Paper No. 01-0577

ORGANIZED DYNAMIC RIDE SHARING: THE POTENTIAL ENVIRONMENTAL BENEFITS AND THE OPPORTUNITY FOR ADVANCING THE CONCEPT

AUTHORS:

Amber Levofsky
U.S. Environmental Protection Agency
Office of Policy, Economics and Innovation
1200 Pennsylvania Avenue, NW
Mail Code 2127
Washington, DC 20460

Phone: 202-260-9264
Fax: 202-260-0512
E-mail: levofsky.amber@epa.gov

Allen Greenberg
U.S. Department of Transportation
Federal Highway Administration
Office of Transportation Policy Studies
400 7th Street, SW (HPPS)
Washington, DC 20590

Phone: 202-366-2425
Fax: 202-366-7696
E-Mail: Allen.Greenberg@fhwa.dot.gov

Transportation Research Board
2001 Annual Meeting
January 7-11, 2001
Washington, DC

ORGANIZED DYNAMIC RIDE SHARING: THE POTENTIAL ENVIRONMENTAL BENEFITS AND THE OPPORTUNITY FOR ADVANCING THE CONCEPT

By Amber Levofsky and Allen Greenberg[1]

Abstract

American cities and suburbs face air quality, mobility, and traffic congestion problems because of automobile use. Conventional transit and traditional carpooling have not worked well to reduce these problems in many of today's low density, auto-oriented cities and suburbs. This is not surprising since only 11% of the United States suburban population lives within one-quarter of a mile of a transit stop with non-rush hour service frequency of 15 minutes or less. A flexible approach needs to be taken that draws commuters out of their cars. A new mode of public transit, an organized dynamic ridesharing system, would use global positioning systems (GPS) and wireless communication technology to enable instant ride matching and the fulfillment of incentives for both drivers and passengers. An organized dynamic ridesharing system provides an opportunity for a safe, flexible, convenient and affordable service that takes advantage of underused infrastructure (i.e., automobile seating space and high occupancy vehicle lanes). Efforts to promote this system have not succeeded in several areas across the country. This paper examines why this failure has occurred and advocates a system that should lure commuters out of their cars and thus provide environmental benefits.

1. Introduction

Single occupancy vehicle (SOV) use has led to severe traffic congestion, environmental degradation, and mobility problems in many urban and suburban areas throughout the United States. In the last decade, metropolitan traffic has grown by 30% (*1*). Americans now drive 2.4 trillion miles per year and spend two billion hours in traffic at a cost of $48 billion in lost productivity (*1*). In the next decade, the number of cars on the road is projected to increase by 50% and vehicle miles traveled (VMT) by 30% (*1*). In the past, efforts to reduce congestion focused on (in addition to widening general purpose highways) building expensive commuter rail lines and high occupancy vehicle (HOV) lanes, providing bus service, and developing traditional carpool programs. These traditional means, however, often either do not work well or are not cost effective in suburban locations because population and spatial densities do not support the convenient and flexible service needed to convince people to get out of their cars.

To improve air quality and mobility, new approaches need to be taken to make alternative forms of transportation attractive and affordable to commuters. Approaches such as carpooling, that move more people using existing infrastructure and vehicles more efficiently, are an option. Traditional carpooling, however, is too limiting to accommodate the unconventional schedules of today's workforce, where many commuters will only respond to flexible commuting options.

---

[1] At the time of its writing, the authors were employed by the U.S. Environmental Protection Agency (USEPA). The paper represents solely the views of the authors and not their employer. The authors wish to thank Rebecca Dennison, who as a USEPA Summer Intern provided valuable suggestions throughout the editing process.

The Federal Transit Authority (FTA) has been working since 1992 on innovative technology to provide this flexibility. Its focus has been on the concept of "smart travelers" riding in "smart vehicles". "Smart", in the most advanced sense, means that both the people and vehicles are continuously connected via wireless communications (*2*). Several dynamic ridesharing projects tested this concept using different types of technology, but most have not accomplished their objectives.

Dynamic ridesharing differs from regular carpooling and vanpooling in that ridesharing is arranged on a per trip basis rather than for trips made on a regular basis (*3*). This paper examines and, provides analysis on past and current dynamic ridesharing projects and recommends options to foster dynamic ridesharing in an organized setting.

