

**HOUSTON *SMART COMMUTER* DEMONSTRATION
PROJECT**

Bus and Carpool Concept Definition

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Metropolitan Transit Authority of Harris County
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Urban Mass Transportation Administration

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Texas Transportation Institute
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Houston *Smart Commuter* Demonstration Project

Bus and Carpool Concept Definitions

Introduction

The proposed Houston *Smart Commuter* Demonstration Project is examining the potential for encouraging greater utilization of high-occupancy commute modes -- such as buses, carpools, and vanpools -- through the application of innovative approaches using advanced technologies. Development of the demonstration is based on the hypothesis that commuters who have quick and easy access to relevant, accurate, and up-to-date information on existing traffic conditions, bus routes and schedules, and instant carpool matching services will be more likely to use public transportation and other high-occupancy commute modes. Individuals may also alter their travel time or route based on this information.

Two separate, but interrelated, concepts are being examined. One concept focuses on encouraging a commute mode change from driving alone to using the bus in the traditional suburban-to-downtown travel market. The other concept centers on the potential for instant carpool matching services in the newly emerging suburban-to-suburban travel market. Although the two concepts share many of the same attributes, differences exist in the approach, techniques, and issues associated with implementing each.

In order to ensure a clear understanding of the two project elements, this working paper describes the basic components of each concept as they are currently envisioned. It is realized that these may be modified depending on the results of the market and technology assessments. The intent of the working paper is not to provide the final design for each element; rather the intent is to ensure a common understanding of the starting point for the development of each component and the decisions agreed upon to date. In addition, the working paper presents the proposed criteria for evaluating the different technologies and developing the final concept plan and implementation program.

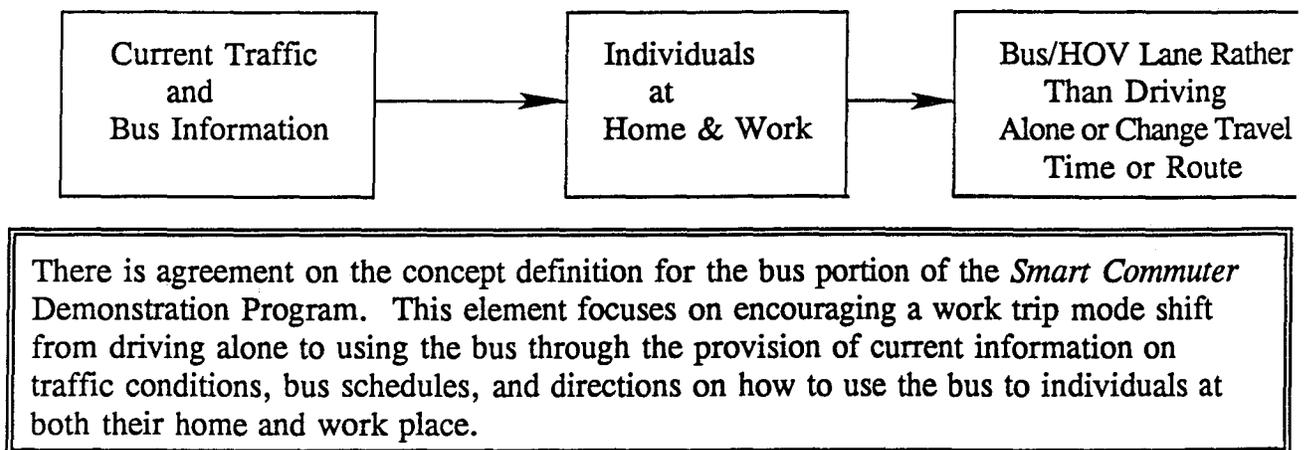
The following items are presented for both the bus and carpool components; concept design, approach, potential technologies, provision of needed information, and possible implementation and evaluation activities. The status of the research associated with each of these items is briefly described. The decisions that have been made to date and the issues to be addressed are highlighted in the boxes within each section.

