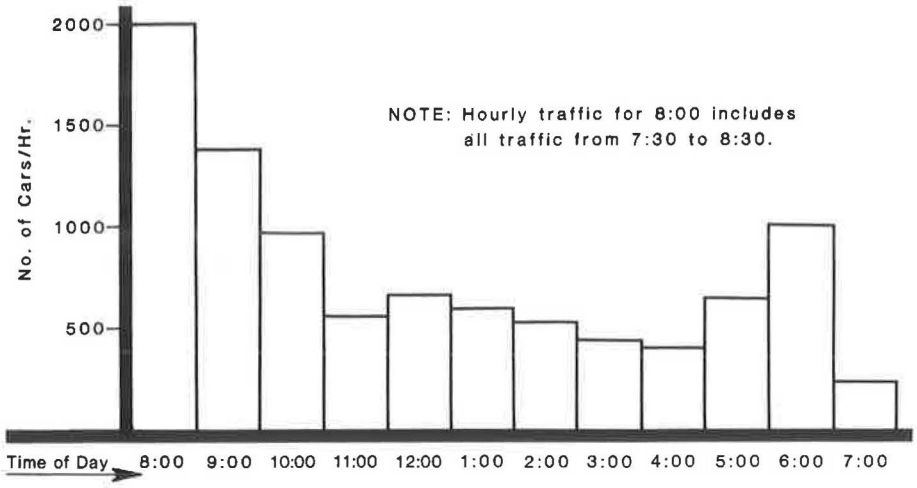


Figure 2. Hourly traffic arriving at the university (Tuesdays).

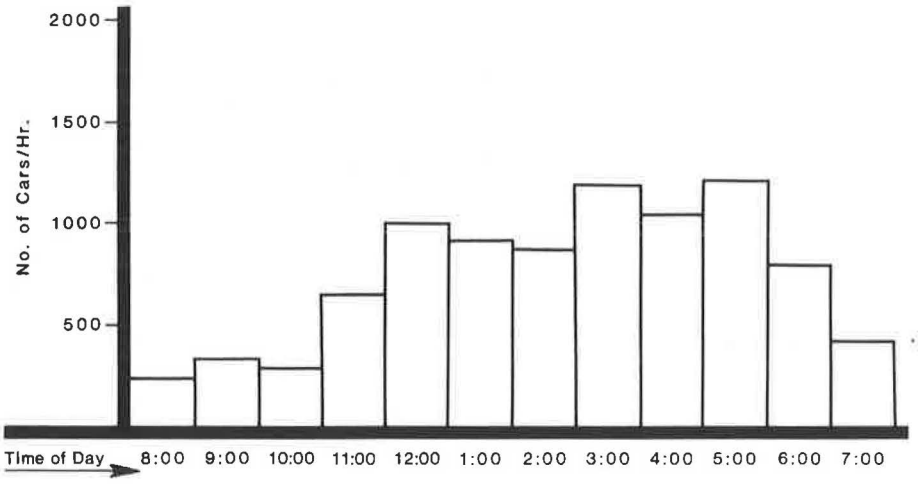


Figure 3. Hourly traffic leaving the university (Wednesdays).

drivers. Even crimes of a minor nature would have a demoralizing effect on the users.

To avoid the occurrence of crime, the following measures are proposed:

1. All drivers who choose to participate in the program will be required to paste "UCF Carpooler" stickers on their front and rear bumpers. These stickers will be issued by the university.
2. All students, staff, and faculty will be advised to check each other's bona fides before accepting or offering rides. The university identification issued annually to all students, faculty, and staff will be handy means of verification.
3. Payment of the ridesharing cost will be in university-supplied coupons and not in coins. This would be an additional means of verifying that the rider belongs to UCF.
4. Female students will be advised not to ride with male students they do not know, and vice versa. This could restrict the use of the program by female students, but a cautious approach during the initial phases is considered desirable to ensure the continued success of the program.
5. Carpool stops will be located along well-used streets, and any isolated spots will be avoided.
6. Program participants will be advised to carpool during the daytime only.
7. The UCF police chief will serve on the management team during the implementation phase of this program to monitor the crime aspect and to deal with any undesirable events.

After the program has been in operation for some time, some of the above restrictions may gradually be relaxed.

Reliability

Reliability in this context implies the punctuality of drivers in picking up waiting riders. In a few extreme cases, waiting riders may be delayed or may miss classes because no driver chose to stop at a particular carpool stop. Such incidents would have an adverse impact on the acceptability of the program.