2. Traditional ridesharing

Traditional ride matching systems formally or informally link riders and drivers who travel between the same places at the same time. In 1991, a study of 84 traditional ride matching systems across the country, conducted to identify the characteristics of a successful system, suggested five program components for success:

1. A database to store commuter trip information;
2. A system that links drivers and passengers;
3. A method to deliver match lists;
4. A validation system that deletes old data; and
5. An evaluation system (*4*).

Because only 27 of the 84 systems studied monitored ride matches, this 1991 study was unable to make a correlation between the characteristics above and high ride match rates (*4*). However, it did suggest that fully automated matching, mail-based contact, and quick mailing of match lists positively influenced match levels. In addition, the study found that environmental characteristics, such as commute distance and availability of transportation alternatives and parking, influenced ride match rates. Thus, it suggested that best results could be achieved with a combination of a good ride matching service and supporting policies (*4*).

Traditionally, carpools have been a very effective alternative to driving alone, although carpooling rates have been declining. According to Census data, carpooling use for work trips in the United States declined from 19.7% in 1980 to 13.5% in 1990; the absolute number of people carpooling fell 19% from 19.1 million to 15.4 million during the same time period (*5*). In 1995, there was a modest 3% increase from 1990 levels of the number of carpool vehicle commute trips (*6*). The increasing dispersal of work sites and the trip chaining of women, in particular, to meet household needs have been factors in the overall decline of carpooling.

3. Dynamic ridesharing

Dynamic ridesharing, also known as real-time ridesharing, is a form of ridesharing that is used for single, one way trips rather than for trips made on a regular basis at the same time (*7*). A "trip" is defined as "a single instance of travel from one geographic area to another (*7*)."

Dynamic ridesharing differs from traditional ridesharing in two ways (*3*). First, a traditional ridesharing system assumes that users have a fixed schedule and fixed origin and destination points. Dynamic ridesharing systems consider each trip individually and are designed to accommodate trips to random points at random times by matching user trips without regard to trip purpose. Second, dynamic ridesharing systems have to provide match information close to the time when users need travel. Traditional ridesharing systems normally provide a match list through the mail, a process that can take several days.

Similar to traditional ridesharing, dynamic ridesharing can either be an organized program run by an agency or an informal system run by users (casual carpooling). A discussion of organized dynamic ridesharing and a review of pilot projects that have been conduced to date follows. Casual carpooling is discussed later.

3.1 Organized Dynamic Ridesharing

In an organized dynamic ridesharing program, people either offer or request rides from a central database or ridesharing agency. When a request is made, a database of potential drivers and riders (those who registered for the program) is searched for matches corresponding to the approximate time and destination of the request. The requestor receives the names and contact information of any matches made. Usually, the person requesting the ride contacts potential drivers to arrange it. In some cases, the ridesharing agencies may make initial contact with potential drivers and put the participants together only if a match is found.

Development of organized dynamic ridesharing programs is in its infancy. Several organized ridesharing projects have been attempted, but they failed or ended. Project failure, however, is not inevitable.

3.2 Environmental Benefits

Automobile travel causes serious adverse environmental effects and damage to human health (*8*). Air pollution emitted from vehicles, in the form of carbon monoxide, ground level ozone, nitrogen oxide, particulate matter, and sulfur dioxide, can cause respiratory problems and headaches in humans. Toxic pollutants released by automobiles cause cancer and birth defects. Vehicle travel also causes acid rain, reduced agriculture yields, greenhouse gas emissions and related climate change, water pollution, and loss of habitat (*8*).

Organized dynamic ridesharing could combat the increase in the numbers of vehicle trips, levels of VMT, and amounts of congestion on the road that negatively affects environmental quality. According to the United States Department of Transportation, 17% of the growth of VMT in the United States between 1983 and 1990 was caused by a decrease in vehicle occupancy – accounting for far more than the 13% increase due to population growth (*9*). But addressing this growth through traditional means is difficult because only 11% of the United States urban population lives within one-quarter mile of a transit stop with non-rush hour frequency of 15 minutes or less (*10*). Organized dynamic ridesharing, in contrast, has the potential to reduce each of these factors; 35% of participants in a Bellevue Smart Traveler project focus group (*11*) and 50% of respondents to a Hawaii Department of Transportation study (*12*) expressed a willingness to use such a service if it were available. The nation's largest (open to the general public) dial-a-ride, door-to-door transit service in San Jose, CA, failed due to overuse that seriously exceeded projections. This overuse shows the great potential that door to door services have in attracting users (*13*). An expensive U.S. average $13 per-ride cost, however, prohibits conventional dial-a-ride service from becoming a viable option for a large number of trips (*14*).

