dial-a-ride

PILOT PROJECT FINAL REPORT

APRIL 1973

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ANN ARBOR TRANSPORTATION AUTHORITY
IN COOPERATION WITH
THE STATE OF MICHIGAN & FORD MOTOR COMPANY
TRANSPORTATION RESEARCH & PLANNING OFFICE

ANN ARBOR DIAL-A-RIDE PILOT PROJECT

FINAL REPORT

APRIL, 1973

Presented to the State of Michigan

Department of Commerce, Bureau of Transportation

Pursuant to Contract 1971-5

by the

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SUMMARY

Ann Arbor, like virtually every North American city of its size, finds that almost all its urban area travel is by private automobile. This fact is reflected in the heavy investments made by the city for roadway construction, roadway maintenance and parking structures. The Ann Arbor Dial-A-Ride program is an exploratory step toward increasing the relative importance of public transportation in the city, while conversly decreasing citizen dependence on the private automobile.

The mandate of the Ann Arbor Transportation Authority since its inception in 1968 has been to increase the attractiveness of public transportation to the point where it is a realistic alternative to automobile travel. The Dial-A-Ride pilot program, launched in September of 1971, is a meaningful step toward providing high quality public transportation which can compete effectively with the private car. Dial-A-Ride is a system of small, centrally dispatched buses which provide doorstep service for passengers on a demand-responsive basis. Rather than operating with regular routes and schedules, the vehicles are readio dispatched to serve specific requests for service. Passengers are taken where they want to go, when they want to go.

The program is small, using only three vehicles to serve approximately 16% of the city's population. However, the findings of the program have been extremely significant:

1. The demand for public transportation from the target neighborhood has been virtually doubled, using the previous fixed route bus patronage as a base. Weekday mean Dial-A-Ride patronage over the one year test has been 182 riders, including summer vacation period.

The highest single day's ridership was 270 paid fares although on one day when free service was offered, 390 passengers were carried.

2. Approximately 50% of the Dial-A-Ride patrons would have used automobiles for their trips, according to survey results. This implies a high level of potential diversion from automobile travel. Comparative survey results show that more "choice" or non-captive riders are using Dial-A-Ride than are attracted to regular bus service. This is particularly significant given the high level of auto ownership in the Dial-A-Ride service area.

3. Many Dial-A-Ride patrons are not regular everyday users; only about 15% of the passengers ride every day. Previous surveys have indicated that over 70% of the conventional bus patrons ride every day. Further research has established that this occasional usage pattern is not due to dissatisfaction, but rather to perception of Dial-A-Ride as an "auxiliary" transportation alternative to the private automobile. In order to effect a long-term change in the public's travel habits, it appears that Dial-A-Ride would have to be perceived as a permanent system.

4. Operational feasibility of manually dispatched Dial-A-Ride service has been convincingly demonstrated under Ann Arbor operating conditions. There have been no insurmountable problems in finding capable drivers and dispatchers. With three vehicles and a single dispatcher/call taker, system capacity of between 320 and 390 demands per 11-1/2 hour day has been demonstrated.

5. The target area population has been given excellent door-to-door service. Waiting time averages approximately 10 minutes and average riding time has been approximately 13 minutes. The service has been

well received by the public. Attitude surveys conducted during the project have revealed that waiting time is by far the most sensitive service variable in the riding public's opinion.

6. The project has been operated on-budget for the one year test period. Cost per ride has averaged $1.74 over the entire period including direct labor, fringe benefits, dispatch center operations and vehicle operating cost (but not including any capital amortization or overhead). On the same basis, cost per ride during the winter season (maximum demand) was approximately $1.35. Revenue has averaged $0.484 per ride. The cost per ride for a larger system can undoubtedly be reduced by:
   a. Increasing demand from a given area through adding to the available destinations.
   b. Improving the ratio of vehicles in operation to dispatchers on duty.
7. Citizens and elected officials have demonstrated considerable support for the Dial-A-Ride concept as demonstrated in the pilot program. For example, 63% of the service area residents indicated support for a $5.00 per person per year tax to support a city-wide Dial-A-Ride system.

The Ann Arbor Transportation Authority is continuing to operate the Dial-A-Ride service beyond the one year test period, using only local funding. Based on the results obtained in the one year pilot program, and drawing from the continued conviction that Ann Arbor must offer its citizens an attractive public transportation option to the private auto, the Authority has authorized development of a plan for expansion of Dial-A-Ride to serve the entire com-

munity. In this expanded system, Dial-A-Ride would operate as a local neighborhood service and simultaneously as a feeder system for trunk line, limited-stop through buses.

Appendix A to this report comprises the proposal outlining this expanded system, which was submitted to the Ann Arbor electorate in support of a requested tax increase reserved for public transportation. On April 2, 1973, the city charter amendment authorizing the requested tax was approved by the voters, and work began immediately to implement a comprehensive Dial-A-Ride-based transportation system, now named Teltran.

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CHAPTER 1

OVERVIEW

1.1 CHARACTERISTICS OF ANN ARBOR

Ann Arbor is located 38 miles west of Detroit in Washtenaw County, and is the eighth largest city in Michigan, with a population of approximately 100,000 persons and an area of 21.8 square miles. Well located in relation to major transportation systems, Ann Arbor is adjacent to Interstate 94, the main east-west highway between Chicago and Detroit, and U. S. 23, the most direct north-south expressway between Toledo and Flint. The city also is on the main Penn Central Railroad line between Chicago and Detroit and is within a 20-minute drive of Detroit-Wayne County Metropolitan Airport. It is located on the western edge of the Detroit metropolitan area which contains over four million people or over 75 percent of the state's total population. Although Ann Arbor is dependent on the Detroit metropolitan area for many goods and services, it has retained a physical and cultural identity of its own.

The City of Ann Arbor has been defined as a "metropolitan center," a place that offers complete market service-distribution, financial, and health facilities for a large trade area and serves as a major center in the state economic structure. Ann Arbor's medical center is its most significant generator of state and interstate traffic. The presence of University of Michigan produces a college town atmosphere and many of the social and cultural advantages usually found only in a large metropolis.

Ann Arbor has a national reputation as the "research center of the Midwest." The University's total research budget of 52 million dollars and close to 5,000 research employees have made it a national leader in academic research. Since 1960 over 20 new research and development firms have located

in Ann Arbor. The total number of private research firms in Ann Arbor exceeds 45, with over 3,600 employees. Few, if any, American cities of a comparable size have this concentration of research skills.

Ann Arbor has about 70 percent of its employment in the government sector, and a rather low proportion, about 11 percent, in manufacturing and industry. About 32 percent of the population consists of students at the University of Michigan.

1.2 HISTORY OF PUBLIC TRANSPORTATION IN ANN ARBOR

Ann Arbor, like virtually every city in America, experienced a decline in public transportation usage in the decades following World War II. Increasing incomes led to increasing automobile ownership and use. This reduced public transit riding, while simultaneously inflation drove costs upward. In 1946, with a population of approximately 40,000, the Ann Arbor city bus system carried 1,700,000 passengers. By 1954, ridership had dropped to 700,000 passengers, despite a population increase to 55,000. Finally, in May of 1968, the last of a succession of private companies was forced to give up attempting to run city public transit service as a profit-making business.

The Ann Arbor Transportation Authority was created on July 15, 1968, to deal with community public transit concerns. A short-term (June, 1968 - February 1969) operating contract with an outside firm allowed interim service. Following the failure of the outside contractor to remain within contract costs, city-run operation commenced in the spring of 1969 with four mini-buses. As an interim measure, used transit coaches were purchased when the mini-buses could not keep up with demand. The Authority purchased 16 new air conditioned buses in 1970. Two-thirds of the cost of these vehicles was provided by a grant from the U.S. Department of Transportation, Urban Mass Transit Administration.

Ridership on the regular city bus system has increased at the rate of more than 10 percent per year since the Transportation Authority has been the operator. The Authority currently operates a fixed-route system with an available fleet of 18 transit coaches. This system consists of radial routes covering most of the city, with 1/2 hour headways during high demand periods and 1-hour headways on some routes during midday. Service is offered Monday through Friday, with a basic adult fare of 35¢ and a youth and senior citizen fare of 20¢. Transfers are free, and all of the lines meet at a central downtown transfer point once every half hour. Present ridership is about 650,000 per year, with an annual budget of $450,000, of which approximately half derives from revenues and the remainder is subsidized by an annual appropriation from the City general fund.

The Ann Arbor Transportation Authority bus services are only one of several public transportation services in the city. Table 1, listed on the next page, gives basic features of the various transportation services available in Ann Arbor.

The first consideration of a Dial-A-Ride system in Ann Arbor came in April of 1968; a Citizen's Bus Committee met with representatives of Ford Motor Company to explore the feasibility of the concept. A contract between the Ann Arbor Transportation Authority and the Transportation Research and Planning Office, Ford Motor Company, in January, 1970, directed Ford to furnish a plan for implementing demand-responsive service. An initial proposal was submitted in June, 1970, for a pilot program in the Model Cities Area.* Negotiations between the Ann Arbor Transportation Authority

*"Ann Arbor Dial-A-Ride Program: Proposed Summer Experiment," Transportation Research and Planning Office, Ford Motor Company, publication #70-8, June 27, 1970.

TABLE 1

Public Transit in Ann Arbor

Operation	Daily Passengers	No. of Vehicles	Annual Budget
Transportation Authority Bus Service	2400-2800	18 Total 10 Reg Svc	$450,000 (not including depreciation)
Transportation Authority Dial-A-Ride	150-300	3	$115,000
Taxi Cabs (Two companies)	1500-2000	70 Total 30-60 Reg Svc	$600,000 (rough estimate)
School Bus System	3500 children (7000 Trips)	52 Total 46 Reg Svc	$485,000
Social Service Bussing W.C.O.E.C.D. & W.A.R.C.	Unknown	At Least 5	Unknown
University of Michigan Free Bus System	13,000-16,000	27 Total 21-23 Reg Svc	$536,000
Private Systems - Apartment Complexes & Business Courtesy Buses	Unknown Probably 100-200	At Least 3	Unknown
Model Cities Bus Service	Under 50	4 Total 2 Reg Svc	$37,500

and the Model Cities Policy Board were not successful, however. (Over a year later, a small fixed-route service was undertaken independently by the Model Cities Board.)

Subsequently, in November of 1970, a proposal for a pilot system was submitted to the State of Michigan Bureau of Transportation for funding as a service improvement demonstration. The State's initial reaction was favorable, and serious negotiations were carried out through the next several months.

Preliminary approval for funding a one-year pilot program was conditionally granted to the Ann Arbor Transportation Authority by the Bureau of Transportation in June of 1971. Final contract negotiations, including the satisfaction of the several conditions, resulted in the final contract approval and signing on August 6, 1971. The contract between the Ann Arbor Transportation Authority and Bureau of Transportation was subsequently modified in April, 1972 to reflect slight revisions in budget, cash flow, and project evaluation.

A major concern was the possibility of having local taxicab companies operate the Dial-A-Ride service. In August of 1971, a comprehensive proposal was offered to local taxicab operators, wherein they would have contracted for operations of the Dial-A-Ride system on behalf of the Ann Arbor Transportation Authority. However, neither of Ann Arbor's two principal taxicab firms elected to respond to this proposal. Consequently, the Authority proceeded with plans to operate the system under the line bus management structure.

Shortly before the scheduled beginning of service, the two local taxi companies jointly filed for a court injunction against operation of the service. The case was heard promptly following a motion submitted by the City of Ann Arbor and Ford, requesting summary dismissal. Section 3.3 and Appendix C of this report detail the arguments presented and decision rendered in that court proceeding. The City's motion was granted, and service commenced September 22, 1971, slightly delayed by the court proceedings.

1.3 DIAL-A-RIDE - WHAT IT IS

Dial-A-Ride public transportation is designed to provide door-to-door convenience for the user, while at the same time obtaining operating efficiency by grouping passengers moving in the same general direction in a

common vehicle. The traveller is taken where he wants to go, unbound by the limitations of regular bus routes. The traveller is taken when he wants to go, relieved of the inconvenience of deciphering and following schedules. Doorstep pickup and dropoff eliminates the need to walk to a bus stop and wait in possibly inclement weather. Because the system responds to the traveler, rather than the traveler to the system, Dial-A-Ride is called a "Demand-Responsive" system.

In North America, it has been demonstrated that the public reacts favorably to high quality, door-to-door service which Dial-A-Ride provides.* The examples cited all show that Dial-A-Ride is more attractive than fixed route service, and thus has significantly increased transit ridership in the face of general industry declines.

The user is spared parking problems and traffic worries associated with automobile travel, although Dial-A-Ride journeys are typically more time-consuming. The service compares favorably with a taxicab in quality of service, at a substantially lower fare. Dial-A-Ride can increase mobility for those dependent upon public transportation -- the elderly, physically handicapped, poor, and young, who have limited access to automobiles and who may experience difficulty using regular buses.

If substantial numbers of people can be convinced to use public transportation, communities can realize important benefits: reduced need for street widening and parking expansion, reduced air and noise pollution, decreased peak-hour congestion on major arteries, and lower costs from traffic accidents.

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*cf.: "Dial-A-Bus -- The Bay Ridges Experiment," Ontario Department of Transportation and Communication, August 1971.
"Regina Telebus Study," Regina Transit System, Government of Saskatchewan and Canadian Ministry of Transport, June 1972.
"Report on the Columbus, Ohio Model Cities Second Year Transit Project," Mid-Ohio Regional Planning Commission, November 1972.

Against these potential benefits must be weighed the cost of the service, which as an unavoidable consequence of its personalized and relatively labor-intensive character, is usually more expensive per ride serviced than conventional transit service. In addition, Dial-A-Ride implementation in a community must face the costs of innovation and changing established ways of doing things. Resistance may arise from the taxi industry or from existing transit franchises, and an expanded public transportation system will have to compete with other services for the always-limited amount of public expenditures. The "cost of innovation" is most often reflected in the great amount of staff time and effort associated with launching the new service, as opposed to the much lower cost of retaining status quo.