Bus Element in the Suburban-to-Downtown Market

Concept Definition

The bus component of the Houston *Smart Commuter* Demonstration Project focuses on encouraging a work trip mode shift from driving alone to using the bus through the provision of current information on traffic conditions, bus schedules and how to use the bus to individuals in their home and work place. The hypothesis, as illustrated in Figure 1, is that bus ridership will increase when individuals are provided with current and accurate information on traffic conditions, travel times on the freeway and HOV lane, bus schedules, and directions on use of the bus in their home and work place. This concept will be tested through the implementation and evaluation of a demonstration project focusing on commuters living in the Kuykendahl park-and-ride lot market area along I-45 North and working in downtown Houston.

Figure 1 - Smart Commuter Bus Concept

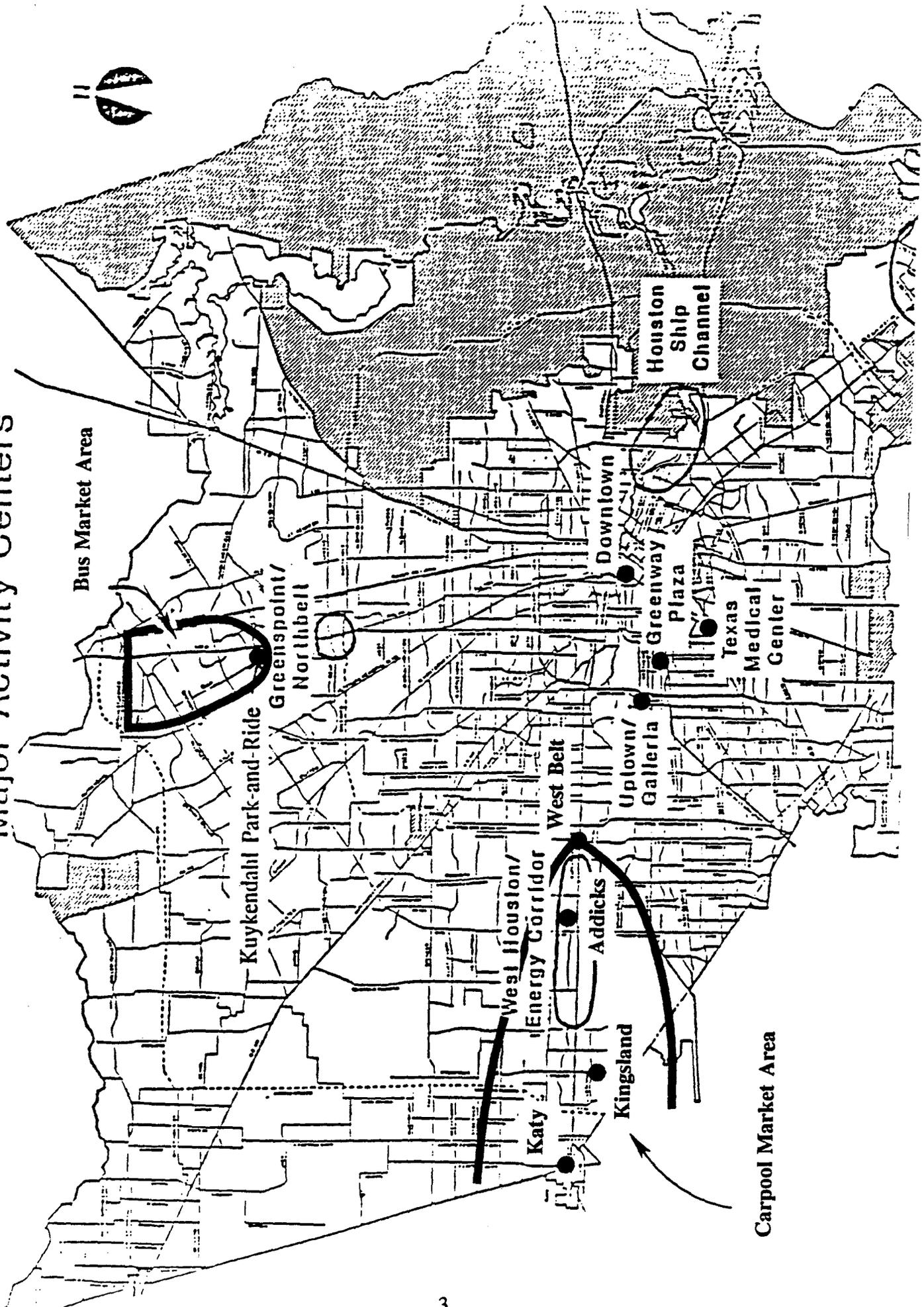


Approach

The bus component of the *Smart Commuter* Demonstration Project will focus on commuters living in the Kuykendahl park-and-ride lot market area along I-45 North and working in downtown Houston. This represents the traditional suburban-to-downtown transit market which is well served by regular route bus service. The location of the Kuykendahl park-and-ride lot and the market area are shown in Figure 2. This area was selected for the initial demonstration based on the high level of existing peak-period bus service (2-5 minute headways in the peak hour), the travel time savings offered to bus riders due to the use of the North HOV lane, available capacity at the park-and-ride lot and on buses, the ability to add buses if demand warrants, and the strong travel demand to the downtown area. In addition, the North HOV lane is basically completed with major construction activities finished, the needed support facilities

Figure 2. Locations of Bus and Carpool Demonstration Market Areas

Major Activity Centers



are in place, and all major agencies (Metro, SDHPT, UMTA, and FHWA) have participated in funding for the different elements.

There is agreement that the I-45 North Freeway Corridor, focusing on the Kuykendahl park-and-ride lot is the appropriate area for an initial demonstration program for the following reasons.

- HOV lane virtually completed
- Travel times savings provided to users of the HOV lane
- Support facilities in place
- High level of existing peak-period bus service
- Some available capacity to serve new riders and ability to add service if needed
- Strong travel demands to downtown area
- Metro, SDHPT, UMTA, and FHWA all have participated in funding different elements in the corridor