It is expected that the last rider would reach a particular carpool stop before the last car driver, since the driver knows his or her exact travel time and would plan the time of departure accordingly. It is also expected that the teams of drivers and riders would get to know each other in the first few days of each quarter and would wait for each other. However, no conclusions can be drawn at the present time. If reliability becomes a significant problem, use of vans or buses of an appropriate size may have to be planned to ensure that the last waiting riders are transported to the university before each class hour.

PROGRAM MANAGEMENT AND OPERATION

Program Management

A universitywide committee has been formed to oversee program planning and operation and to make decisions when necessary. This committee consists of (a) a representative of the university administration (the committee chairman), (b) a representative of the student government, (c) a representative of

Figure 4. Residential locations of commuters and proposed carpool stops in a section of the Orlando urban area.

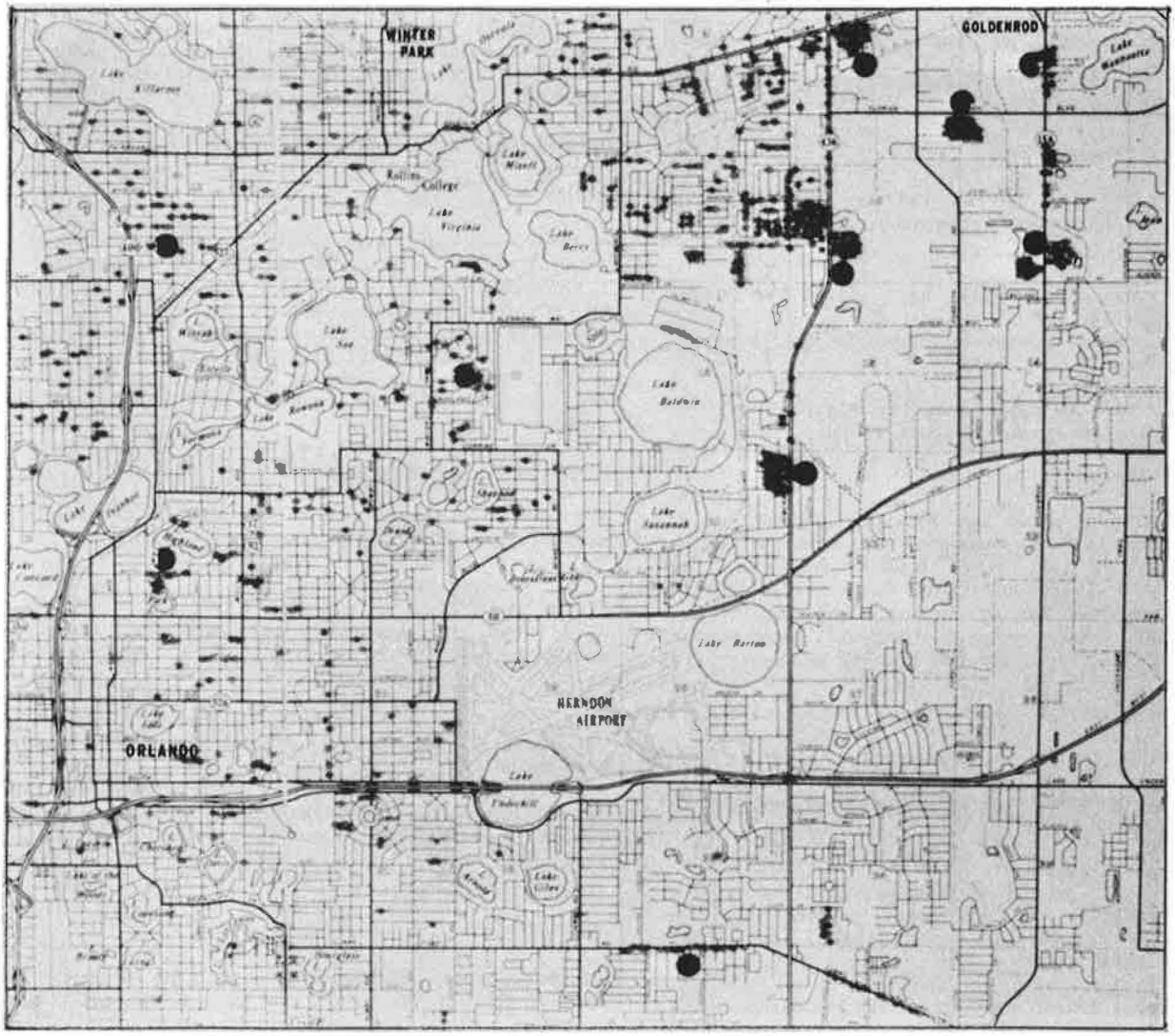


Table 1. Summary of findings of opinion survey conducted in winter quarter of 1980.