In a typical Dial-A-Ride system, a person who wishes to travel will contact a dispatching center, usually by telephone, and convey his or her location and desired destination. The dispatcher will give an approximate arrival time for the vehicle. The dispatcher then accumulates requests for service which can be logically grouped, and dispatches the vehicle best suited to serve that group of customers. Actual routing (sequencing of stops) may be done by either driver or dispatcher, and two-way radio communication must exist to enable the dispatcher to follow the vehicle's progress and make amendments to pickups and dropoffs as necessary. The customer is picked up and taken to his or her destination, with variable stops along the way to accommodate other persons making similar trips. Calls for service at some future time (advance orders) and for standard daily times (regular everyday orders) can also be made. The dispatching function can become very complex and is crucial to the system operation.

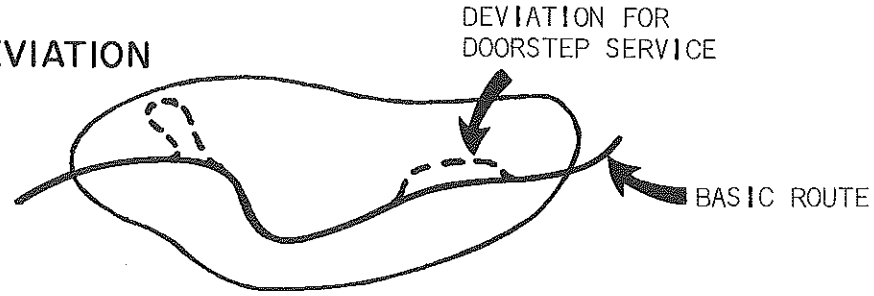
Dial-A-Ride can be specifically tailored to the needs of a particular community. The system is best applied where demand is relatively low, spread out thinly over a large area, and multi-directional in pattern. Successful applications have included:

1. Replacement of lightly used, uneconomical (suburban or neighborhood) bus lines.
2. Collection and distribution between a neighborhood and a single activity center or connection with a high-density transit line.
3. Similar collection and distribution service between a neighborhood and several such destination centers.
4. Broad coverage of all travel needs within a small to medium size community.

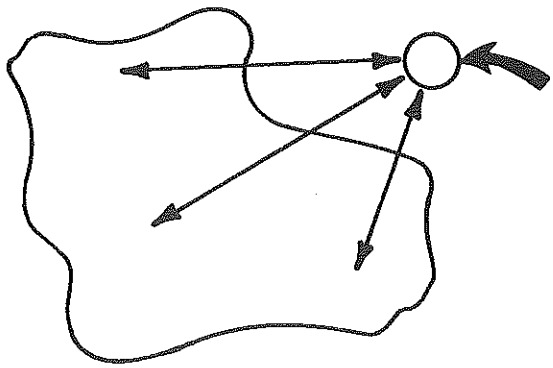
All of these applications share a common principle - the dispatching of vehicles to serve customer requests is on a demand-responsive basis. Basic demand-responsive system designs include the following categories (See Figure 1):

1. Route deviation, in which a transit vehicle has a skeleton route and flexible schedule, allowing detours from the regular route for door-step service.
2. Many-to-one service, in which any address within a specified area can be served for trips to one major destination, such as an airport, rail or bus terminal, major shopping area or other focal activity center. Routing and scheduling is completely dynamic in such a design.
3. Many-to-few service, which is very similar to many-to-one in operation except that several destination points are served,

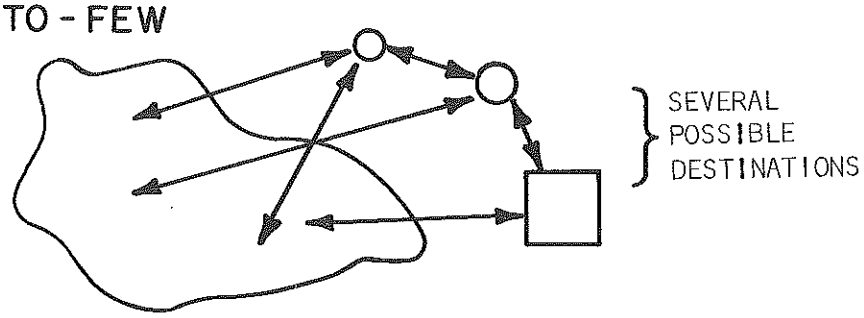
1. ROUTE DEVIATION



2. MANY-TO-ONE



3. MANY-TO-FEW



4. MANY-TO-MANY

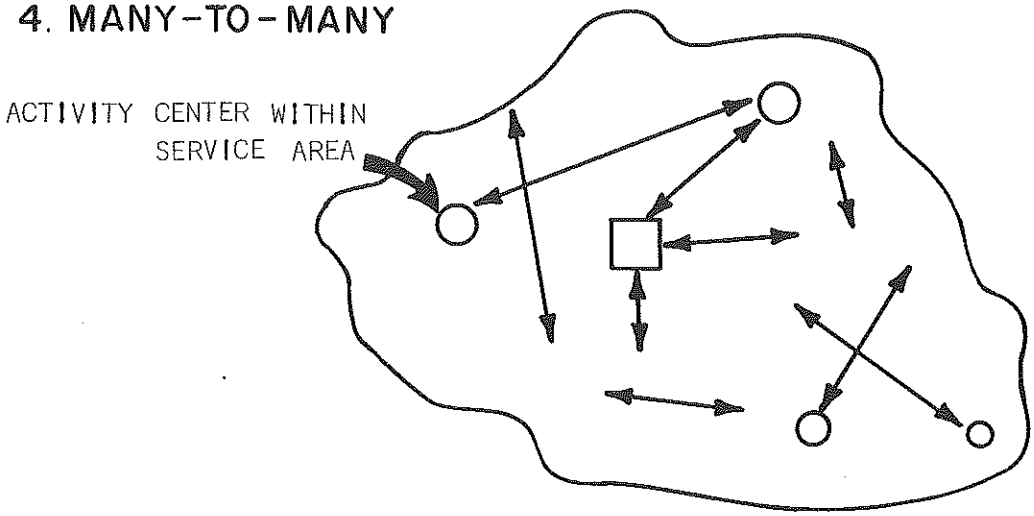


FIGURE 1 -- DEMAND-RESPONSIVE SERVICE OPTIONS

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usually close enough to each other to avoid seriously indirect routing for mixed-destination loads.

4. Many-to-many service, in which any two points can be directly linked in a suitably limited area. This type of system is the most complex and expensive to dispatch and requires a high level of skill to operate.

In actual applications, features of these different basic designs may be combined to suit the geography and time pattern of demand of particular communities.

Demand-responsive systems of all types are operating in approximately a dozen cities or neighborhoods within cities in North America. These systems serve areas ranging from central-city poverty neighborhood to high-income suburbs, with populations generally in the tens of thousands but ranging in size from a very few to more than ten square miles (Appendix B tabulates basic data for several Dial-A-Ride systems). The Dial-A-Ride operation in Ann Arbor is close to the middle of the range in area demography and system design complexity, and has been one of the pioneer test areas for this new transportation system design.

CHAPTER 2

PROJECT SCOPE

2.1 PROJECT OBJECTIVES

As a university community and a city which has long prided itself as a uniquely attractive and forward-looking place to live and work, there is special concern in Ann Arbor that public transportation be strengthened, and that innovative approaches be used to attain a fruitful balance between private and public transport. In recent years a widespread community resistance to road building and improvement projects has been evident, coupled with action and expressions of concern on the part of numerous groups to expand opportunities for alternative forms of transportation -- bicycle paths, pedestrian ways, and public transit.

Following a total collapse of city bus service four years ago, ridership on the new city-operated system has steadily climbed due in large part to many individual decisions to patronize and support public transit. Probably more than many American cities, Ann Arbor is interested in and responsive to new and better service in public transit.

Ann Arbor has been and is expected to remain one of the fastest-growing cities in the state and region. As such, a transit system rooted in demand-responsive service is especially well suited to the city, because such a system is dynamically adaptive to changing land use and trip making patterns. It is not capital-intensive, and therefore can change and grow readily with the community.

Ann Arbor's City Planning Department and Planning Commission have recommended in the "Guide for Change" (1969) a "district center form" for orderly

growth of the city and environs. Such a form of urban organization results in a trip-making pattern best characterized as "many-to-few". In the great majority of cases, one end of every trip to or from a district center is in a low density residential area. Of all the new public transportation concepts under study, only Dial-A-Ride can efficiently serve this kind of trip-making pattern.

The Ann Arbor Transportation Authority, in a resolution passed April 13, 1971, has set its objectives which are quoted here in part:

> "A diversified, coordinated, public transportation system... that permits any individual to make any desired trip quickly, safely, conveniently, and economically.... The relative attractiveness of public transportation in both service and user price should be sufficient that it is the method selected for most, if not all, routine trips ..."

and in particular, to utilize

> "... vehicles operating on demand-activated schedules to serve areas of low origin density to high destination density ..."

Dial-A-Ride demand-responsive service has been part of the Authority's planning since its formation. It was recognized very early that service innovations would be required to lure passengers from their automobiles and effect a genuine shift in the auto/transit travel pattern mix. Despite the fact that patronage on the fixed-route bus system is increasing at approximately 10% per year, the Authority was hopeful that Dial-A-Ride could divert a much greater number of trips from automobiles. The Dial-A-Ride pilot project has been viewed as the first step toward a new kind of public transit network, better suited to the long-term needs of the city.

The specific project objectives, as stated in the proposal submitted to the State of Michigan, have been to:

1. Evaluate market response to doorstep public transportation service in selected neighborhoods, and demonstrate the economic feasibility of the new service concept, breaking ground for a larger system.
2. Provide improved public transportation to particularly dependent segments of the community.
3. Address operating and management issues for implementation of a new system.
4. Test dynamic dispatching.
5. Avoid irrevocable commitment to high-cost fixed facilities which cannot be modified to meet changing demand patterns.
6. Establish economic criteria for determining optimum allocation of fixed bus routes and dynamically routed service areas, in order that efficient utilization of both technologies can be made for a city-wide system.

Evaluation of the attainment of each of these project objectives is found in Chapter 10.

2.2 BASIC DESIGN FEATURES

The Ann Arbor Dial-A-Ride project is basically a many-to-few service operating from a service area in the southwest section of the City with destinations including the central business district, the periphery of the University of Michigan Central Campus, and two downtown hospitals. The project was carried out in two phases over a one-year period from September 20, 1971, to September 16, 1972. During all of Phase I, which ran from Septem-

ber 20, 1971, to February 26, 1972, a single neighborhood of about 2100 households was offered service. In November, 1971, the Phase I service area was expanded by addition of a second neighborhood of 1200 households. A grouped set of activity center destinations (along a downtown loop) in central Ann Arbor were the initial trip generators served. These destinations included an interchange with the fixed route bus service, a near-campus shopping area and the central business district. Phase II started February 28, 1972, and ran until the end of the project on September 16, 1972. For this phase, the Phase I service area was again expanded to include about 2300 more households, and service was offered to extra destinations including two shopping centers on the western edge of the city. Section 4.5 details the service changes throughout the project.

The bulk of trips to be served were expected to be between the primarily residential service area near the southwest corner of Ann Arbor, and downtown -- construed to mean the downtown loop. Thus the normal operation of a vehicle would consist of the following sequential operations, repeated during the day:

1. Collection of passengers in service area.
2. Express run from service area to downtown loop.
3. Distribution of downtown-bound (inbound) passengers along the loop and simultaneous collection of outbound passengers.
4. Express run back to service area.
5. Distribution of passengers in service area.

This sequence of operations, starting with the bus empty in the service area, about to collect passengers, and ending with the bus also empty in the service area, having just dropped off its last outbound passenger, is called a vehicle tour.

Under reasonable demand conditions, inbound demands would normally be queuing for collection during the service area distribution (Step 5 above) and it might appear to be more efficient to perform distribution simultaneously with collection (Step 1) for the next tour. In the interest of minimal ride times, this was proscribed and tours were thus kept distinct in time. In actual many-to-few operation this distinction was in fact maintained, except for a very few instances.

Service was also offered between any two points where both were within the service area, nominally at the dispatcher's option. Requests of this sort, comprising a very small proportion of total demand, were carried in slack time between two tours or were fitted into either a distribution or collection operation when a vehicle would in any case be passing near the appropriate locations.

During the course of the project, as the service area was expanded and additional destinations were served, some modifications to the original tour concept came to be made. These are discussed in some detail in Chapter 5 of this report. Nevertheless, the vehicle tour has remained the primary organizational concept of the service throughout the project.

Three vehicles were used for both Phase I and Phase II. These vehicles included two vans already owned by the Ann Arbor Transportation Authority and one vehicle loaned by the Ford Motor Company. A 33-passenger bus was used as a backup vehicle when one of the regular vehicles was out of service. It had been proposed that new vehicles be purchased for Phase II, but because a grant was not received from the U.S. Department of Transportation, no major capital expenditures could be made.

CHAPTER 3

ORGANIZATION AND MANAGEMENT

3.1 AGENCY AND INDUSTRY ROLES

The Ann Arbor Dial-A-Ride project is a result of a combined effort of the Ann Arbor Transportation Authority, the City of Ann Arbor, and the Michigan Bureau of Transportation, with Ford Motor Company acting as a technical consultant.

3.1.1 Ann Arbor Transportation Authority

This is the responsible agency charged with conducting public transportation within the City of Ann Arbor and up to ten miles beyond the city limits. The Ann Arbor Transportation Authority receives its operating funds from fare box and charter revenues, and an annual appropriation from the City of Ann Arbor General Fund.* For the Dial-A-Ride pilot project, the Ann Arbor Transportation Authority provided vehicles, drivers and dispatchers, radio equipment, storage and maintenance facilities, and management. (Operation was originally placed out for contract by local taxicab operators, but was undertaken by the Ann Arbor Transportation Authority when no responses to a proposal were received. See Section 1.2).