It is well understood among transportation planners that small reductions in peak period vehicle trips and VMT can produce large congestion benefits that, in turn, relieve pressure for environmentally damaging and sprawl inducing new roadway capacity. This understanding is a primary rationale behind support for congestion pricing, pay-as-you-drive insurance, "cash-out" parking, and car sharing. Dynamic ridesharing, like car sharing (hourly neighborhood car rentals), allows households to limit their car ownership by providing opportunities to use an alternative form of transportation that does not sacrifice convenience. It helps urban areas and their transit systems by encouraging car-free living, since they fill the "car" gap in urban transportation without requiring car ownership and its related high urban insurance rates and parking costs, and vehicle theft and vandalism concerns. By providing real time information on less expensive transit services to its users, dynamic ridesharing systems are expected to further bolster transit ridership.

3.3 Organized Ridesharing Examples

3.3.1 Bellevue, Washington:

The University of Washington and the Bellevue Transportation Management Association developed the Bellevue Smart Traveler system, a traveler information center that provided dynamic ridesharing support, real-time traffic reports, and transit information, with funding from the University and the Federal Transit Administration. All Bellevue downtown employees were eligible to sign up. Users could access information over the telephone. For ridesharing purposes, users were divided into groups based on where they lived; all users were going to Downtown Bellevue. When rides were offered or requested, messages went out to participants only in the same group. Since the origin and destination of the user was already known, the system only requested the day and time of the trip. Users could also search for rides using a pager. The pager received hourly transmissions containing the available rides for the pager holder's group.

The project ran from November 1993 to March 1994. During that time, 53 people were registered, 509 rides were offered, and 148 rides were sought producing 40 potential matches (*11*). Only six ride matches were logged (*11*). Yet logging a ride was not required, so there is no way to know how many matches actually occurred.

Results from the project showed that participants liked the idea of the project and the way it was represented, were comfortable with the technology, and were willing to offer rides. However, there was reluctance to seek rides and few matches were made. Reasons for this result may have been: lack of ride choices due to the size of the group, uncertainty of obtaining a return trip, short length of the project, or limited incentives due to lack of HOV lanes (*11*).

Another possible reason for failure of the project may have been the inconvenience of the service. The system did not actually do the matching. When users received potential matches from their ride groups, they were left to locate a time match and to coordinate the trip. Contacting another user had to be done by telephone to either a telephone or a page number. The evaluation report suggests an Internet based matching system would improve success by allowing participants to "more easily obtain and respond to rideshare information (*11*)." Since participants were placed in location-based ride groups, trips were limited to work and home, with time of the trip as the sole variable. For maximum benefits, dynamic ride matching systems need to allow both location and time to vary to enable matching for work and non-work trips (*7*).

3.3.2 Los Angeles Smart Traveler

The Los Angeles Smart Traveler project was an Automated Rideshare Matching System (ARMS) that the regional ridesharing agency, Commuter Transportation Services, added to its overall ridesharing program to help alleviate traffic after the 1994 Northridge earthquake. It was therefore limited to the approximately 68,000 people affected and operated only from July 1994 to September 1994 (*15*). Users calling a toll free number could select dynamic ridesharing from an options menu. An AutoText interface allowed users to input and change their travel times and to search for new matches based on the new times. Ride match lists were provided over the phone to the users who then had the option of calling the potential matches or having a computer send a message. In order to use ARMS, individuals had to be registered with Commuter Transportation Services. If they were not registered, they could transfer out of the automated system, speak to an operator, and register. Costs for the service were reported to be $145,000 for development and $28,000 or $110/call for the three-month period of operation (*15*).

An evaluation of the Los Angeles Smart Traveler program conducted from October 1994 to March 1995 showed that an average of 34 people per week used the system (*15*). There is no way to know how many matches where actually made because users were not required to report them. Usage data was collected and surveys of both users and non-users were conducted. The evaluation concluded that the market for "one-day-only" rides was very limited because of participants' concerns over safety (*15*). Rather than participate, most potential users would ask a friend for a ride if their normal mode of travel was not available.

3.3.3 Sacramento, CA

The California Department of Transportation (CaDOT) tested a dynamic ridesharing program in Sacramento, CA, which began in late 1994 and terminated in 1995. The service was not automated, but operator-based. Users answered questions over the telephone about origin and destination locations, purpose of trip, etc. Trip matches were made by sorting from database orientation and destination zip codes, and then prioritizing by the closeness of desired trip times.