Item	Number	Percent	Item	Number	Percent
Type of survey respondent			Mode of transportation		
Student	1154	94.1	Automobile		
Faculty	22	1.8	Large	297	24.2
Sex			Compact	518	42.3
Male	655	53.4	Subcompact	357	29.1
Female	571	46.6	Bicycle or walk	54	4.4
Race			Avg distance of one-way trip (km)	26.05	
Black	112	9.1	Preferred solution to problem		
White	1048	85.5	Bus	586	37.1
Other	66	5.4	Carpool	739	46.8
Transportation problem perceived			Other	254	16.1
Yes	1143	93.2	Intent to participate in pay-and-ride program		
No	83	6.8	Yes	747	60.9
Nature of problem perceived			No	479	39.1
Parking	989	51.6	Avg walk distance to pickup stop (km)	1.2	
Congestion	492	25.7	Avg number of classes per quarter to which respondent arrived late	1.1	
Money	307	16.0			
Other	129	6.7			

the staff council, (d) a faculty member in the area of transportation, and (e) a representative of the faculty senate.

The data collection and planning required for the operation of the program have been accomplished through classroom work and through voluntary help from students and faculty. The university administration has allocated funds to meet expenditures for the initial layout and operation of a prototype program on an experimental basis. After the results of the prototype experiment are available, federal and state agencies will be approached for necessary funding.

Program Operation

Location of Carpool Stops

Carpool stops will be located on the basis of residential densities according to two major criteria:

1. Carpool stops will be located on major streets only.
2. At least 10 commuters should be living within 1 km of a carpool stop.

Road signs such as those shown in Figure 5 will be erected at the designated carpool stops.

Program Publicity

After the carpool stops are located, the outline of the program will be announced in the university newspapers. At that time, coupon books will be available to riders and "UCF Carpooler" stickers will be available for drivers. A map showing the locations of various carpool stops will be given to each UCF student and staff and faculty member.

Monitoring of the Program

A campus office will be maintained to receive complaints and suggestions from program participants, and the program committee will keep in close contact with this office.

Parking Restrictions

After the program is operational, parking restrictions will be recommended as considered necessary, in the following order:

1. Cheaper and/or closer parking for carpoolers,
2. No campus parking permits to freshmen and sophomores,
3. Higher parking fees for lone drivers, and
4. Campus parking permits to the handicapped and carpoolers only.

Extension to Other Industries

After the pay-and-ride carpool program is implemented for UCF commuters and shows signs of widespread use, a management package will be prepared and forwarded to industries in the local area for their consideration. It will be possible for some industries to use some of the UCF carpool stops in their programs.

Cost of Program Management

The costs of operating the pay-and-ride carpool program during the first three years are given below:

Year	Cost ($)
1	45 000
2	25 000
3	20 000

The cost during the first year includes the cost of stop signs. After the first two years, during which the program will be implemented and tested, only minimal expenses (to maintain an office on campus for selling and cashing coupons and for receiving any suggestions or complaints) will be incurred.

MEASUREMENT OF PROGRAM EFFECTIVENESS

Goals

A recent survey showed that the average occupancy rate of cars entering and leaving the university is 1.17 persons/vehicle. A rate of 3.0 will relieve the UCF parking problem and is therefore set as an immediate goal. Efforts to improve, intensify, and debug the program will continue until an occupancy rate of 4.0 is achieved, at which time operation of the program will be transferred to the student government.

Measures of Effectiveness

The following criteria will be used to measure the effectiveness of the program:

1. Car occupancy rates,
2. Campus parking surveys,
3. User convenience and comfort (program participants will be interviewed at intervals to measure these attributes),
4. Program reliability (waiting time at carpool stops, the number of late arrivals on campus, and the number of missed classes will be used to measure this criterion),
5. Crime rates (a record of the number and type of reported crimes will be kept, and the impact of various management actions on the crime rate will also be recorded), and
6. Accident rates.

CURRENT STATUS OF THE PROGRAM

At the present time, the start of the pay-and-ride carpool program is stalled for want of the following:

1. Since the proposed program involves monetary transactions, the university legal office has required the approval of the Florida Public Service Commission. A petition to this effect has been filed with the Public Service Commission, and their approval is awaited.
2. The approval of highway authorities for the erection of carpool-stop signs along roadways will be sought after the approval of the Public Service Commission is obtained.
3. The financial resources of the university are not adequate for the management of the proposed program. After approval of the program by the Public Service Commission, the Florida and/or U.S. Department of Transportation will be approached for the necessary funding.