The Ann Arbor Transportation Authority has provided $13,210 in cash and significant contributed services (both staff and Authority members' time and energy), for the duration of the project. The leadership and tenacity demonstrated by Authority members was responsible for overcoming apathy and institutional inertia which resisted innovation in public transportation. The Transportation Authority initiated the planning for a Dial-A-Ride pilot project, and worked for its implementation over a period of more than three years before achieving an operating Dial-A-Ride system in September, 1971.

*This is expected to be revised in Fiscal 1974 when a property tax for the support of Ann Arbor Transportation Authority operations begins.

3.1.2 City of Ann Arbor - Department of Traffic Engineering & Transportation

The City of Ann Arbor, Department of Traffic Engineering and Transportation, has historically furnished staff assistance to the Ann Arbor Transportation Authority, assisting the Authority's full-time transit manager. During the second half of the pilot project, a coordinator was furnished by the Department of Traffic Engineering and Transportation at no cash cost to the program. While the relationship between the Authority and the Department of Traffic Engineering and Transportation has been awkward at times, it would have been virtually impossible for the Authority to provide all of the staff and services required to undertake the pilot project.

3.1.3 State of Michigan, Bureau of Transportation

The State of Michigan, Department of Commerce, Bureau of Transportation has provided funding and technical assistance for the project. The financing of the project was dependent on the Bureau since it provided approximately half of the project costs. The Bureau has retained responsibility for overall direction of the project, and for approval of the final report.

3.1.4 Ford Motor Company

Ford Motor Company, through its Transportation Research and Planning Office, has acted as technical consultant for the duration of the Dial-A-Ride project as a part of local contributed services, at no cash cost to the project. The consulting responsibilities have included:

1. System design
   - Demand and capacity estimation.
   - Dispatching algorithm and aids.
   - Vehicle assignments.
   - Communications system specifications and procedures.
2. Field support and training assistance

3. Data collection and analysis

- Design of reporting forms.
- Ongoing data analysis.
- Preparation of periodic summaries.
- Design, administration and analysis of customer surveys.
- Final report preparation.

Ford Motor Company has also loaned to the Ann Arbor Transportation Authority a modified van-type vehicle for use in the project.

3.1.5 U.S. Department of Transportation

Additional funding for capital expenditures was hoped for from the U.S. Department of Transportation, Urban Transit Administration. An application for a grant was submitted on May 27, 1971, but it was refused, without prejudice toward future applications, on March 17, 1972.

3.2 PROJECT COORDINATOR

Management has been a critical issue since project inception. The Transportation Authority is a seven member unpaid citizen board appointed by the Mayor with the approval of the City Council. The Ann Arbor Transportation Authority has a full-time transit manager who supervises daily operation of the regular bus system, but there is no executive director or research staff. The Traffic Engineering and Transportation Department of the City of Ann Arbor acts as the staff for the Transportation Authority, on an "as needed" basis.

During Phase I of the project, it became evident that an upgraded effort was warranted to tighten control on daily operations, provide adequate attention to marketing, implement plans and revisions in the service, and integrate

Dial-A-Ride into the overall Ann Arbor Transportation Authority system. The Ann Arbor transit manager did not enthusiastically support the Dial-A-Ride project, and did not have time to adequately plan, manage, and supervise its conduct.

In response to this need, a new post of Project Coordinator was created at the commencement of Phase II of the project. A planning engineer from the City Department of Traffic Engineering and Transportation was given a half-time assignment to this post. The coordinator had the responsibility of overseeing the following matters:

- Supervision of drivers and dispatchers; including coordination of shifts and run assignments, setting work standards (based on customer service), creation and enforcement of written policies, and training and evaluation of new drivers and dispatchers.
- Establishment and implementation of emergency procedures (radio failure, vehicle failure, etc).
- Dial-A-Ride vehicle maintenance and daily cleaning (interior as well as exterior).
- Daily record keeping - including audit of dispatch logs, counts, tallies, etc., - for single page weekly summaries.
- Preparation and distribution of monthly passes.
- Preparation and distribution of periodic information newsletters and announcement of new services.
- Identification of potential problem areas and trouble shooting.
- Promotion of system ridership with merchants, senior citizen groups, Parent-Teacher Organizations, etc.

In some cases, he performed the work himself. In other cases, he assigned work to other staff members, or procured services from outside sources.

With the creation of this position, the Authority designated a single person with primary responsibility for day-to-day and week-to-week administration of the Dial-A-Ride project, while retaining control over broader policy and long-range planning issues. The operating manager retained control of staff assignments, labor administration policy, and equipment scheduling.

3.3 DEFENDING THE LEGALITY OF ANN ARBOR DIAL-A-RIDE

Prior to the commencement of Dial-A-Ride service in Ann Arbor in September, 1971, rather clear indications existed that the local taxicab industry regarded the program with fear and suspicion. In an effort to cooperate with the taxicab industry and to alleviate its fears, the Ann Arbor Transportation Authority specifically designed the Dial-A-Ride program so that taxicab companies could bid to become the operators of the system. No bids were received, however, and the Authority proceeded with plans to operate the system itself.

A law suit was filed by Ann Arbor's two major taxicab companies just a few days prior to the scheduled commencement of service. The principal relief requested in the suit was an injunction against the operation of the Dial-A-Ride system. The taxicab companies contended that the establishment of Dial-A-Ride would be unlawful for three reasons:

(1) Dial-A-Ride vehicles were really taxicabs, and were therefore required to obtain licenses under the Ann Arbor taxicab ordinance;

(2) The granting of licenses to existing taxicabs by the City constituted an implied agreement by the City that it would not engage in a competing business, or, in the alternative, that

if it did engage in such a business it would do so on terms identical to the terms under which the taxicab industry operates;

(3) Ford Motor Company (which was sued as a co-defendant) was being greatly enriched by the program without giving adequate consideration in return, and the public was thereby defrauded.

The City of Ann Arbor filed a motion for summary judgement in response, and was joined by Ford Motor Company in its motion. The City clearly answered all principal contentions of the plaintiffs. (The following is quoted directly from the City Attorney's motion)

(1) Because the Dial-A-Ride vehicles are not to be subject to the specific directions of their passengers, because they furnish mass transportation service, and because they operate over fixed routes,* these vehicles are simply not "taxicabs" under the provisions of the City Code, and therefore need not conform to that code.

(2) The taxicab companies are municipal licensees, and claimed that this status gives them standing to prevent the City from instituting The Dial-A-Ride system. A remarkably similar contention was advanced by the operators of private streetcar systems which had been municipally-franchised when the City of San Francisco proposed to construct a municipal system; the battle progressed through the Federal courts and up to the United States Supreme Court, and at all levels, the power of the municipality to create its own transportation system was upheld. [United Railroads v. San Francisco, 239 F. 987 (N.D. Calif. 1917); affirmed, 249 U.S. 517 (1918) (Holmes, J., for a unanimous Court).]

*Referring to the downtown loop: See Section 4.2.1.

What was true in the case of the San Francisco streetcars in 1917 is even more true in today's crowded urban environment: the municipality must be permitted to further the public interest by improving the system of public transportation. Particularly in a case like the present one, where the proposed improvement is experimental in nature and covers only a small part of the city, the speculative fears of the taxicab industry provide no basis for equitable relief.

(3) While it is true that Ford may obtain data which will be useful to it in developing Dial-A-Ride systems in other localities, the information to be obtained from the Ann Arbor experiment will be public information, usable not only by Ford, but by all other interested parties. Furthermore, Ann Arbor is under no obligation whatever to obtain future vehicles from Ford if the system proves successful. Ford, in exchange for this information, is devoting numerous hours of expert manpower to developing a system which is expected to be of great long-term benefit to the citizens of Ann Arbor in meeting their transportation needs; additionally, Ford will, at no cost, loan a vehicle to the Transportation Authority for use in the initial phases of the program. Even if the court is inclined to consider the question of adequacy of consideration, there can be no doubt that the citizens of Ann Arbor are being treated fairly in the instant situation.

The lawsuit was heard by Washtenaw County Circuit Judge Ross W. Campbell (Washtenaw County Circuit Court No. 5967. Judge's opinion reproduced in Appendix C.). The judge granted the city's motion for summary judgement, thereby dismissing the case. The taxicab companies subsequently filed an

appeal with the Michigan Court of Appeals. The appeal was heard in April, 1972. On June 2, 1972, the Court of Appeals rendered a unanimous decision upholding the Circuit Court, and thus upheld the legality of Ann Arbor's Dial-A-Ride system.

CHAPTER 4

DESCRIPTION OF SERVICE

4.1 SERVICE AREA CHARACTERISTICS

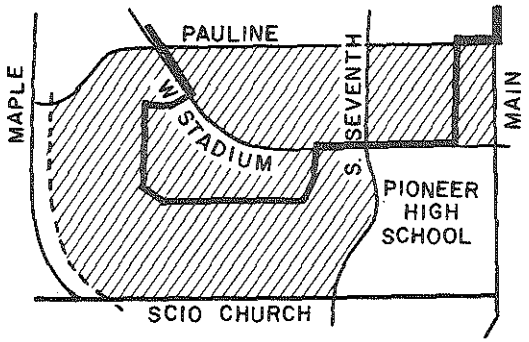
The final service area for Ann Arbor Dial-A-Ride is, for purposes of analysis in this report, divided into four sections (A, B, C, D) as seen in Table 2. These correspond to the original service area and three areas added incrementally during the course of the project. Figure 2 shows the stages in the growth of the final service area. The west side of the Transportation Authority Orange Line scheduled bus route traverses the service area Monday through Friday only, as shown in Figure 2. During most of the service day (6:45 a.m. - 6:15 p.m.) service is run as a one-way loop on a half-hour headway. The loop direction is switched on alternate trips. Midday service (10:15 a.m. - 2:15 p.m.) has been with one-hour headway and constant counter-clockwise loop direction. The total loop is scheduled to be run in one-half hour. This service had been in place for some years prior to the Dial-A-Ride project, and has continued unchanged throughout the project except that midday service was suspended during the last three project months.

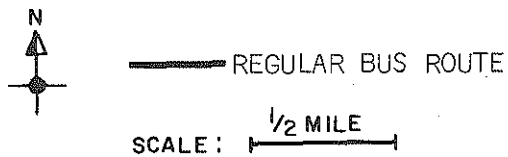
TABLE 2

DESCRIPTION OF SERVICE AREA SECTIONS A, B, C, & D

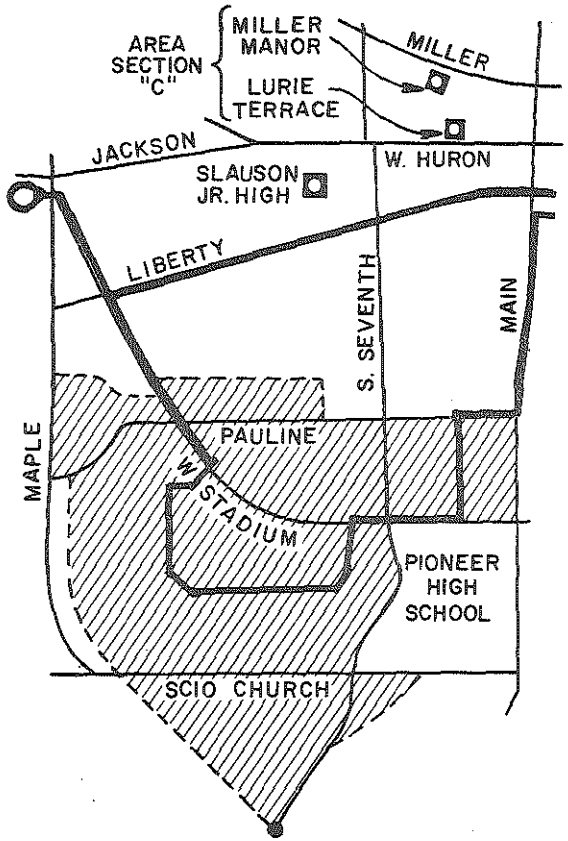
Area	A (Original)	B	C	D
Service Began	Sept. 22, 1971	Nov. 1, 1971	May 1, 1972	June 1, 1972
Number of Households	2,100	1,200	250	2,050
General Demographic Characteristics	90% single family, middle to high income	80% single family, 20% multi-family, south portion high income, northwest portion middle income	low income elderly, all apartments	70% single family, middle income

1. ORIGINAL SERVICE AREA:
SECTION "A"

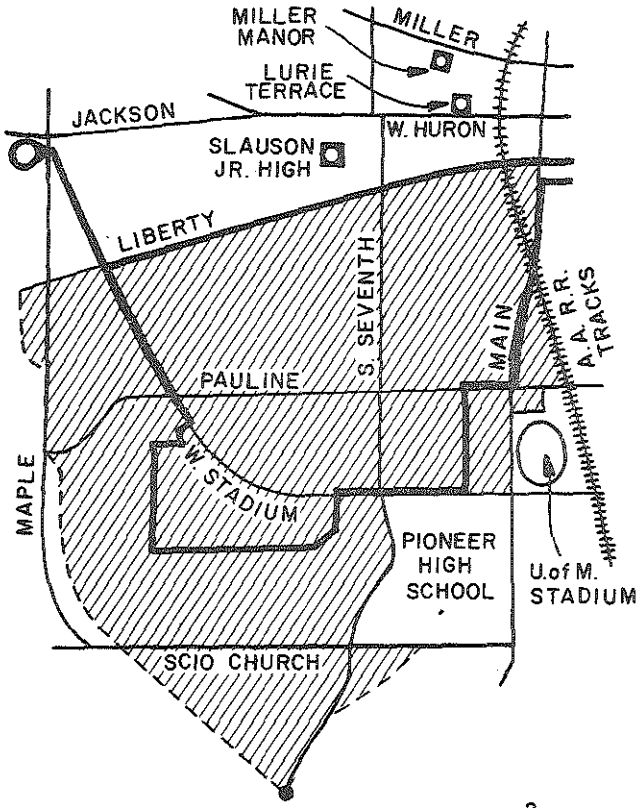




2. ADDITIONS OF AREA SECTIONS
"B" & "C"



3. FINAL SERVICE AREA,
AREA SECTION "D" ADDED



FINAL SERVICE AREA ~ 2.4 MI.^{2}
WITH POPULATION ~ 17,000

FIGURE 2 -- SERVICE AREA GROWTH

Area Section A is the original service area and is a typical Ann Arbor neighborhood. Its boundaries are Pauline on the north, Maple Road on the west, Scio Church on the south, and Main Street on the east.* The area is almost exclusively composed of single-family dwellings and contains 2,100 households. The average family income is a few thousand dollars higher than for Ann Arbor as a whole. The street pattern is primarily a grid although there are several sections without good access to main arteries. Very few people in this area have used public transportation since nearly almost all have access to one or more cars. The area is far enough away from downtown, the University, and the hospitals so that few residents walk to work.