The bus element will focus on two groups of commuters living in the Kuykendahl park-and-ride lot market area. One group will be provided with current traffic and transit information in their home and work place through one or more types of technologies. The other group, which will serve as the control group, will not be provided with the same information. Based on preliminary statistical analysis, it is anticipated that each group will be comprised of approximately 600 individuals to ensure the statistical validity of the demonstration. It is further anticipated that individuals will be identified to participate in the demonstration through major employers in the downtown area. Home zip codes will be used to identify a pool of possible participants. Commuters who currently drive alone all or most of the time will be targeted to participate.

There is agreement that two groups should be used in the bus demonstration. One group would be the test group, while the second would act as the control group. These groups will be sized to ensure the statistical validity of the demonstration.

Potential Technologies

The technologies being examined to communicate the desired traffic and transit information include touch-tone and cellular telephones, cable television, and videotex terminals (both "smart" and "dumb" terminals). Different combinations of these technologies will be considered, as will the use of different methods at the home end and at the work end. The

potential exists that the technologies utilized may evolve over time, with a relatively simple approach implemented during the initial demonstration.

There is agreement that the following technologies will be examined for possible use in the bus component of the *Smart Commuter* Demonstration Project. It is realized that this list may evolve over the course of the assessment as additional information is obtained. In addition, the actual use of these technologies may take different forms and more than one technology may be used.

- o Telephone based systems (live operator, voice synthesis, voice recognition, voice mail)
 - touch-tone telephones
 - cellular telephones
- o Television based systems
 - traffic reports as part of commercial station programming
 - cable television
 - interactive cable television
- o Videotex based systems (smart terminal, such as a microcomputer, or dumb terminal)
 - U.S. videotel
 - Prodigy
 - AT&T

These technologies will be evaluated based on a number of criteria to select the technology or combination of technologies most appropriate for the demonstration. It is anticipated that the evaluation criteria will include input from the focus groups, capital and operating costs, ability to deliver the desired information, compatibility with existing and future system elements, and potential for private sector involvement.