Three hundred and sixty people (from a database of 5,000 who expressed interest in carpooling) registered as drivers willing to offer on-demand rides (*16*). From the ten requests made for dynamic ridesharing, only one potential match was made, and it is not known if the match was secured (*16*). The final report concluded there were several reasons for the poor performance of the program:

1) Marketing the service to potential users: there was little promotion of the service, and therefore many people were unaware of its existence.
2) Recruiting drivers to provide rides: potential drivers were unaware of or unmotivated by the small HOV lane incentive available.
3) Personal security concerns made people apprehensive about taking a trip with strangers (*16*).

Project costs were reported to be $806,000 ($317,000 for marketing and personnel) for the service and $142,000 for evaluation (*16*).

3.3.4 Coachella Valley (Riverside County, CA)

Commuter Transportation Services, Inc. (CTS) developed the TransAction Network (TAN) as a pilot for testing an interactive way to provide information on transit and ridesharing, including real-time match list distribution in the Coachella Valley area. TAN was a system of stand-alone commuter information kiosks that provided access to bilingual transit and ridesharing information including the CTS ride match database containing commuting information on over 700,000 registrants throughout the area (*17*). This allowed users to generate a real-time match list of potential ridesharing partners and to input their own information. Four kiosks were located in areas of high pedestrian and retail activity. Over a seven-month test period (May 1994 to December 1994), more than 21,510 people accessed the kiosk system (*17*). Of that number, only approximately one-third accessed information on ridesharing. Only 8% of the 3,200 printouts were rideshare match lists (*17*).

The cost for developing and running TAN for seven months was $550,000 or $25.57 per user (*17*). The kiosks' use of expensive, market specific media (commercial quality animation, graphics, b-roll, stereo sound) contributed to this high cost. Projected second year operating and maintenance costs were $155,000 (*17*). CTS projected that TAN may have become cost efficient in six years. However, SunLine Transit decided against funding the project after the demonstration phase.

In its test form, duplicating and replicating TAN outside the pilot phase test area would have required a complete redevelopment of the system's audio-visual user interface, pricing it out of small to mid sized markets. Instead, CTS recommended that future kiosks retain the current design, logic and user interface, but eliminate the expensive market specific media elements. However, because user statistics revealed a lack on interest or resistance to TAN's ridesharing application, CTS recommended it not be included in future models (*17*).

3.3.5 Seattle, Washington

The Seattle Smart Traveler Program, based at the University of Washington, tested dynamic ridesharing in the Seattle area from March 1996 to November 1996. The Internet was the main method used to deliver the matching service. Users entered information over the Internet and received matches by e-mail. The information included the user origin, destination, departure time, and arrival time for each match sought. Requests could be for regular or single trips. Users could make final trip arrangements through e-mail or over the telephone, with e-mail being the preferred method. The targeted users of the system were the staff, students, and faculty of the University (*7*).

Faculty and staff made up 68% of users, with students comprising the remaining 32% (*7*). Approximately 500 rides were requested, with 150 potential matches generated, and 34% of these matches actually made (*18*). It is possible that more ride matches were made, as there was no requirement to report the trips taken.

The system operated alongside of the region's traditional carpooling effort. The program evaluation report found that there was little overlap between the two user groups. In fact, almost 80% of the system usage occurred between normal business hours (*7*), a time when most traditional carpoolers are at work. One reason for the dynamic ridesharing market was the strict parking policies that provided an incentive for users to arrive at the University without a car. Use of the system was restricted to the University population, producing a closed environment; thus, most fears of riding with a stranger were removed and security was not an overwhelming concern.

Today, this system still exists, but because of lack of funding the records have not been fully kept up to date and system monitoring is non-existant.

3.4 Summary of Reviews

The projects above share a number of common characteristics. All but the Seattle project were abandoned for low usage. In each abandoned project there was only a small number of requests for rides and a smaller number of matches made. This failure could be attributed to how each was designed. Commuter behavior is important to understanding what happened.

Commuters need to be made aware of a new service, but the abandoned services were not aggressively advertised. They were short lived, allowing insufficient time for effective marketing and commuter experimentation. If commuters know a transportation service exists, they make their travel choices based on a number of factors. Time and monetary savings are important in convincing commuters to take alternative forms of transportation (*19*), but they did not exist or were not apparent in these abandoned pilots. If such incentives are not provided, other inducements for participation are needed.