The inclusion of area Section B extended the service area boundaries to the city limits on the south, and Arbordale on the north. As Figure 2 shows, area Section B consists of two portions with a combined total of 1,200 households. The northwest portion includes a large complex of apartments, a neighborhood shopping center, and a residential section very similar to area Section A. The southern portion is an exceptionally high income neighborhood with a mean income of around $28,000. More than 90% of the households in this section have two or more cars. This area is a greater distance from the center of the city than area A, and virtually nobody walks to work or uses public transportation. The streets in the southern portion of area B are laid out in a curvelinear pattern with many cul-de-sacs. There is no street grid and few points of access to major arteries.

A February, 1972, survey revealed that less than 1% of the Dial-A-Ride patrons were over 65 years old. In an effort to improve service to the elderly,

*Pioneer High School, which is adjacent to the service area boundaries, was excluded from direct service, although service to nearby corners was occasionally allowed for students. The highly peaking demand generated by school shift changes was inappropriate for the capacity and destination limitations of the pilot system.

area Section C was added to the Dial-A-Ride system on May 1, 1972. Area C consists of two high-rise buildings some distance from the rest of the service area and from each other. One of the buildings, Lurie Terrace (600 W. Huron), is administered as a non-profit corporation and contains 142 apartments for senior citizens. The second building, Miller Manor (727 Miller), is owned by the Ann Arbor Housing Authority and contains 105 apartments for handicapped, disabled, and senior citizens. A survey of 25% of the residents in these buildings revealed a serious need for public transportation. In particular, 86.5% do not have access to an automobile, but 83% of the residents do travel around Ann Arbor at least once a week. Service hours to this area have been from 9:00 a.m. to 3:00 p.m. on weekdays and all day Saturday.

On June 1, 1972, service was expanded to include the 2,050 households in area Section D. This brought the total households with access to Dial-A-Ride to 5,600. Addition of area Section D extended the service area boundaries to Liberty Street on the north, the Ann Arbor Railroad tracks on the east and Maple Road/Hickory Avenue on the west. The streets in this area are laid out primarily in a grid fashion similar to area Section A. The housing is about 70% single-family and the population is middle income. Area D is less affluent than areas A or B, having a mean family income of about $11,000 and over 5% of its families earning less than the poverty level. Still, the majority of the people in this area use an automobile to get to work, but a number of people are able to walk to work because part of this area is close to downtown and the University. 11.6% of the households in area D do not have access to a car but few people use public transportation to get to work (3.7%).

Table 3 presents a more detailed socio-economic comparison for three of the four service area sections and the city average.

TABLE 3

SOCIO-ECONOMIC CHARACTERISTICS OF THE DIAL-A-RIDE SERVICE AREA

(From 1970 Census Figures)

	Area Section A	Area Section B (Southern Part Only)	Area Section D	City of Ann Arbor (for comparison)
Median Family Income (Approx.)	$16,000	$23,500	$10,400	$12,800
Mean Family Income (Approx.)	17,000	28,100	10,800	14,900
% Families Below Poverty Level	1.7%	None	5.2%	4.7%
Median Years of Schooling	14.0 yrs.	16.4 yrs.	12.7 yrs.	15.4 yrs.
% High School Grads among adults	84.2%	94.3%	66.3%	82.9%
% Households with:				
0 auto available	3.6%	None	11.6%	11.3%
1 auto available	46.5%	9.0%	59.7%	52.3%
2 autos available	42.3%	85.5%	21.8%	30.8%
3 autos available	7.6%	5.5%	6.9%	5.6%
% workers using cars to get to work	93%	92%	74%	72.1%
% workers who walk to work	3.3%	-	15.7%	17.6%
% workers using public transportation to get to work	1%	-	2.5%	3.7%

[Census figures not available for Area Section C]

4.2 DESTINATIONS

Destinations offered Dial-A-Ride passengers, listed by order of introduction, were as follows:

4.2.1 Downtown

The original downtown destination points served were organized into the downtown loop seen in Figure 3. There are two kinds of "stops" available:

1. At Maynard Street (east side) and in the 200 block of Main Street (west side), there are identified boarding areas with direct line communication with the dispatch center. Travelers desiring return trips to their homes in the service area can walk to one of these two locations and call for service on the direct line telephones provided there. By talking with the dispatcher customers know approximately how long they will have to wait.
2. At any other address along the loop, passengers may disembark by requesting the driver to stop. Pickups will be made at any point on the loop, provided passengers have telephoned their requests to the dispatcher in advance. Coin telephones can also be used. No stops are made on streets off the loop. Hail stops are tolerated but passengers are encouraged to call ahead for service or to walk to one of the two key boarding areas.

The following important generators are located along the Central Business District loop as defined:

1. Main Street Shopping Area
2. State Street Shopping Area
3. YM-YWCA
4. Library
5. City Hall
6. County Building
7. Bus interchange point (transfers available to all city fixed-route lines)
8. Regional Bus Station -- Greyhound and Short Line connections to and from Detroit, Metro Airport, and other points. (1/2 block from loop)

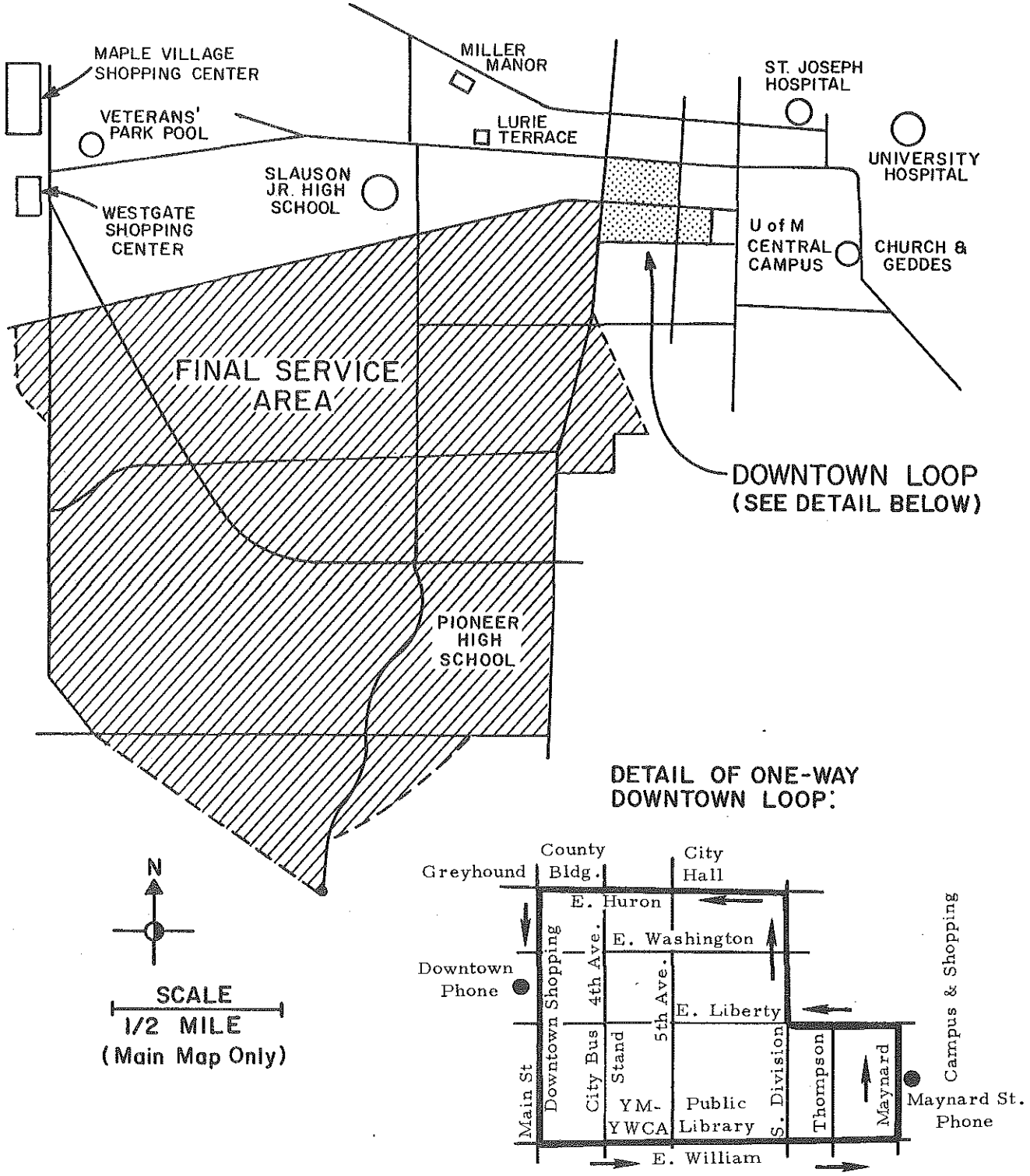


FIGURE 3 -- DESTINATIONS

4.2.2 Intra-Service Area

From the beginning of system operation customers could travel from one point in the service area to another internal point, although on a low-priority basis. Trips between downtown points (such as from a point on the loop to one of the hospitals) were tolerated but discouraged by assignment on very low priority.

4.2.3 Slauson Junior High School

Service to Slauson Junior High School began October 11, 1971 in response to a large number of requests from service area residents. As Figure 3 shows, Slauson can be reached along a reasonable route from the service area to the downtown loop, and also in return. Demand to and from Slauson quickly organized itself into regular service, filling a vehicle to capacity for four trips a day, coordinated to serve each of two overlapping school shifts. Slauson shift times during the project year were 7:40 a.m. - 12:50 p.m. (1st) and 11:10 a.m. - 4:20 p.m. (2nd). These trips became approximately scheduled runs for a very loyal group of riders. A sprinkling of calls for service at times other than shift changes were worked into otherwise normal tours between downtown and the service area. No additional equipment was used on these runs; one bus was usually dedicated to this service for approximately one-half hour at each shift-change time.*

4.2.4 Hospital/University Service

Beginning November 1, 1971 Dial-A-Ride served four discrete pickup/dropoff points (Figure 3) covering the city's two major hospitals (University and St. Joseph Mercy) and the eastern edge of the University of Michigan Central Cam-

*In further operations during school year 1972-3, this special Dial-A-Ride school run service expanded to include a dedicated run for Pioneer High School as well, and Slauson service was usually run with an additional backup transit coach for higher capacity.

pus. (The western edge of campus was already covered sufficiently by the Maynard Street-State Street shopping area stop on the downtown loop.) These four stops have no signs or direct-line phones and can be used only by telephone request. One of the two stops servicing the eastern edge of campus (Church and South University) was deleted on March 1, 1972 because the low demand did not justify the considerable delays caused by traffic congestion at that corner.

4.2.5 Westgate and Maple Village

Located across a main traffic artery from each other near the western edge of the city, these two shopping centers became off-peak (9:00 a.m. - 3:00 p.m. weekdays, all day Saturday) destinations on March 5, 1972. Trips were allowed only between the service area and these destinations.

4.2.6 Veteran's Park Pool

Veteran's Park is the major park for the entire western section of Ann Arbor and contains a large pool, tennis courts, and heavily utilized baseball diamonds. Near the two shopping centers discussed above, the park pool became a distinct destination on June 19, 1972, available after 9:00 a.m. through the remainder of the day.

It is important to notice the effect of some of the later additions of service area and destinations on the geometry of potential trip patterns (see Figures 2 and 3). The addition of Lurie Terrace and Miller Manor (service area Section C), Westgate, Maple Village, and Veteran's Park created a more complex dispatching problem, converting the system from a many-to-few configuration into something approaching many-to-many service during off-peak hours.

4.2.7 City-Wide Coverage via Line-Bus System

Throughout the project, Dial-A-Ride cash fare customers had available free transfers to AATA line buses to any location in the city. Similarly

transfers from line buses to Dial-A-Ride could be made on payment of an additional 25¢ to equal Dial-A-Ride fare. Transfers of this nature occured at the main line-bus transfer point, located along the downtown loop.

4.3 SERVICE HOURS

The initial service hours for Monday through Thursday were from 6:30 a.m. until 6:00 p.m., with the dispatching center open at 6:00 a.m. On Friday service continued until 9:00 p.m. Saturday service hours were from 6:30 a.m. until 6:00 p.m., except that on the first Saturday, service continued until 9:00 p.m. (with no riders). Three vehicles operated during all service hours, except Friday evening when only one vehicle was used.

On November 29, the number of vehicle and driver hours assigned to the mid-day operating period was reduced. The three-vehicle operation was maintained from 7:00 a.m. to 8:30 a.m., and from 2:30 p.m. until 6:00 p.m. A two-vehicle operation was deemed to be adequate to meet demand during the rest of the day. Saturday operations were reduced to two vehicles all day and the service hours became 8:00 a.m. to 6:00 p.m.

Because Friday evening service averaged only 10 riders from 6:30 p.m. to 9:00 p.m., ridership was not adequate to justify the expense of providing the service. Therefore, Friday evening service was discontinued effective March 1, 1972, and Friday service hours were changed to 6:30 a.m. until 6:00 p.m.