Suggested criteria for evaluating the different technologies for the bus element of the *Smart Commuter* Demonstration Program include the following. These will be discussed at the February 14, 1991 Project Management Team meeting.

- Preference/ranking from focus groups
- Ease of access by users
- Ability to provide two-way (interactive) communication
- Ability to provide information at both trip ends (home and work)
- Ability to deliver needed traffic and transit information (both short and long term)
- Ability to deliver different information to different corridors and geographical locations
- Costs
 - initial capital costs
 - ongoing operating costs
 - long term capital costs (system expansion and upgrading)
 - cost to user
- Compatibility with long term Metro and SDHPT efforts
- Potential for private sector involvement and participation
 - R&D involvement
 - Cost sharing

Provision of Current Traffic and Transit Information

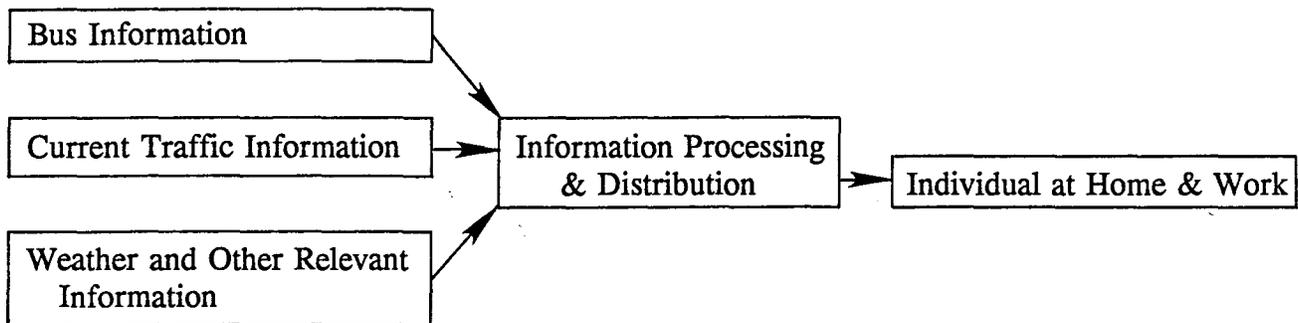
The demonstration is based on the ability to provide current or real-time traffic and transit information to individuals in their home and work place. Given the frequency of bus service to and from the Kuykendahl park-and-ride lot, it is not anticipated that real-time information on the status of specific buses will be provided during the initial demonstration. Rather the bus information will be oriented to how to use the service (e.g. lot location, fare levels and payment methods, scheduled service, and bus stop locations in the downtown area), and major service delays (problems in the HOV lane or other significant impacts on service).

The critical element of the demonstration is the ability to obtain current information on traffic conditions so that it can be provided to individuals at both their home and work place. A number of possible approaches exist to obtaining this information. These include commercial traffic reporting services, bus drivers in the corridor, cameras, pavement loop detectors, automobiles equipped with cellular telephones, and vehicles equipped with transponders. These different approaches will be evaluated based on capital and operating costs, coordination with

other advanced technology projects in the Houston area, and compatibility with existing and future system elements.

The traffic and transit information will be brought together at some type of processing location. The relevant information will then be transmitted from the processing location to individuals at home and at work through the different technologies utilized in the demonstration. A simple diagram of how this process might work is provided in Figure 3. The nature and organization of this process could take many forms. The exact organization of the facility will be determined based on the needs of this demonstration and other projects being developed as part of the Houston Intelligent Transportation System. The potential nature and scope of this system is currently being examined in a coordinated effort.

Figure 3 - Information Gathering and Dissemination



It is anticipated that the provision of the real-time traffic information, which is an important element of the bus component of the *Smart Commuter* Demonstration Project, will be coordinated with other parts of the Houston Intelligent Transportation System. Defining the potential nature and scope of this system is currently underway and is being coordinated with the *Smart Commuter* project.