People have a natural distrust of strangers, and are hesitant to ride in a car with one. The projects verified that without enhanced security measures, this is a clear deterrent to participating in a dynamic ridesharing program. Commuters want reliability and are therefore reluctant to leave their car at home if they are uncertain about obtaining a ride for the return trip. They also want flexibility and ease when using a transportation system (*20*). In all but the Seattle project, the actual process of obtaining a match inhibited participation. It was a time consuming and burdensome process that required getting lists, and then attempting to make contact with possible drivers with no guarantee that a match would be made.

In contrast, there has been limited success in organized ridesharing, as demonstrated by the Seattle Smart Traveler Program. With its well defined community and high computer and Internet accessibility, commuters were willing and able to use this convenient system. Yet, even with many of the appropriate conditions for dynamic ridesharing, the current lack of funding for the system's operation suggests that this application lacks institutional support.

4. Casual Carpooling

Real-time ridesharing does work and exists as casual carpooling in two areas in the United States: San Francisco, CA, and Washington, DC. Unlike traditional carpooling and to some extent organized dynamic ridesharing systems, no prearragements or fixed schedules are necessary to match drivers and passengers. Casual carpooling runs on its own momentum; it was not started and it is not run by a public or private entity. Carpools form when drivers and passengers meet at designated locations, usually near transit stops. Casual carpooling began in the 1970's. The driving force in casual carpooling is the availability of HOV facilities that avoid extensive congestion – HOV lanes in the DC area, and HOV lane tollbooth bypasses on the Bay Bridge. The HOV facilities in these areas draw commuters to casual carpooling. Casual carpooling provides commuters with:

1) Time saving benefits: commuters save up to an hour or more on their commute (*21*), and commute times may be more reliable;
2) Money savings directly (transit fares or gas/tolls) or indirectly (buying a second car);
3) Minimal personal commitment requirements; and
4) Flexible schedule accommodations.

The dilemma with casual carpooling is that it has the greatest potential of success when transit is available, resulting at times in mode shifts from transit to carpools. A study by Rides for Bay Area Commuters, for example, suggests that casual carpooling is likely adding cars to roads around the Bay Area, and thus not improving congestion and air quality (*19*). This addition of cars on the road is not a necessary outcome of casual carpooling, but the phenomenon should be considered when designing any dynamic ridesharing system.

4.1 San Francisco, CA

Approximately 8,000 to 10,000 people, or 9% of total carpoolers, participate in casual carpooling in the San Francisco area (*19*). During the morning commute periods, pick-up points are in Oakland near Bay Area Rapid Transit (BART) stations and in Alameda-Contra County near Costa Transit bus stops. These sites serve as loading zones, provide users with a back-up choice if a ride is unavailable, and guarantee users a ride home in the evening. Drop-off points usually are near the Transbay bus terminal in downtown San Francisco, although other destinations are also common. These sites are centrally located and provide passengers with other means to continue their trip if needed. Carpoolers gain the benefit of a 10 to 20 minute timesavings while avoiding a $1.00 toll by using the HOV toll bypass lane (*3*). Until recently, there was no market for evening casual carpooling since there were no HOV lanes heading out of San Francisco. In 1999, a 20-mile HOV lane was constructed and, with support from Environmental Defense organizing and securing destination signs in downtown San Francisco, evening casual carpooling has begun.

4. 2 Washington, DC:

Casual carpooling in the Washington, DC area is well organized with approximately 3,000 people, or 11% of carpoolers, participating (*22*). Northern Virginia commuters, who want a ride to the Pentagon or Washington, DC, stand at specific suburban locations, usually near parking lots or bus stops. Drivers wanting to legally use the HOV lane system pick them up. Destinations are usually announced, except in certain places where drivers stand in queues according to which bridge they want to cross. A similar arrangement is used for the return trip from DC, but rides are harder to find causing some passengers to take transit home in the evenings. Drivers save up to an hour or more on their commute time, and commute times may be more reliable; passengers find that casual carpooling is normally faster and more flexible than bus or subway service because of the ease and speed in which a ride is obtained and cheaper because they are not paying fares.

4.3 Summary

Although casual carpooling differs from organized dynamic ridesharing, it does prove that there is demand for flexible ridesharing arrangements and that fears of riding with strangers do not need to be an obstacle to creating a dynamic ridesharing system. However, as shown below, certain conditions are present in Washington, DC and San Francisco that allow casual carpooling to occur:

1) Corridor oriented approach enabled gradual growth and high successful match rates;
2) HOV facilities provide time and money saving incentives to drivers;
3) Pick up locations provide easy access to both drivers and riders;
4) Employment densities provide a critical mass of participants;
5) Good public transit service is available for passengers to make return trips and for back-up service for incoming trips;
6) Personal security is not an issue because users have become familiar with each other and system etiquette allows "no-questions asked" rejection of rides. This removes much of the uneasiness of participating. In addition, HOV-3 lane restrictions provide commuters with a sense of security because they are not alone with an unknown driver (*22*); and
7) Casual carpooling evolved over time. This allowed commuters to overcome their initial fears of riding with unknown people and of using an unconventional means of commuting.