With the expansion of midday demand and more complex trip-making patterns, three-vehicle operation for the entire operating day (except morning startup) was reinstated June 19, 1972.

4.4 FARE STRUCTURE

All trips were charged on the same basis.

1. Cash fares: 60¢ for one-way trip, exact fare basis.
2. Advance ticket sales: $5.00 for ten-ticket strips, for sale on board vehicles and at the Transportation Authority office.
3. Subscriber's Pass: Unlimited ridership good for all members of the subscriber's family -- rate was $10.00/month from September until December; from January on, the rate was $15.00/month.
4. Off-peak Pass: Beginning March 1 a special pass good from 9:00 a.m. until 3:00 p.m. weekdays and on Saturdays was offered at a rate of $10.00. A 25¢ surcharge with this pass was accepted at other times.
5. Transfers: Free transfers to all regular routes were issued by Dial-A-Ride drivers on request. Pass riders did not have a free transfer priviledge. Regular fixed route bus transfers were acceptable on Dial-A-Ride vehicle upon payment of cash fare difference.

No special or reduced fares for special classes of riders were offered. In keeping with established Authority procedures, all revenues were collected in locked fare boxes, and counted and tabulated by a person designated by the Authority. Revenues were tabulated and reported daily, by category.

4.5 SUMMARY OF SERVICE MODIFICATIONS

A capsule summary of the actual service modifications of the Ann Arbor Dial-A-Ride project is tabulated below:

Date	Service Change
September 20, 1971	- Phase I began; driver training
September 22, 1971	- Service began between service area Section A and the downtown loop
September 27, 1971	- Saturday evening service dropped for lack of ridership
September 30, 1971	- Dial-A-Ride dispatch center integrated with line route dispatching
October 11, 1971	- Slauson Jr. High School service initiated in response to demand
November 1, 1971	- Hospital/University destinations offered as planned - Service area enlarged by the addition of Section B as planned, since Section A did not use the system to capacity
November 29, 1971	- Reduction in midday vehicle scheduled hours to improve productivity
February 28, 1972	- Phase II began
March 1, 1972	- One of original four Hospital/University stops deleted because of service difficulties - Friday evening service dropped because of low demand
March 5, 1972	- Westgate/Maple Village added as midday destination to increase midday utilization
May 1, 1972	- Service area expanded by the addition of section C (midday only) to better serve a needy group - Promotional Free day
June 1, 1972	- Service area expanded by the addition of section D to compensate partially for anticipated summer ridership decline
June 19, 1972	- Veteran's Park added as a destination - Reinstatement of three-vehicle scheduling midday to handle summer midday demand - Suspension of midday (10:15 a.m. - 2:15 p.m.) service on AATA line route through service area; Dial-A-Ride used as replacement for poorly utilized line route
September 16, 1972	- End of Phase II, project continues under other funding

This chronology illustrates an important concept: that a demand responsive transportation system can be modified in response to changing or unexpected trip patterns and operational constraints. Not all of these service changes were programmed in advance, although some contingency plans were outlined in the Work Programs. Notable exceptions to the plans were:

1. Service to Slauson Jr. High School
2. The Thompson Street spur, originally planned as part of the downtown loop, was not implemented because of difficulties in accommodating turning movements in the existing traffic pattern.
3. The planned Theater/Entertainment service was postponed and finally dropped after poor experience with evening service.

The ability to modify service to meet changing customer and community demands is one of the most valuable features of the Dial-A-Ride system.

CHAPTER 5

SYSTEM DESIGN AND OPERATION

5.1 BASIC DISPATCHING ALGORITHM

Customers telephone the dispatch center for service either from their homes in the neighborhood or from other served locations. The dispatcher answers all incoming telephone calls and records the following information:

- Time of call
- Pickup address or point
- Drop-off address or point

In addition to requests for immediate pickup, area residents may telephone the dispatch center for:

- Pickup reserved for some future time that day, e.g., call at 9:00 a.m. for pickup at noon.
- Standing order, e.g., pickup every day at 7:45 a.m.

The dispatcher verifies this information with the calling party, thanks the customer, and, if possible, gives an estimated pickup time. The ability to advise customers of expected vehicle arrival times was developed as part of the learning process in dispatching, with no exact calculation of arrival estimates built into the system design. Experienced dispatchers became adept at estimating reasonably accurate pick up times in most circumstances.

Calls for outbound service are received in three ways: as telephone calls to the dispatcher from points along the downtown loop or Hospital/University area; as direct line calls to the dispatcher from one of the two key downtown boarding points; or as direct requests to the driver. In the last case, the driver radios the information to the dispatcher, in order that each request is properly sequenced in the vehicle tour and so that the dispatch log will be complete.

There is normally one dispatcher on duty. For relief, the dispatcher is able to have telephone calls and vehicle communication functions revert to the Transportation Authority office, where one assistant manager-dispatcher and one secretary are available on duty from 8:00 a.m. to 5:00 p.m. In the event that the dispatcher is overloaded, he is able to route information request calls to one of these persons.

The central concept in dispatching the Ann Arbor Dial-A-Ride system in the original many-to-few mode is the vehicle tour. A tour is created either when a specified number of requests (both inbound and outbound) has been received, or when a reasonable time (approximately 15 minutes) has elapsed and at least one request has been registered.

The demand dispatch number (number of requests which trigger a tour) varies according to the demand level, at the dispatcher's option. These demand dispatch numbers are in the range of one to four in most cases.

Each vehicle tour consists of the following events:

1. Driver calls dispatcher when ready to begin tour. Ordered list of inbound pick up addresses is then transmitted to driver by the dispatcher, and the inbound sub-tour begins. Dispatcher may suggest entry point for downtown loop.
2. Driver picks up inbound passengers in order given. Passengers give driver their destinations on boarding.
3. Driver calls dispatcher when all inbound collections are made and he is entering downtown loop. Dispatcher acknowledges and gives driver list of passenger pick up locations along loop (if any).
4. Vehicle circulates on downtown loop (or executes hospital/university leg run) simultaneously dropping off inbound

passengers and picking up outbound passengers (if any), according to the list of stops transmitted from the dispatcher. All outbound passengers also give their destinations to the vehicle driver upon boarding. Driver records addresses on driver's log sheet. If there are no outbound demands, the dispatcher will instruct the driver either to return empty to the service area or to standby at a specific location.

5. Vehicle exits downtown loop at point indicated by dispatcher and proceeds express to service area neighborhood. Driver notifies dispatcher when exiting loop.
6. Driver sequences drop-offs himself, but may call on the dispatcher for assistance. When last delivery is made driver notified dispatcher that he is "complete at (last drop-off address)" ending tour.
7. If no demands are awaiting service,the dispatcher instructs the driver to return to one of the key downtown boarding points, or standby in the service area, depending upon anticipated demand.

The dispatcher takes calls, logs and tabulates incoming demands and dispatch vehicle tours. The dispatching log used is seen in Figure 4. The log sheets are used as dispatching aids and simultaneously as the first level of data collection for ridership and system performance statistics. In addition to the regular dispatch log kept for each tour, the dispatcher records:

- Pre-booked and standing requests, for insertion in proper vehicle tours and/or the current file of standing

Date SEP 11 1972

Assigned Vehicle No. 14

Tour No. 8

ANN ARBOR DIAL-A-RIDE DISPATCH LOG

☐ CBD
☐ Hos/Univ
☐

INBOUND

Call Time	Telephone Number	No. Party	Pickup Address	Disp. No.	Dropoff Address	Code	Pickup Time	Dropoff Time	Wait Time	Travel Time
TC 8:20		1	1850 S Maple		Dicken Sch		ISA	838		
8:20		1	2116 [illegible]		Lawton Sch		ISA	845		
8:35		2	[illegible] Lib		Dicken Sch		ISA	909		
TC 9:00		1	2310 E[illegible]		Pioneer H.S.		ISA	(1)		
10:06		1	Pauline & Stdm		DT					
10:06		1	Pauline & Stdm		4th & Wm					
9:51		1	1807 Hanover		U. Hosp					
10:30		1	1913 Weldon		Wm & Fillmore					

OUTBOUND

Call Time	Telephone Number	No. Party	Pickup Address	Disp. No.	Dropoff Address	Code	Pickup Time	Dropoff Time	Wait Time	Travel Time
10:30		1	J		[illegible]		10:46			
10:53		1	DT		[illegible]		10:59			
					comp ISA		9:00	(1)		

Dispatched 8:13 Arrive Loop (Dicken) 8:35 Standby (Dicken comp) 9:09 Completed 10:34 Restart 9:20 ISA → 10:03 Leave Loop → 10:35 Comp. Tour 10:46

FIGURE 4 -- DISPATCHING LOG

orders. These requests are assigned to the nearest possible vehicle tour to the desired time.

- Customer complaints.
- Requests for services not presently offered (input for future Dial-A-Ride service areas).

5.2 DISPATCHING MODIFICATIONS

During the course of the Dial-A-Ride project the basic dispatching and operating routine was revised and refined.

5.2.1 Dynamic versus Semi-Scheduled Service

As designed, and in the bulk of normal operation, dispatching has been completely dynamic. Standing orders for daily pick up were normally expected to be fitted into tours as they happened to form. However, in the early morning inbound demand peak, a rather large number of standing orders accumulated and established runs at specific times. Eventually a fairly stable sequence of run times for the first two hours of operation evolved, and inbound demands were fitted into the next available run of that set. A few extra seats were available on each run, and were filled if demand arose along a feasible inbound routing which would not unduly delay the run. In effect, informal priority was given to regular customers with standing orders, and they were picked up at the same time each day on an automatic basis. In some cases, regularly expected calls which were not standing orders received similar treatment.

Most notable and stable among these runs was a bus dedicated to Slauson students. Similar dedicated runs occurred three additional times during the day to serve the Slauson return trip and a second shift both ways. To a lesser extent, a set of standing order times developed for

evening return trips from downtown points and also established semi-regular runs.

5.2.2 Evolution of Downtown Loop and Hospital/University Service

As originally conceived, the downtown loop was to be followed strictly, although entry and exit points were discretionary and variable. The hospital/university stops were generally to be run quite separately, with one bus at any one time dedicated to service to and from the hospital/university area and the other two reserved for downtown loop service. In practice this distinction soon came to be obliterated, partly because of difficulty in separating inbound demands for the two areas, and partly because a heavy outbound demand surge would result in unacceptably long waiting times for the hospitals. Operations eventually became quite fluid, with a single vehicle usually serving both areas in any one tour. As a consequence, many alternate routings developed for passing from the hospitals through the loop area and out toward the service area, considerably altering and short-circuiting much of the loop routing on a dynamic basis. Passenger boarding was still carried out almost entirely on the loop, however.

5.2.3 Development of Quasi-Many-to-Many Mid-day Dispatching

From the beginning of the project, intra-service area trips superimposed a very small degree of many-to-many demand-responsive operation on the normal many-to-few system. As the service area grew in size, this component increased in importance. With the addition of Westgate, Maple Village, and Veterans' Park as destinations and Lurie Terrace and Miller Manor as service area points (service area Section C) for midday travel, trip-making on Dial-A-Ride became considerably more complex. Demand for the above points never became high during the project, but single passengers waiting for service in opposite directions are not appreciably easier

to handle than multiple passengers in the same pattern; the vehicle is tied up for approximately the same amount of time in either case.

The dispatching method developed to handle this demand pattern was basically to maintain one and sometimes two vehicles in circulation between the service area and the non-downtown destinations, responding to calls in sequence as they arrived, except that calls were sometimes serviced ahead of turn if they were for a trip similar to one under way. However, dispatching remained extremely fluid and downtown-destined passengers were sometimes carried along to non-downtown destinations if no other expeditious service was possible. Normally, vehicles would be rotated between inbound-outbound service and such circulation near the edge of town. In actual dispatching, Lurie Terrace and Miller Manor were handled more as destinations than as service area locations. The chief dispatching difficulty in this quasi-many-to-many mode is the necessity to review and amend all pending assignment decisions in the light of each new demand, and the consequent uncertainty in estimated arrival times.

Because of the highly fluid sequence of operations for any one vehicle, and the frequent rotation of vehicles between inbound-outbound mode and circulation, the concept of and record-keeping procedure for a vehicle tour in midday operation became less useful, and dispatch logs became simple time-series records of what demands had been serviced.

5.3 COMPUTER-ASSISTED DISPATCHING

An initial project objective was to evaluate and test possibilities for automation of some dispatching functions. Work in this area had previously been carried out at the Massachusetts Institute of Technology as part of their federally-funded research project. The Institute's work focused primarily on automating the decision-making aspects of the dispatchers task:

specifically, the decision as to which vehicle should be assigned to serve a given incoming demand.