Implementation and Evaluation

It is anticipated, that if the assessment indicates the bus element of the *Smart Commuter* Demonstration Project is a viable project, the demonstration would last for at least a three year period. This duration is based on the realization that it takes time for individuals to change their travel behavior. The three-year period allows for the introduction of the concept, building awareness among potential users, and allowing individuals to become comfortable using the services. The results of the demonstration will be used to determine the future use of the approach, including possible expansion to other corridors.

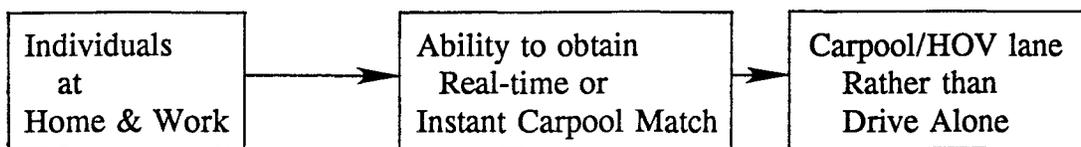
It is anticipated that a variety of methods and techniques would be used to monitor and evaluate the results of the bus component of the *Smart Commuter* Demonstration Project. These may include monitoring bus ridership and parking levels at the Kuykendahl park-and-ride lot, on-board ridership surveys, special surveys of both the participants and the control group, monitoring the use of the selected technologies, monitoring the freeway and HOV lane, and monitoring possible confounding variables such as changes in the price and availability of gasoline. Some of these elements are currently conducted as part of other ongoing monitoring efforts in the Houston area, while other elements would be undertaken specifically for the demonstration. A comprehensive evaluation program would be developed as part of the overall Study Design and Implementation Program.

Carpool Component in the Suburban-to-Suburban Market

Concept Definition

The carpool component of the *Smart Commuter* Demonstration Project focuses on encouraging a work trip mode shift from driving alone to carpooling through the application of a real-time rideshare matching program. The hypothesis, as shown in Figure 4, is that carpooling will increase when individuals are provided with a way to obtain a match either the same day or the evening before for a single trip. It is not envisioned that the provision of current traffic information is as critical for the carpool concept as it is for the bus concept. Thus, while real-time traffic information will be provided if possible, the main focus of this element will be on the development and testing of the real-time carpool matching program. This concept will be tested through the implementation and evaluation of a demonstration project focusing on commuters living along the western end of the Katy Freeway Corridor and working in the Post Oak/Galleria area. This is representative of the suburban-to-suburban travel market. Experience suggests that carpooling on HOV lanes can be an effective means of serving these trips.

Figure 4 - *Smart Commuter* Real-time Carpooling Concept



There is agreement on the concept definition for the carpool portion of the *Smart Commuter* Demonstration Program. This element focuses on encouraging a work trip mode shift from driving alone to carpooling through the provision of a real-time or instant carpooling matching program. Such a program would allow individuals to obtain a carpool match for a single trip either immediately prior to the trip or with some advanced notification.

Approach

The carpool component of the *Smart Commuter* Demonstration Program will focus on commuters living in the West Belt, Addicks, Kingsland, and Katy park-and-ride lot market areas and working in the Post Oak/Galleria area. These areas are shown in Figure 2. This represents a suburban-to-suburban travel market that is not traditionally well served by regular route transit. The Katy to Post Oak/Galleria market was selected based on a relatively high concentration of origins and destinations, the lack of extensive direct regular route bus service, available space at many of the park-and-ride and park-and-pool lots, the travel time savings provided to carpools using the HOV lane, and the 3+ peak-hour vehicle occupancy requirement on the Katy HOV lane. In addition, the Katy HOV lane is complete and all major agencies (Metro, SDHPT, UMTA, and FHWA) have participated in funding for the different elements.