MERITS OF THE PROPOSED PROGRAM

1. Pay-and-ride carpooling is relatively simple to manage and run after the initial groundwork is done.

Figure 5. Proposed carpool-stop sign.

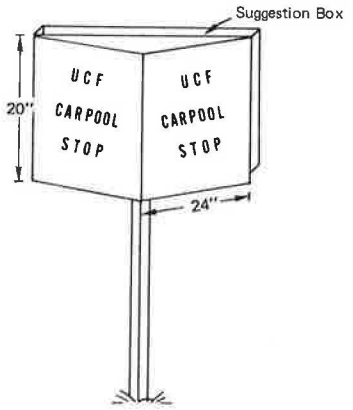
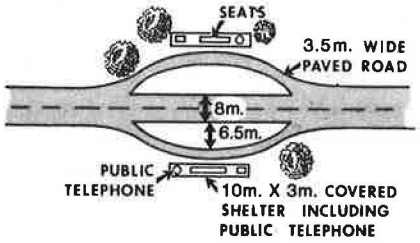


Figure 6. Proposed design for carpool stops.



2. The UCF carpool program permits an extent of geographic coverage that is not possible in a bus transportation program. In fact, pay-and-ride carpooling can simulate bus transportation where seating capacity is 5 seats/bus and where frequency of supply matches frequency of demand.
3. Members of the driver-riders carpool teams are not committed to each other, and there would be no inconvenience to program participants if any one member withdrew.
4. The program does not require any initial investment. Given the appropriate environment, the program can be financially self-supporting.
5. The program is demand-responsive in scheduling and routing.
6. The program is highly energy efficient. It makes use of unused automobile capacity. Apart from saving energy and improving the environment, the program would save about $6.5 million annually for UCF commuters and about $2.1 million for the university by eliminating the need for 3000 additional parking spaces, at an average car occupancy rate of 3.0.

EXPECTED PROGRAM BENEFITS

The program benefits would be directly proportional to the car occupancy rates, if one assumes that the program does not give rise to problems such as crime and delays. For a car occupancy rate of 3.0 persons/vehicle, which seems to be an achievable target, the benefits of the proposed pay-and-ride carpool program are, briefly, (a) savings in commuting expenses ($6.5 million/year), (b) savings in gasoline consumption (10.0 million L/year), (c) savings in parking spaces ($2.1 million), (d) reduction in accident rates, (e) improvement in air quality, (f) educational opportunities for the poor, and (g) reduced travel and parking delays.

FUTURE OUTLOOK FOR THE PROGRAM

Continued operation of the pay-and-ride carpool program for a few months would provide the user confidence in the program so necessary for its mass acceptability. Once the initial problems are gradually solved and the program is widely accepted, the commuter population would choose to live nearer to the UCF carpool stops. Such a change in living patterns would greatly increase the productivity of the program. A list of the possible future needs of the program is given below:

1. Establishment of an independent "university transportation office" at the UCF campus may be required to operate the program.
2. Parking lots and garages may have to be built near intensely used pay-and-ride carpool stops, where commuters could park and carpool.
3. Pay-and-ride carpool stops would have to be housed in roadside facilities to provide protection from the weather for waiting riders. Glass walls, benches, and a public telephone would make waiting time less unpleasant. The possible layout of such a facility is shown in Figure 6.
4. Reasonable success of the proposed plan may make it attractive to local industries. This will require multiple use of carpool-stop signs.

ACKNOWLEDGMENT

We acknowledge the support of the administration of the University of Central Florida in providing necessary resources at the management and financial level for the initial layout and operation of the proposed pay-and-ride carpool program on an experimental basis.

Evaluation of the Commuter Computer Carpool Program

JARVIA SHU AND LAWRENCE JESSE GLAZER

A study of the Commuter Computer carpool matching program in the Los Angeles metropolitan area is discussed. The study included a performance evaluation (the number of carpools formed, etc.) and a policy evaluation (to improve future performance). An innovative methodology was used to evaluate marketing activities in the carpool formation process and to compare the characteristics of carpoolers and noncarpoolers. Three population categories were surveyed: (a) applicants for matching, (b) nonapplicants at companies where Commuter Computer has been marketed, and (c) commuters among the general public (serving as a control group). It was found that mass-media marketing has resulted in widespread recognition of Commuter Computer but only limited knowledge of its available services. Employer-oriented marketing produced 75 percent of all applications. The low rate of carpool formation