Ford Transportation Research and Planning Office researchers began their evaluation of the potential for automation in dispatching during January, 1972, when ridership had stabilized at just over 200 trips per day. Initial contact was made with Cyphernetics, Inc., an Ann Arbor based computer time-sharing service bureau, and they indicated a willingness to cooperate in a test of computer dispatching. The first step in Ford's evaluation was to analyze the existing manual dispatching operation in detail. Figure 5 is a schematic of the Ann Arbor dispatching algorithm which was developed from that analysis. The findings of this analysis were:

1. There was no system capacity limitation due to manual dispatching. The eventual capacity of the single dispatcher/call taker system had not been established.
2. The demand request-to-vehicle assignment decision is the least complex, easiest decision made in the dispatching operation. There was little potential for benefit in the Ann Arbor system to be derived from automating this task.
3. The most critical task in dispatching is to give customers accurate estimates of pick up time. This represented a real potential for automation.
4. Automation would permit advertising of and adherence to guaranteed maximum customer waiting times.
5. The data input/output tasks associated with the dispatching function could become critical as the number of vehicles in the system increases, representing another potential for automation. (A computer storage/retrieval system is now operating

DISPATCHING LOGIC FLOW CHART

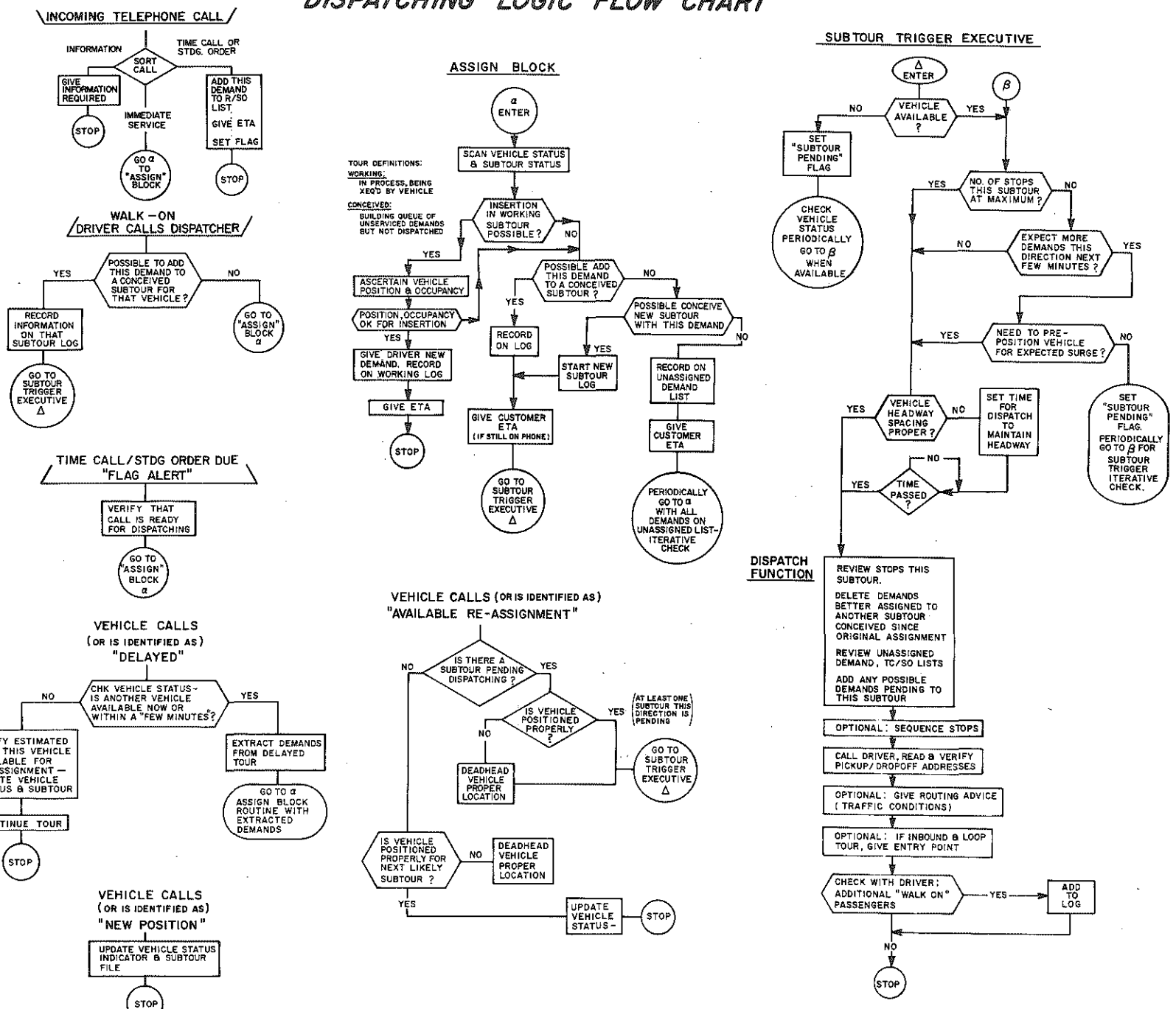


FIGURE 5

in the Regina, Saskatchewan "Telebus" system, handling trip requests for approximately 450 regular subscribers. The daily passenger list is updated as required, and each driver is provided with a printout of pickup addresses for each run.)

6. Any computer-assisted dispatching system could be expected to yield benefits in creation of on-line data files which could easily be processed for periodic reports.

Based on the immediate potential for improving the dispatcher's ability to estimate pickup time accurately, the design team went ahead with a preliminary hardware system design having these characteristics:

1. Dedicated port access to large time sharing computer

   Justification: Avoid any capital committment for test system. Insure adequate Central Processing Unit and on-line storage capacity. Dedicated port allows immediate top-priority access.

2. 30 Character per second input/output device (probably video)

   Justification: Dispatcher cannot wait for computer to print out responses on slower device with customer waiting on telephone.

   Dispatcher can key input information in "local" mode and transmit instantly when ready to access machine.

3. Dedicated on-line storage files of all ridership data

   Justification: Access of data is key to giving good time estimates. Action report generation is made feasible by having instant access to data (daily reports first thing next morning).

This configuration of hardware would cost on the order of $2,500 per month, including both on-line dispatching and action report generation capability.

In actual use, the dispatcher would key in customer service requests as received by telephone. The machine would actually develop and add to tours by assigning each incoming call as received, much as the dispatcher does manually. Vehicle status information would be keyed into the machine by the dispatcher as received by radio. The system would alert the dispatcher when a tour was ready to dispatch, and display a sequenced list of addresses which the dispatcher would radio to the vehicle. The dispatcher also could insert new incoming calls to a previously dispatched list without accessing the computer if that were advantageous.

This configuration would be ideal for interface with a digital vehicle communication system. Ford's Transportation Research and Planning Office has recently tested such a system in the Batavia, New York, Dial-A-Ride system with outstanding results.* With mobile teleprinter and vehicle status digital communication capability, two additional advantages would be achieved:

1. The vehicle driver would directly update vehicle status information without voice transmission and without the necessity of going through the dispatcher.
2. The address lists would be printed out hard copy in the vehicles, virtually error-free, without any necessity of voice transmission.

The present cost of mobile teleprinters is approximately $1,200 per mobile unit and $18,000 for the control terminal/base station unit.

Because of the foregoing costs, it was concluded that the project budget could not be expanded to include actual operation of the computer equipment, even though certain elements would have been donated by the consultant and the time sharing firm. However, a determination of economic feasibility was made which indicated that with a four-sector, 16-vehicle

*"Evaluation Report Radio Teleprinter Test; Batavia, New York Dial-A-Bus System" Transportation Research & Planning Office, Ford Motor Company, Report #72-22, December, 1972.

Dial-A-Ride system, the computer assisted dispatching system would permit the elimination of two or three full-time call taker/dispatchers, thus justifying the monthly expenditure for equipment rental and computer time.

5.4 VEHICLES

Three vehicles were required to undertake the Ann Arbor Dial-A-Ride pilot program. Detailed specifications for new vehicles were developed, and can be found in the General Work Program (Phase I). However, because of time and economic constraints, it was not possible to procure new vehicles in time for the project. As a result, two 1969 Ford Econoline Club Wagons owned by the Ann Arbor Transportation Authority were refurbished and repainted for use as Dial-A-Ride vehicles. Both have driver operated doors, air conditioning, and seating for 10 passengers with bench seats. The use of these vehicles was intended to be strictly an interim measure to permit startup of operations on schedule. Since Federal funds did not become available for later purchase of new equipment, however, these two vehicles were used for the duration of the project.

One new Ford Econoline Van with a raised roof and other modifications was loaned at no charge to the Ann Arbor Transportation Authority by Ford's Transportation Research and Planning Office. This vehicle has 10 forward-facing bucket seats, standing interior headroom, carpeting, driver operated door, and is fully fitted out for the first-class Dial-A-Ride service. This vehicle was painted to match the other two in the Ann Arbor Transportation Authority color scheme, and is shown in Figure 6.

The color scheme used for the vehicles is the basic purple with yellow and green accents, as used on the latest Transportation Authority buses. A special Dial-A-Ride logo was affixed to identify the vehicles uniquely. All three vehicles were equipped with locking fareboxes from existing Authority

FIGURE 6 -- ANN ARBOR DIAL-A-RIDE VEHICLE

inventory. Backup vehicles (28 or 33-passenger GM coaches) were available from the existing Authority fleet.

There appears to be considerable potential for use of vehicles somewhat larger than 10-passenger vans for high-demand conditions. At busy times, overload conditions would arise, especially in the semi-subscription service to Slauson Junior High School. A few drivers, already used to driving transit coaches, indicated their preference for the 33-passenger backup vehicles over the vans, and with such skilled drivers no deterioration of service speed could be found. It seems that vehicles in the range of 15-20 passengers would be desirable, particularly if the maneuverability of 10-passenger vans could be retained.

5.5 COMMUNICATIONS

The Dial-A-Ride system utilizes the Transportation Authority's existing radio channel and transmitter. This channel has adequate reserve capacity to allow Dial-A-Ride communications and is satisfactory from a technical point of view. This system is licensed on 44.520 Mhz in the Federal Communications Commission designated Motor Carrier Urban Passenger Radio Service with call letters KRE-266. Communication coverage of the Ann Arbor area on 44.520 Mhz has been satisfactory, with an effective two-way communication range of approximately 10 miles.

In an effort to maintain privacy for Dial-A-Ride vehicles from the Ann Arbor Transportation Authority line route radio traffic, a quick-call signal unit was initially used but was abandoned because of occasionally crucial delays in reaching vehicles and line driver protest over the comparatively loud signal tones used.

The dispatch center is one room located in the Ann Arbor Transportation Authority office at 315 West Huron. This room has adequate space for two persons to work, and a large window permits viewing of dispatch functions

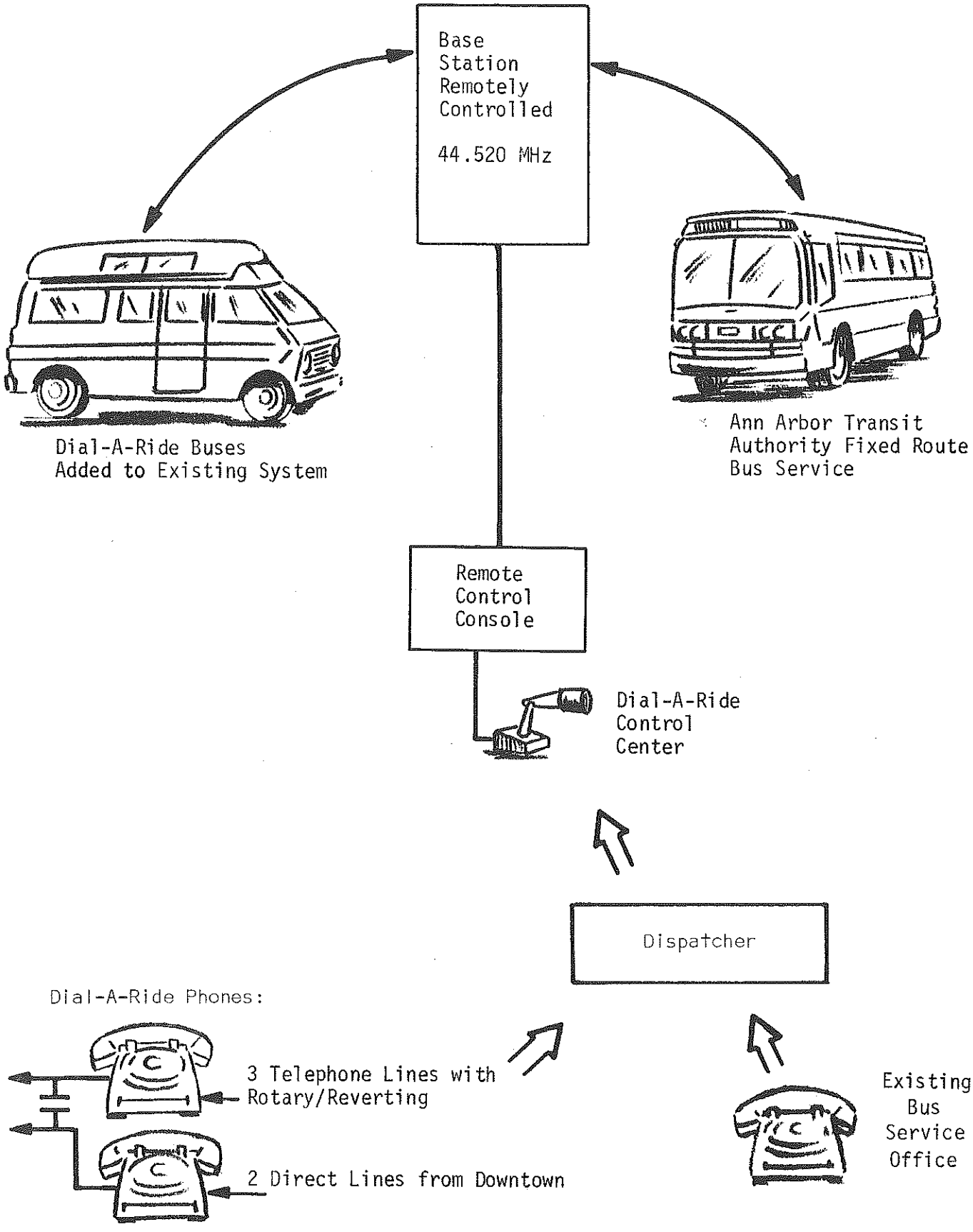


FIGURE 7 -- COMMUNICATIONS SYSTEM SCHEMATIC

without disturbing those at work in the office. Control center equipment includes a Motorola remote control console for dispatcher control of the base station and three incoming telephone lines of the rotary/reverting (group hunt), push button variety to receive outside calls. The provision of three lines permits one line to be tied up with an information call while retaining two available for service requests. Two additional lines service the two direct telephones located in the downtown area. One is located in an entry foyer of a major department store (Jacobson's), which has been supportive of Dial-A-Ride. A schematic of the communications system is shown in Figure 7.