There is agreement that the I-10 West (Katy) Freeway Corridor, focusing on the West Belt, Addicks, Kingsland, and Katy park-and-ride lot market areas to the Post Oak/Galleria area, is the appropriate area for an initial real-time carpool demonstration program for the following reasons.

- Katy HOV lane completed
- Travel time savings provided to users of the HOV lane
- Relatively strong travel demands to Post Oak/Galleria area
- Available capacity at park-and-ride and park-and-pool lots
- Little direct regular route bus service
- 3+ occupancy requirement in the peak-hour
- Metro, SDHPT, UMTA, and FHWA all have participated in funding different elements in the corridor

Unlike the bus element, it is not anticipated that a control group within the corridor will be utilized with the real-time carpool component. This is due to both the difficulty of restricting participation and the need to include as many participants as possible to ensure the potential pool

is large enough to draw matches from. However, carpool levels and matching activities will be monitored on the other HOV lanes and freeway corridors where the real-time carpool program is not available. This information will serve as a control measure to gauge carpooling activities in corridors without the real-time carpool program. The sample size for the real-time carpool demonstration program will be identified based on statistical requirements and the pool of available participants.

It is suggested that a control group within the Katy Freeway Corridor is not appropriate to be used with the carpool portion of the *Smart Commuter* Demonstration Project. This is due to the difficulty of restricting participation and the need to provide a large pool from which to obtain matches. However, carpool levels on the other HOV lanes and freeway corridors will be monitored throughout the demonstration to provide information on areas not receiving the real-time carpooling service. The exact sample size for the carpool component will be identified based on statistical requirements and the pool of potential participants.

Potential Technologies

The technologies being examined to provide the real-time carpool matching service are similar to those being considered for the bus component. These include touch-tone and cellular telephones, cable television, and videotex terminals (both "smart" and "dumb" terminals). Different combinations of these technologies will be considered, as will the use of different methods at the home end and at the work end. Also, like the bus component, the technologies used in the carpool program may evolve over time, with a relatively simple approach implemented during the initial demonstration. However, while the technologies being considered in the two parts of the demonstration are similar, the actual information to be provided, the operation of the system, and the supporting software and data requirements may be quite different.

There is agreement that the following technologies will be examined for possible use in the carpool component of the *Smart Commuter* Demonstration Project. It is realized that this list may evolve over the course of the assessment as additional information is obtained. In addition, the actual use of these technologies may take different forms and more than one technology may be used.

- o Telephone based systems (live operator, voice synthesis, voice recognition, voice mail)
 - touch-tone telephones
 - cellular telephones
- o Television based systems
 - traffic reports as part of commercial stations programming
 - cable television
 - interactive cable television
- o Videotex based systems (smart terminals, such as microcomputers, or dumb terminals)
 - U.S. videotel
 - Prodigy
 - AT&T

The technologies identified for possible use in the real-time carpool demonstration will be evaluated based on a number of criteria to select the technology or combination of technologies most appropriate for the demonstration. Similar to bus component, it is anticipated that the evaluation criteria will include input from the focus groups, capital and operating costs, ability to deliver the desired information, compatibility with existing and future system elements, and potential for private sector involvement.

Suggested criteria for evaluating the different technologies for the real-time carpool element of the *Smart Commuter* Demonstration Program include the following. These will be discussed at the February 14, 1991 Project Management Team meeting.