Without these features in some form, dynamic ridesharing will not work (as demonstrated by the failure of four organized dynamic ridesharing pilots); with these features, there is still no guarantee that it will work. So, how can the features that allow casual carpooling to exist be applied to an organized dynamic ridesharing program to bring about success?

5. Recommendations: Advanced Public Transportation Services

If an organized dynamic ridesharing system is to work, it will need to provide "reliable, convenient and safe transit services [like the casual carpooling system] for traditional carpool trips, as well as for irregularly timed and non-commute trips while creating a seamless system of transit services (*23*)." The Smart Traveler technology developed by FTA, as part of the Advanced Public Transportation System (APTS) program, could be used to create this type of system. APTS has the potential to work well in suburban locations because it takes the emphasis off of creating new fixed bus or train service (which often is not successful) and seeks to instead use the empty passenger capacity that is currently available in public and private vehicles (*23*).

For a system to be successful, it will need to give SOV users trip-by-trip options and incentives to leave their cars behind. Examples of such incentives include preferential parking, reduced parking costs, discounts at local businesses, other monetary benefits, and timesavings for drivers and passengers. An APTS system could be programmed to provide participating drivers with the best routes to avoid congestion giving them an information advantage over SOV drivers (except, perhaps, SOV drivers that subscribe to a private provider of such information).

Wireless communications and Automatic Vehicle Location (AVL) technology would be the foundation of such a system, continuously connecting vehicles and people. This technology can monitor the origins and destinations of people seeking rides and locations of all participating vehicles with room for passengers. The position of vehicles and their passengers would always be known, thus providing much needed security. In addition, drivers and passengers could press a button for emergency assistance. Central to the success of such a program would be a system of electronic fare collection that would transfer payments to drivers who give rides. This system would strive to provide rides from door-to-door, the suburban ideal. If a door-to-door ride was unavailable, a rider could be taken to a transfer point where he could transfer to another participating vehicle or public transit to complete the trip. Additionally, a taxi backup could be deployed—at the system's expense—where no reasonably convenient alternatives were available.

In markets where conventional transit has some prevalence, a pilot project could play an important role in bolstering transit use. It could inform ride seekers, in real time, of less expensive, convenient transit alternatives. Since many forego transit, even when it would meet their needs, if route and schedule information were not readily available, such a pilot would be expected to increase transit ridership. Organized dynamic ridesharing would serve as a valuable backup for conventional transit and carpool trips, providing transit riders and carpoolers with the confidence that they can get home if their schedule changes unexpectedly.

System effectiveness and efficiency is best maximized if at least some participants are sometimes flexible as to whether they drive or ride for a particular trip. With the right incentive, many might occasionally offer the ride matching system the option of assigning them to either the driver or passenger role. The availability of hand-held phone/GPS units should help facilitate this flexibility.

This system would provide the universal and low cost service that traditional transit options (commuter trains, light rail, fixed bus routes) could not. It would offer the flexibility and convenience that the projects in Bellevue, Los Angeles, Coachella Valley, and Sacramento did not. It would offer incentives to drivers and passengers, which is critical to the success of casual carpooling in San Francisco and Washington, DC. How would such a system work?

Government agencies and private companies have already begun to develop this concept. The City of Ontario, California, with funding from the FTA, began development of the ATHENA smart traveler system in 1994, but the project was abandoned in 1996 due to a turnover of the city council.