Operations originally began with the Dial-A-Ride dispatch center physically removed (across the street) from the Ann Arbor Transportation Authority line route dispatch center, although both were using the same radio channel. This proved cumbersome and costly, and the two functions were integrated after a week of operation. As a consequence, the Dial-A-Ride dispatcher handled emergency calls, transfer coordination, and information requests from 9-12 fixed route and special buses as well as Dial-A-Ride traffic. On occasion, this generated communication delays of a few minutes, but in general the interference was not excessive. However, if Dial-A-Ride had been operating at capacity, one channel for both line buses and Dial-A-Ride vehicles would not have been adequate.

5.6 PERSONNEL

Drivers and dispatchers for the Dial-A-Ride project were drawn from the regular pool of Ann Arbor Transportation Authority drivers on a bid basis. Extra drivers were hired and trained for both line route service and Dial-A-Ride, and extra-board workers were expected to substitute freely in either form of service. Drivers and dispatchers were thus all

union personnel (Local 369, AFSCME) initially. Later in the project, management took steps to reclassify dispatchers as supervisory, but this was not possible for a driver-dispatcher.

Initial training consisted of instruction in the concepts of the new system and opeating procedures, plus two days of on-the-road simulation just before service began. On-the-road simulation practice continued in the first few days of low-demand operation. Subsequent training of new personnel has consisted of informal orientation and on-the-road student driving under the supervision of an experienced driver.

Driver turnover has not been exceptionally high, although periodic bid changes have resulted in considerable interchange between fixed-route and Dial-A-Ride drivers. In general, drivers of all ages and backgrounds have learned quickly and performed well after a short learning process. In one instance, a line driver with considerable seniority bid into the Dial-A-Ride system and could not handle the differing demands of such a service. This person had to be replaced in a run switch, but ill-will was kept at a minimum. The new-hire drivers have proved capable of performing respectably on Dial-A-Ride.

Dial-A-Ride inception was met with some hostility by a few of the senior drivers, but in general, those feelings abated after a few months and the entire Ann Arbor Transportation Authority system has worked smoothly. Good relations are especially important among drivers and dispatchers in a demand-responsive system with much radio conversation. With only a few instances of personal conflict, these problems have been minimal.

It should be recognized that Dial-A-Ride imposes some unique demands on operating personnel. As in any public service position, courtesy is

crucial and sometimes hard to maintain, especially because of the high degree of driver-passenger and dispatcher-passenger communication necessary. Ordering of passenger drop-offs or accuracy of time estimates can become sensitive issues, especially when dealing with passengers who may not understand the nature and constraints of the system.

Dispatchers must have a detailed knowledge of the city and an ability to make rapid decisions under considerable pressure, while being considerate of individual drivers' personalities and capabilities. Simultaneous handling of call taking, radio traffic, and record keeping at peak demand times can become a frantic and stressful activity. Information calls can become a serious burden at such times. Despite the high demands on drivers and dispatchers, their response in Ann Arbor has been exemplary, and several have expressed their pleasure at the relatively higher responsibility and opportunity to exercise skill.

5.7 MARKETING PROGRAM

There is general agreement that marketing is an important element in encouraging usage of public transportation, particularly a new system like Dial-A-Ride. Implementation of a marketing program is much more difficult than agreeing to undertake one, however.

Total marketing expenditures for the Ann Arbor Dial-A-Ride program were $3151 in cash, plus many man-hours expended by the Ann Arbor Transportation Authority members and staff. Because Ann Arbor is in the greater Detroit market area for most media coverage, it was easily determined that purchase of advertising time on radio and television was not cost-effective. Even at a local level, the use of community newspapers and radio was not deemed effective in reaching the relatively

small 2100-household original service area. Therefore, a direct mail campaign was selected. Periodic Dial-A-Ride newsletters were distributed in the service area. A sample is seen in Appendix D. There were 15 newsletter mailings in all.

A marketing effectiveness research project was implemented by Michael Berla, Ann Arbor Transportation Authority member and Ph.D candidate in the University of Michigan Urban and Regional Planning Program. The research required a control group; therefore, there was a four-way split of the sample population:

1. Residents of the Dial-A-Ride service area receiving the newsletter.
2. Residents od the Dial-A-Ride service area not receiving the newsletter.
3. Residents of the same political ward, not in the service area, receiving the newsletter.
4. Residents of the same political ward, not in the service area, not receiving the newsletter.

Creation and distribution of the newsletter took a great deal of time and energy. The first ten mailings were made on an almost-weekly interval after project commencement, as part of Mr. Berla's research. This early period was, of course, most important in providing information on the new system to potential users. Upon completion in December, 1971, of surveys on the effectiveness of the newsletter, the frequency of mailings decreased greatly. Subsequent newsletters were used to advise residents of new service areas of the availability of Dial-A-Ride as the program staging progressed, and to inform the traveling public of service changes. Since the last major service revision in June, 1972, no further mailings have been made.

The survey indicated that the newsletters had been only marginally effective in informing area residents about the service, inducing them to use it, and generating support for a city-wide system financed by a one-mill tax increase. The fact that the system was well-known both in the service area and elsewhere in the city indicates that coverage in local newspapers, high visibility of the Dial-A-Ride vehicles, and their distinctive logos, and word-of-mouth were the principal media of public information.

An analysis of public response to the Dial-A-Ride project carried out as a part of related work (Berla dissertation, University of Michigan) showed that ridership and willingness to support expansion of the system were not correlated with the number of persons, persons with driver's licenses, or automobiles in a household, nor with household income. A variable intended to measure attitudes concerning the automobile's impact on the urban environment and the relationship of that impact to public transportation was found to be weakly predictive of Dial-A-Ride use and support.

Dial-A-Ride was offered free to all service area residents on May 1, 1972, as part of a city-wide "car-free week". The response was outstanding, with 390 riders being carried that day, although many of the extra riders were school-age children. No real permanent effect of added ridership was found, although interviews did reveal a few "first time" riders on the free day. One newsletter mailing included clip-out coupons for free rides on four Saturdays, which generated additional rides on those days, but also no permanent gain.

Other promotional campaigns were less effective. The Chamber of Commerce was approached to coordinate a downtown merchant's support program. One major store offered discount tickets for their customers for a 6-week period but this was not well used. Another merchant carried

advertisements supporting Dial-A-Ride. This same store permitted installation of a free direct line telephone in an entry foyer. During the 1971 Christmas Season, Santa Claus "arrived" in a Dial-A-Ride bus. It is conceded that promotional campaigns in conjunction with the retail business community were not totally successful because:

1. No full-time attention was devoted to generating support.
2. The Dial-A-Ride service area is too small to represent a major market opportunity for merchants.

Several hundred posters were printed at no charge to the Ann Arbor Transportation Authority but were not distributed because of lack of staff time.

Some news media coverage was generated in the local newspapers and on the radio. The principal benefit of these periodic news items was increased public awareness of the project; no ridership gain could be noted.

5.8 DATA COLLECTION

Because this was a pilot project, information gathering and analysis was an important project task. Data measured during the project by source and measurement rate are listed on the next page:

Datum	Source	Measurement/Sample Size
Ridership		
by direction and total	dispatch logs	daily 100%
by day of week	dispatch logs	Tabulated periodically early in project; three sample months later
by fare class	fare box cash/ ticket counts; approximated pass usage	monthly 100%
by origin and destination	dispatch logs	1 week sample per month January-August. 100% within sample weeks; 15% of total trips
by hour of day	dispatch logs	100% of trips during 8 sample days: 2%
Revenue by fare type	farebox counts, pass sales	monthly 100%
Labor hours	weekly summary	daily 100%
Expenditures	project budget	100%
Service Times	recording on dispatch log during intensive monitoring periods	10 sample days: 2.4% of total trips
Productivity	weekly operating summary	daily 100%
Vehicle miles and hours	weekly summary	daily 100%
Vehicle operating time/speed	tachograph disc on one vehicle	sample 1%
Passengers: trip purposes frequency of use alternate mode demographic profile reactions to service	administered on-board surveys	100% of persons using system during two periods of three days each: total 298 + 248 respondents
further reactions to service	telephone survey	102 responses
All citizens in area: attitudes toward Dial-A-Ride and public transportation	household interview survey	886 responses: approximately 35% sample of original service area residents
Line route data:	previous passenger survey; daily "revenue passengers"	-

Figure 4 (in Section 5.1) illustrates a dispatch log. One such log was filled out for each tour in the project. If properly filled out, it would be possible to re-create each tour from these logs. Figure 8 reproduces a weekly summary sheet which included passenger totals, vehicle operating data, labor hours, revenue, and special comments. These two records were the principal sources of routine operating data, time studies, and origin-destination analysis.

In addition to these routine data sources, the project consultants conducted waiting and riding time studies during six intensive monitoring periods of 1-3 days each, two on-board rider surveys each of 3 days, a follow-up telephone survey of infrequent riders, and detailed studies of dispatching procedures and hourly productivities. Independent, coordinated research by an Ann Arbor Transportation Authority member (Michael J. Berla) in general public attitudes toward Dial-A-Ride included an in-depth home interview survey. Ann Arbor Transportation Authority operating staff and the project coordinator kept a running tabulation of revenues and expenses.

Other special studies: of pass renewals, stop dwell times, and system operation during an exceptionally high-ridership day when no fare was charged, were performed by the project consultants. Interim and special reports detailing results of all project analysis were issued during the project; their main points and conclusions and considerable additional analysis comprise this final report. Appendix H includes a listing of all interim reports.

Efforts were made to keep all operating data complete and accurate. However, considerable deficiencies arose in vehicle mileage and cost accounting, especially with regard to cost accounting for the backup transit coaches (which were daily used in line route service as well, often on an emergency replacement basis with incomplete records of vehicle assignment). As a result, complete vehicle cost records by vehicle and month are not available, and vehicle costs could only be sampled for those months where information was best available.

PRELIMINARY

ANN ARBOR DIAL-A-RIDE WEEKLY SUMMARY

Week of: 12/6 to 12/11

Day of Week	Date	Ridership Data: Distrib. Outbound	Coll. Inbound	%	Total	Total Revenue	Transfers: Sold	Transfers: Carried	Operating Data: No. of Tours	Vehicle Hours, Net	Veh. Productivity (Pass/Hr)	Vehicle Miles	Vehicle Miles/Hr
Mon.	12/6	101	98	14	213				38	28.30	7.5-	705	
Tue.	12/7	98	93	15	206				41	28.10	7.4+	426	15.1+
Wed.	12/8	98	100	10	208	W.T.			40	27.55	7.5-	364	13.0-
Thu.	12/9	91	97	11	199	265 cash			38	27.35	7.4+	481	17.5-
Fri.	12/10	106	89	14	209	20 Tick			39	32.00	6.5-	397	12.4+
Sat.	12/11	60	83	12	155	160 Passes			28	20.05	7.7+	300	14.9+
Total					1190					163.40		2673	

Day of Week	Date	Driver Hrs.: Reg.	O.T.	Dispatch Hrs.: Reg.	O.T.	Vehicle Data: Total Fuel	Oil	M&R Parts Cost	M&R Labor Hours	Weather	Comments
Mon.	12/6	27.05	4.05	12.00	0.30	60.5	—	13.00	7.0	Rain	4 hrs. sick pay
Tue.	12/7	29.40	3.10	11.30	1.00	64.4	—		1.0	Rain a.m.	Reg. Driver miss
Wed.	12/8	28.40	1.30	11.30	1.00	50.5	—	—	1.0	Wet Pavement	Reg. Driver off
Thu.	12/9	29.20	3.55	11.30	1.00	47.7	—	18.36	7.0	Rain	#20 #2 replaced #21, #20 brakes (off @ 10:00)
Fri.	12/10	29.20	5.35	11.30	1.00	50.0	—		7.0	Clear, Warm	12 hrs Sick pay Reg Driver off
Sat.	12/11	21.0	0.55	11.00	0.15	28.1	—	—	—	Clear, Warm	
Total		161.05	19.10	69.00	4.45	301.2	—	31.36	23.0		

FIGURE 8 -- WEEKLY OPERATING SUMMARY

CHAPTER 6

COST AND REVENUES

6.1 COST AND REVENUE SUMMARY

An important consideration in the operation of any publicly-supported public transportation service is the cost/revenue picture as reflected in the first objective of the project: to evaluate market response and demonstrate the economic feasibility of the new service. As a pilot project, Ann Arbor Dial-A-Ride incurred some non-recurring expenses in system design, evaluation, and adjustment. During most of the project year, ridership was significantly below system capacity. Consequently, the cost and revenue figures here presented cannot be directly extrapolated to a larger system, although some of the direct operating cost results can be taken as approximate indications of large system costs.

A summary of costs and revenues accounted in the project budget is shown in Table 4. Expenses totaled $123,718.98, while revenues were $24,889.54, leaving a net balance of $98,829.44. Of this, the Michigan Bureau of Transportation provided $61,208.00; the City of Ann Arbor provided $13,210.17 in cash and $9,286.27 in contributed services; and Ford Motor Company, Transportation Research and Planning Office provided $15,125.00 in contributed services.

Based on the project budget, average operating cost (not including capital, design, and evaluation costs) per rider for the Dial-A-Ride project came to $1.74 per ride while the revenue averaged $.47 per rider. Fares thus covered 28% of operating cost. Components of the total project operating cost were 87% labor (49% direct driver wages, 20% direct dispatcher wages, and 18% fringe benefits), 11% vehicle operations, and 2% dispatch center operation.

TABLE 4

TOTAL PROJECT BUDGET SUMMARY
September 16, 1971, through September 16, 1972

	Hours	Amount
EXPENSES:		
Capital Costs		$10,807.21
Transit Vehicles		8,000.00(1)
Vehicle Communications		1,882.21
Dispatch Center		925.00
Operating Costs		$88,962.50
Drivers S & W		
Regular	8,746.2	$36,864.97
Overtime	1,051.2(2)	6,629.16
Dispatch S & W	3,808.8(3)	17,722.86
Fringe Benefits		16,454.60
Vehicle Operations	8,505.2(4)	9,775.91
Dispatch Center Operation		1,515.00(5)
Other Costs		$18,026.27
Computer Services		-----(6)
System Design		$ 8,125.00(7)
AATA Staff		6,750.00
Publicity		3,151.27
Project Evaluation and Contingency		$ 5,923.00(7)
TOTAL		$123,718.98
SOURCES:		
Revenue from fares		$24,889.54
Local cash		13,210.17
Local contributed services		24,411.27
State of Michigan, Bureau of Transportation		61,208.00
		$123,718.98

(1) $7,000 of this is a bookkeeping charge for the loaned vehicles; remainder is for refurbishing and painting interim and loaned vehicles.