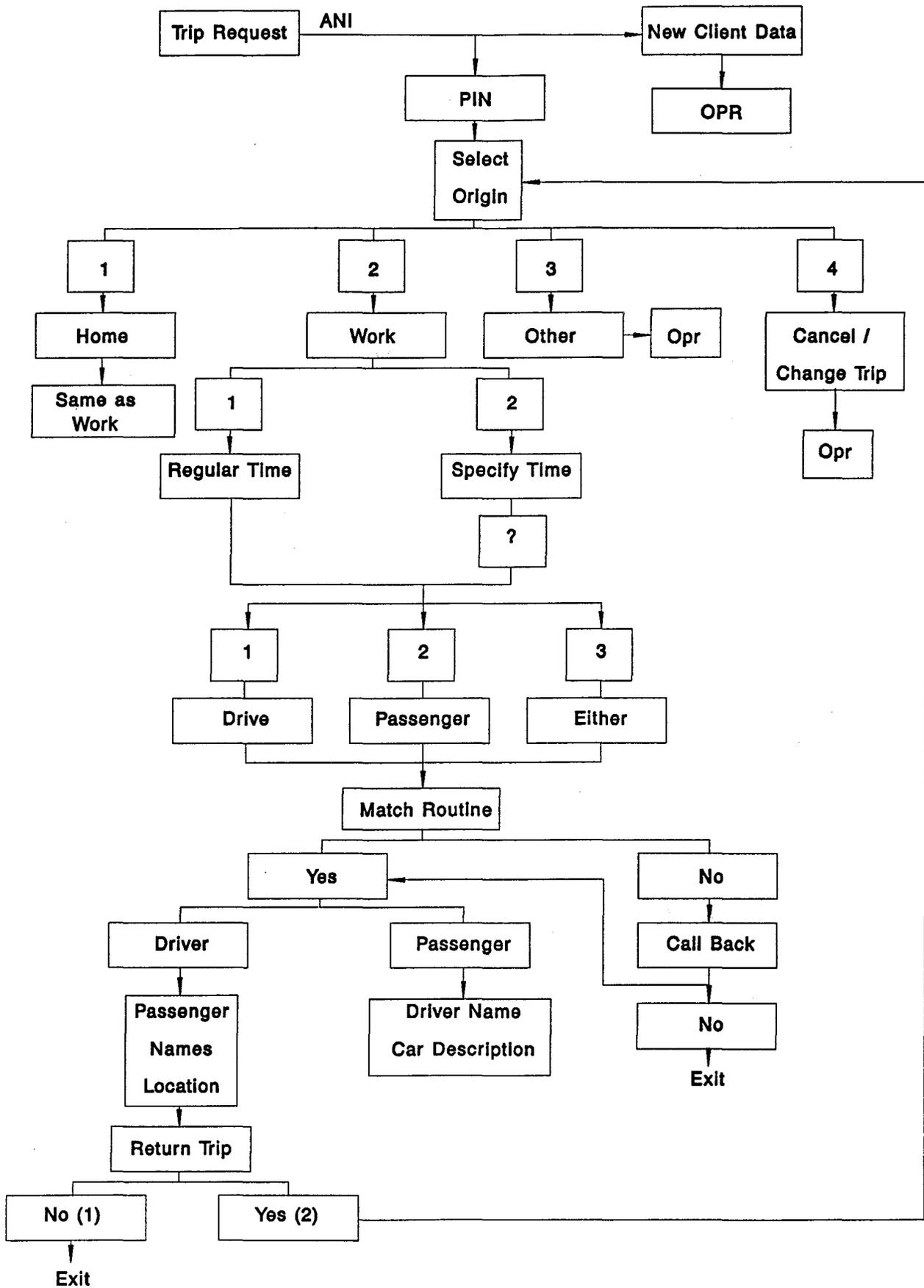
- Preference/ranking from focus groups
- Ease of access by users
- Ability to provide two-way (interactive) communication
- Ability to provide information at both trip ends (home and work)
- Ability to deliver needed traffic and transit information (both short and long term)
- Costs
 - initial capital costs
 - ongoing operating costs
 - long term capital costs (system expansion and upgrading)
 - cost to user
- Compatibility with long term Metro and SDHPT efforts
- Potential for private sector involvement and participation
 - R&D involvement
 - Cost sharing

Provision of Real-Time Carpool Matching Information

As noted previously, the carpool component of the *Smart Commuter* Demonstration Program is based on the concept that providing individuals with quick and easy access to a real-time carpool matching service will encourage a mode shift from driving alone to carpooling. Figure 5 provides a more detailed outline of how the actual matching process might work. This example was designed around the use of touch-tone telephone technology. However, a similar process appears appropriate with other types of technologies. While the general idea is to provide the ability for individuals to obtain carpool matches either the night before or the morning of their trip, there are a number of different ways the system could actually work. In addition, there are a number of issues associated with this approach. The different approaches and issues, which are currently being researched are briefly described in this section.