The ATHENA project differed from other dynamic ridesharing programs in that trip requestors would not have received a list of potential drivers, and would not have had to contact trip providers to arrange travel. Instead, a central computer would have arranged the match and advised the rider and driver of pickup points, times, and fares. The ATHENA project incorporated a central database that interfaced with personal digital assistants (PDA's), hand held devices that have messaging and GIS capabilities. Interested parties would have pre-registered with ATHENA. The registration process had not been designed by the project's end. A possible registration process might have included pre-screenings, or even background checks, on all potential drivers and passengers and a vehicle inspection to ensure its safety. Once registered, all ATHENA drivers would have received a PDA for their car, and all potential passengers would have received cellular phones, although any desk phone or phone booth would also be a means for interacting with the computer. Provision of this equipment to passengers and drivers would have allowed for continuous coordination of ride requests and offers. When drivers could provide rides, they would turn on their PDA. Request for rides could be made over the telephone or Internet. The central computer would determine eligibility for a match based on how close a driver's route at a particular time was to a passenger's request. Rides would have been provided using private vehicles and flexible route mini-buses. A taxi ride subsidized by ATHENA would have been provided if no other arrangements could be made. Hotel and airport shuttles were to be added at a later date. Video kiosks were to be placed in office lobbies, schools, shopping malls, the airport, and train station to provide access to transit information and the ATHENA system.

A driver would have arrived at a pick up site with visual features identifying the car as an ATHENA provider. Once the passenger entered the car, he and the driver would key personal identification codes into the PDA to establish positive identification, record the shared ride, and maintain positive security. Each transaction would have electronically triggered any necessary financial exchanges and provided traffic information reports.

Because the technology to carry out this type of system was not readily available, the City of Ontario began development of a prototype PDA in 1994. Today, however, a system could be built that uses already existing technology. It could take advantage of privately funded, already committed corporate plans that improve technology for other purposes. Automobile makers are already installing GPS based systems into their luxury models; it should not be long before this practice becomes standard to every model. According to GM, almost all of the 9 million vehicles it manufactures annually will eventually have cellular service with Internet connections, and Ford will provide telemactics services to most Ford vehicles over the next several years (*24*). Some cellular phones already have Internet capabilities that send and receive data and video communications. Over the next decade this technology will improve and should become widely available; by 2003, it is estimated that 63 million people in the United States will use wireless technology to connect to the Internet (*25*). A dynamic ridesharing project in Oregon is seeking to take advantage of this trend.

Robert Behnke, President, Aegis Transportation Systems, has developed a system called MINERVA based on the ATHENA model. Like ATHENA, MINERVA will use "smart" technology including cellular phones, palmtop computers, and wireless data communications to provide low-cost, door-to-door transportation in low-density areas and low travel corridors. The service will be integrated with conventional transit, paratransit and ridesharing services. But MINERVA seeks to take the ATHENA concept one step further. MINERVA will attempt to integrate these new services with other online information services—home shopping, telebanking, e-mail, and interactive games—in an attempt to reduce the need for some trips altogether. Currently in Oregon, the State legislature has committed $1.5 million to this project, with additional commitments of $3 million in matching funds from local pilot sites, and $1 million in in-kind support from private management consulting outfits. Already, about a dozen Oregon cities have expressed interest in piloting MINERVA.

There are a number of locally specific issues that need examination before any project can be implemented at a given site:

1. Operational - safe and efficient operation of the system, identification of drivers/riders, survey of locally available incentives.

2. Legal - common-carrier laws (especially regarding "jitneys"), insurance provisions, privacy/safety requirements, liability concerns.

3. Financial - cost of service operation, impacts on transit, benefits/costs to users, Internal Revenue Service limitation on non-taxable payments.

4. Environmental - impacts on alternative modes (transit, regular carpools, vanpools) and use of dynamic ridesharing instead of transit.

5. Opposition- possible objections from the public, transit agencies and their unions, insurance companies, and participating agency risk managers.

6. Conclusions

The Seattle dynamic ridesharing experience and the success of casual carpooling suggest that an organized dynamic ridesharing service may be successful if it is well-designed, properly promoted and convenient to use. Like carsharing, organized dynamic ridesharing provides households with the opportunity to save money by reducing the number of cars they own, but without sacrificing convenience. Past organized dynamic ridesharing projects, however, show that many additional steps are needed before an organized dynamic ridesharing program could have the potential to attract large numbers of users or eliminate a significant number of SOVs from the road, and thus before a program could produce substantial environmental benefits. A project like ATHENA may increase usage rates by addressing many of the concerns that inhibit people from using an organized dynamic ridesharing system. It can be a useful addition to other ridesharing and congestion reduction options. Its cost of operation should be low compared to expanding bus and rail service. If development and implementation of such a system were to occur, pilot sites could be in areas with extensive HOV networks, as a timesaving incentive would already be available. The MINERVA project in Oregon provides an immediate opportunity to demonstrate the viability and environmental benefits of dynamic ridesharing.