First, approaches to actually matching potential carpoolers are being explored. Different software programs, including the system currently used by Metro, are being examined along with the hardware and supporting equipment needed to operate the systems. Also being examined is the potential to initially utilize a relative simple approach based on existing technologies, while a more sophisticated system based on geographical and real-time ride

Figure 5 - Potential Real-Time Carpool Matching Process With Touch-Tone Telephone Technology



matching algorithms is being developed. Such a system would be based on a three dimensional matrix comprised of the trip origin, the trip destination, and the desired trip time.

Second, a variety of arrangements would be possible for the actual formation of the real-time carpools. For example, matched individuals could meet at park-and-ride or park-and-pool lots, or one individual could pick the others up at their residences. Due to the need to provide information on the address and possibly directions to the other residences, it is anticipated that, initially, the demonstration may focus on a common meeting location, with home-based matches provided at a later stage. Ultimately, the potential for in-vehicle information systems could be used to obtain both match information and directions to the meeting location. The results from the focus groups will assist in identifying the approach users prefer.

In addition, matching for the return trip will be needed. This could be accomplished by either matching both ends of the trip with the initial request or by making a subsequent match request in the afternoon. Some type of program, such as a guaranteed ride-home program, should be available to ensure that no individual is stranded at work with out a way to get home.

A number of potential issues or concerns are also being explored. These include potential safety and comfort concerns, liability issues, the degree of formality to the process, and the need for back up services if the projected match is not available. These concerns are being examined and will be considered in the final concept design and implementation plan.

A number of potential concerns are being examined as part of the carpool component of the *Smart Commuter* Demonstration Project. These potential concerns, which are outlined below, will be considered in the final concept design.

- Safety and comfort
 - liability of drivers and Metro in case of accident or incident
 - comfort level of carpooling with possible strangers
 - potential for crime or other incidents
- Degree of formality
 - use of general staging areas for potential riders vs. identification of specific rider for match
 - meeting location - residence vs. general area
 - registration requirements
- Back up services
 - guaranteed ride home

Implementation and Evaluation

It is anticipated that, if the assessment indicates the carpool element of the *Smart Commuter* Demonstration Project is viable, the demonstration would last for at least a three year period. This duration is based on the realization that it takes time for individuals to change their travel behavior. The three year period allows for the introduction of the concept, building awareness among potential users, and allowing individuals to become comfortable using the services. The results of the demonstration will be used to determine the future use of the approach, including possible expansion to other corridors.

It is anticipated that a variety of methods and techniques would be used to monitor and evaluate the results of the carpool component of the *Smart Commuter* Demonstration Project. These may include monitoring calls to request matches, the number of matches provided, utilization levels at the park-and-ride and park-and-pool lots, carpool levels on the Katy HOV lane, surveys of carpoolers, surveys of participants in the real-time carpool data base, monitoring of carpool activities on other Houston HOV lanes and freeway corridors, and monitoring of possible confounding variables such as changes in price and availability of gasoline. Some of these elements are currently conducted as part of other ongoing monitoring efforts in the Houston area, while other elements would be undertaken specifically for the demonstration. A comprehensive evaluation program would be developed as part of the overall Study Design and Implementation Program.

Conclusion

This working paper provided a description of the concepts for both the bus and real-time carpool components of the *Smart Commuter* Demonstration Program. This description included the concepts, general approaches, technologies, and key elements being considered for each program. In addition, issues still needing to be addressed and resolved were identified. The information presented will be further refined based on comments and reactions from the Project Management Team at the February 14, 1991 meeting and through the ongoing research activities. The results of these activities will ultimately be presented in the final Concept Design and Implementation Program for the *Smart Commuter* Demonstration Project.