Works Cited

1. --------, "Metropolitan ITS." URL: http://www.its.dot.gov/metro-its/metro.htm. January 1999.
2. Labell, Lawrence N., Carol Schweiger, Mary Kihl. Advanced Public Transportation Systems: State of the Art Update '92. Report No. DOT-VNTSC-FTA-92-3. Washington DC: USDOT, FTA, 1992.
3. Casey, R.F., et al. Advanced Public Transportation Systems: The State of the Art, Update '96. Chapter 5. Report No. FTA-MA-26-7007-96-1. Washington: USDOT, FTA, January 1996. 109-139.
4. Berolodo, Steve. "Ride Matching System Effectiveness: A Coast to Coast Perspective." Transportation Research Record. No. 1321. Washington, DC: Transportation Research Board, 1991. 7-12.
5. United States Department of Transportation. Commuting Alternatives in the United States: Recent Trends and a Look to the Future. Report No. DOT-T-95-11. Washington DC: USDOT Office of University and Research Education, 1994.
6. --------, Our Nation's Travel: 1995 NPTS Early Results Report. Washington DC: USDOT FHWA, 1997.
7. Dailey, Daniel, Donald Loseff, and David Meyers. Seattle Smart Traveler: Final Research Report. Report No. WA-RD 444.1 / TNW 97-08. Washington: Washington State Transportation Center, October 1997.
8. United States Environmental Protection Agency. Indicators of the Environmental Impacts of Transportation. Washington DC: USEPA Office of Policy and Reinvention, 1999.
9. Surface Transportation Policy Project. Why are the Roads Congested? Washington DC: Surface Transportation Policy Project, November 1999.
10. National Science and Technology Council. National Transportation Technology Plan: Draft. Washington, DC: National Science and Technology Council, Committee on Technology, Subcommittee on Transportation Research and Development, December 1999.
11. Haselkorn, M., et al. Bellevue Smart Traveler: Design, Demonstration, and Assessment. Report No. WA-RD 376.1. Washington: Washington State DOT, 1995.
12. Flannelly, Kevin, et al. A Comparison of Consumer's Interest in Using Different Modes of Transportation. Transportation Research Board's 70th Annual Meeting. Paper No. 910651. Washington, DC, 13 January 2000.
13. Lindsey, Robert. "Failure of Experiment." New York Times. 14 May 1974: 46.
14. Barron, W., et al. "Reaching Out: New Partnerships with State and Local Agencies." VOLPE Journal, Winter 2000: 3-15.
15. Golob, Jacqueline and Genevieve Giuliano. "Smart Traveler Automated Ridematching Service Lessons Learned for Future ATIS Initiatives." Intelligent Transportation Systems: Deployment and User Needs. Transportation Research Board 1537 (1996): 23-29.
16. Kowshik, Raghu, Paul P. Jovanis and Ryuichi Kitamura. Evaluation of the Sacramento-Area Real Time Rideshare Matching Field Operational Test: Final Report. California PATH Report to Caltrans 96-C5. February 1995.
17. Commuter Transportation Services. Remote Multimedia Access to Transit and Ridematching Services. Report Number AB2766/C93036. California: Mobile Sources Air Pollution Reduction Committee, February, 1995.

18. Casey, R.F., et al. Advanced Public Transportation Systems: The State of the Art, Update '98. Chapter 5. Report No. FTA- MA-26-7007-98-1. Washington: USDOT, FTA, January 1998. 5-1-5-25.
19. Rides for Bay Area Commuters. Casual Carpooling 1998 Update. California: Metropolitan Transportation Commission, 1999.
20. Kogan, Marcela. "Slugs and Body Snatchers." The Workforce June 1997. URL: http://www.governmentexecutive.com/features/0697.htm.
21. LeBlanc, David E. Slugging: The Commuting Alternative for Washington DC. Forel Publishing: East Point, GA, 1999.
22. Spielberg, Frank and Phillip Shapiro. "The Mating Habits of Slugs: Dynamic Carpool Formation in the 1-95/I-395 Corridor in Northern Virginia." Transportation Research Board's 79th Annual Meeting. Paper No. 00-0823. Washington, DC, 9 January 2000.
23. Niles, John and Paul Toliver. IVHS Technology for Improving Ridesharing. [c.1991]. URL: http://www.gt-wa.com/gtwork/ihov.htm.
24. Orski, C. Kenneth. "Telematics' auto-embrace." Traffic Technology International Feb/Mar 2000: 10.
25. Stone, Brad. "Wireless Web Garb." Newsweek 13 March 2000: 49.