(2) Of total hours worked, 89% were at straight time and 11% at overtime.

(3) 795 hours of dispatcher total were actually driving time in vehicles rather than dispatching. During most of the project, one dispatcher spent part of the working day as a driver, and this time was thus charged at dispatcher's wage, although not spent actually dispatching.

(4) Total vehicle hours are less than total driver hours because of shift change time and some driver lunch breaks.

(5) Telephones and printing of dispatch forms.

(6) Anticipated computer-aided dispatching test not carried out.

(7) Additional services were contributed by City of Ann Arbor and Ford Motor Company, Transportation Research and Planning Office. Ford billed for 54 man days in system design and 11 days in project evaluation; actual expenditure was 160 man days. AATA Staff billed for approximately one-half man-year; actual expenditure was one man year, plus approximately one additional man-year in donated services by the AATA Board members.

6.2 LABOR COSTS

Operating costs are a direct function of labor rates. Up until July 1, 1972, drivers received $4.16 per hour and dispatchers received $4.36 per hour. After July 1, wages went up to $4.40 per hour for drivers and $4.55 per hour for dispatchers. Fringe benefits add an additional 25% to the base hourly rate. Total labor costs were $77,671; total hours were 13,606. Labor costs and hours are shown in Table 4. In considering Dial-A-Ride for other communities, it is clear that local labor rates -- which vary a great deal from place to place -- must be used in developing a budget. Productivity (Section 9.2) is thus the more important determinant in planning a new system.

6.3 VEHICLE OPERATING COSTS

The vehicle operating costs were initially estimated at $1.15 per vehicle hour. A total of 8,505.2 vehicle hours were run and total project vehicle costs charged were $9,775.91. Because of the reporting problems discussed in Section 5.8, total and accurate vehicle costs by vehicle for the entire project are not available. The basic problem was that the project was run with no dedicated spare vehicle, and with interim vehicles subject to frequent breakdown and emergency repairs. In an attempt to verify the charged rate of $1.15 per hour, sample months for which the reporting of costs was best were analyzed as shown in Table 5.

The average operating cost per vehicle hour for the four sample months was $1.193/hour, of which gas and oil represented 29.8¢ per hour (25%), repair costs were 53.7¢ per hour (45%), and insurance came to 35.8¢ per hour (30%). The charged rate of $1.15/hour would appear to be a reasonable estimate of vehicle operating cost from this sample.

TABLE 5

SAMPLE MONTHLY VEHICLE COSTS FOR DIAL-A-RIDE VEHICLES

	January	February	April	May
Gas and Oil	$175.47	$208.34	$202.60	$168.21
Maintenance and Repairs (parts and labor)	287.15	457.76	388.19	224.60
Insurance	225.00	225.00	225.00	225.00
TOTAL COSTS	$687.62	$891.10	$815.79	$617.81
Vehicle Hours	592	606	742	581
Operating Cost per Vehicle Hour	$ 1.16	$ 1.47	$ 1.10	$ 1.06

The costs and vehicle hours shown above are those accounted to the three regular Dial-A-Ride vehicles. Back-up vehicle costs per hour cannot be calculated separately because the vehicles were shared between Dial-A-Ride and normal route service. They are included in total vehicle costs at the same rate of $1.15/vehicle hour for the hours they were used in Dial-A-Ride service. Garage overhead and washing were not accounted separately for the Dial-A-Ride vehicles, since these items produced no marginal cost increase over normal Ann Arbor Transportation Authority fleet operating cost.

6.4 CAPITAL COSTS

Actual cash capital costs were $3,897, mostly for communications and dispatch center equipment. An entry of $7,000 was charged as a local contribution for the vehicle loaned to the project by Ford Motor Company. The two existing Ann Arbor Transportation Authority vehicles also used in the

project were not charged as a capital expense. If a U.S. Department of Transportation capital grant had been approved and three $9,000 vehicles purchased, the one-year total vehicle capital cost would have been $10,260, conservatively assuming a three-year vehicle life and 6% interest. The capital grant would have covered two-thirds of this, leaving an annual vehicle capital cost of $3,420 for the project.

6.5 OTHER COSTS AND PROJECT EVALUATION

Aside from capital and operating costs which occured in simply running the project service, the Dial-A-Ride pilot project incurred costs of administration, design, marketing, and evaluation, as well as the costs of implementing an innovative system. Because many of these costs, especially the last mentioned, are difficult to quantify, and represent the volunteered time of numerous individuals in many situations not necessarily directly related to the project operation, it is nearly impossible to provide a complete tabulation of all costs.

Administrative costs, listed as "AATA staff" under "Other Costs," and probably some portion of costs listed under "Publicity" were expenses that were not necessarily unique to the experimental nature of the pilot project. That is, an established operating Dial-A-Ride system would incur administrative or overhead costs and probably should include a marketing effort at some continuing cost. To the cash outlay for publicity should be added approximately one man-month of time not explicitly charged, which could reasonably be priced at $1,000. Probably about half of the resulting total marketing cost would be desirable in a continuing operation, resulting in a total "normal" marketing outlay of approximately $2,000. For continuing

supervision of a three-vehicle project, the one-half man year charged as "AATA staff" should be adequate. Combining these two items results in a "normal" overhead to operating cost for the one-year project of $8,750.

The remainder of the expenses charged under "Other Costs" and "Project Evaluation" are extraordinary costs incurred as a result of the project's experimental character. Subtracting the "normal" costs derived above, these appear in the project budget in a total amount of $15,199. To this figure can be added the estimated additional time on the part of AATA members and staff and Ford Transportation Research and Planning Office personnel as indicated in note (7) to Table 4. A reasonable pricing of this time would total approximately $35,000 ($23,000 for AATA members and staff; $12,000 for additional consultant time), resulting in a total estimate of $50,000 to design, implement, adjust, evaluate, and report on this project.

6.6 COMPARATIVE COSTS AND ADDITIONAL BENEFITS

During the latter part of the pilot project, service on one of the AATA line routes was suspended during the midday hours and replaced with Dial-A-Ride. The savings to the AATA resulting from the reduction of previously scheduled bus hours amounted to approximately $3,250 over the remaining weeks of the pilot project; this can be counted as a cash benefit of Dial-A-Ride to the total AATA budget.

Recognizing that Dial-A-Ride provides a significantly higher level of service than other public transportation systems, it is nonetheless informative to compare the fares and costs of alternate modes. For the pilot Dial-A-Ride project, a typical trip would be two miles in length, from the corner of Stadium Boulevard and Pauline to Jacobson's downtown.

Table 6 shows the comparative costs and travel times for this typical trip by the various modes normally available to Dial-A-Ride service area residents.

TABLE 6

TYPICAL TRIP COSTS FOR DIFFERENT MODES

Mode	Fare	Actual Cost	Total Travel Time
Dial-A-Ride Pilot Project	60¢	$ 1.74	23 min. (10 min. wait, 13 min ride)
Regular city bus	35¢	$ 0.69	35 min. (15 min. wait, 13 min. ride, 7 min. walking at both ends)
Taxi	$2.05 plus tip	unknown	17+ min. (5-10 min. wait, 10 min. ride)
Private car	(12¢/ mile)	$ 0.24 plus parking (20¢/ hr.)	15 min. (no wait, 10 min. ride, 5 min. park and walk)

Dial-A-Ride thus offers service close to that provided by taxi or private car, at similar or substantially lower out-of-pocket cost, but with a total cost similar to but somewhat below taxi fare.

6.7 REVENUE

Revenue is dependent on both ridership and the fare structure. Fares were 60¢ cash, 50¢ tickets (sold in strips of 10 for $5.00), and $15.00 ($10.00 introductory rate until February) monthly passes. The pass was unusual in that it was good for any number of members of the same family

traveling together between the same two points. A special off-peak pass good only between 9:00 a.m. and 3:00 p.m. was offered for $10.00 beginning in February. Sales of the off-peak passes were few, but the regular monthly passes at the introductory rate were an important stimulant to ridership growth.

The average fare per passenger was 46.9¢ through August, and the average fare per pass rider was 36.1¢. Just under half of all trips were made by pass riders, about 41% were paid in cash, and 10.8% were paid for with tickets. Table 7A is a summary of revenue and ridership by fare classes for the eleven complete pass periods during the project. The table also shows average pass fare for each pass period as derived from pass ridership and pass revenue and shows the average revenue for all users. Data in Table 7A do not include riders and revenues for September 1-16, 1972 because only a partial pass period was included there and revenue figures would therefore be distorted.

From September through August, 650 passes were sold, bringing in $8,090 in revenue. Table 7B lists the number of new passes, renewed passes, and pass revenues per month. Although this table does illustrate the seasonal trend of regular ridership, one must also consider that pass usage dropped starting in February partially in response to the increase in the pass fee. Many regular riders who had held passes began using tickets, as reflected in the considerable increase in ticket revenues from February on shown in Table 7A.

A total of 5,840 tickets were sold, of which 5,235 tickets were redeemed. Ticket revenue was $2,617. Ticket sales and redemptions for September through August are also listed in Table 7C.

TABLE 7

REVENUE BREAKDOWN
A. Revenue/Ridership by Month

	Passes	Cash	Tickets	Total Revenue	Total Paid Ridership	Average Fare Pass Riders	Average Fare
Sept/	$ 480	$ 835	$ 131	$1,446	3,580	24.9¢	40.4¢
Oct	1,926	1,392	262				
Nov	810	1,036	154	2,000	4,773	29.6	41.9
	2,739	1,726	308				
Dec	880	1,100	148	2,128	4,602	35.6	46.2
	2,474	1,831	297				
Jan	920	1,040	162	2,122	4,919	32.1	43.1
	2,862	1,734	323				
Feb	1,110	1,046	268	2,424	4,908	42.2	49.4
	2,628	1,744	536				
Mar	980	1,142	318	2,440	4,998	39.9	48.8
	2,458	1,904	636				
Apr	795	935	312	2,042	4,300	37.5	47.5
	2,121	1,558	621				
May*	675	1,009	280	1,964	4,259	33.5	46.1
	2,017	1,682	560				
June	615	1,187	320	2,122	4,407	34.3	48.2
	1,793	1,975	639				
July	420	1,302	240	1,962	3,841	35.4	51.1
	1,188	2,168	485				
Aug	405	1,393	284	2,081	3,854	41.8	54.0
	969	2,317	568				
TOTAL	$ 8,090	$12,024	$2,617	$22,731	48,441		
	23,180	20,031	5,235				

Adjust total pass ridership downward to account for 1.7% of total rides unpaid: new pass ridership total = 22,381

Total ridership by fare classes, excluding free day:

46.2% passes, 41.3% cash, 10.8% tickets, 1.7% unpaid

Overall average fare = 46.9¢, overall pass fare with adjusted ridership total = 36.1¢.

*May 1, 1972, Free Day, Dial-A-Ride Promotion: 390 passengers carried (8.5% of month total) at no fare.

TABLE 7 (Con't.)

B. Monthly Pass Sales

	New Passes	Renewed Passes	Total Passes	Pass Revenues
Sept/Oct	48	--	48	$ 480
November	37	44	81	810
December	18	70	88	880
January	21	71	92	920
February	5	69	74	1,110
March	5	61	66	980
April	4	50	54	795
May	5	41	46	675
June	6	37	43	615
July	9	20	29	420
August	10	19	29	405
Total	168	482	650	$8,090

C. Ticket Sales and Redemptions

	Ticket Sales	Tickets Redeemed	Cumulative Outstanding
September	100	43	57
October	270	219	108
November	210	308	10
December	370	297	83
January	550	323	310
February	580	536	354
March	620	636	338
April	580	621	297
May	690	560	427
June	630	639	418
July	610	485	543
August	630	568	605
Total	5,840	5,235	

20,031 of the Dial-A-Ride trips were paid with cash, resulting in a cash revenue of $12,024. Cash riders represent the largest component of the total revenue.

Some passengers were carried free of charge. The "free day" on May 1, 1972 resulted in 390 passengers carried at no fare, and approximately 150 free rides were allowed with coupons during June. In addition, miscellaneous short-changing and forgotten fares resulted in an effective rate of 1.7% of total passengers riding free. This figure derives from a careful correlation of dispatching passenger records and farebox revenues during the first two months of operation. There were no notable problems in fare collection, wholesale cheating, or robbery. Note that pass ridership month-by-month in Table 7A is derived, and therefore is likely higher than actual pass user ridership by the approximately 1.7% of lost cash fares. The total figures for Table 7A are explicitly corrected for this effect, however.

CHAPTER 7

RIDERSHIP

7.1 GROSS RIDERSHIP

A total of 51,370 rides were served by the Ann Arbor Dial-A-Ride project during the period September 22, 1971 through September 16, 1972*. From project startup, weekday ridership grew rapidly to the vicinity of 210 rides/day before Christmas and stayed at a high level through March, occasionally touching 250/day. Spring and summer saw weekday ridership decline gradually to an August low of 150-160 rides/day, but with the return of fall and school ridership, weekday totals again reached approximately 250 rides/day**. The highest paid daily ridership was 270, on the last weekday of the project.

Ridership totals for Saturdays never reached concurrent weekday levels, and for most of the project service was offered for 1-1/2 hours less on Saturday than on weekdays. Saturday ridership peaked in excess of 160/day at Christmas shopping time and thereafter stabilized at 100-120/day for the spring. Immediately after public school closing, summer Saturdays had a sharp surge in ridership followed by an equally sharp drop to a stable summer Saturday average of 70-80 rides/day. With the coming of fall, Saturday ridership rebounded to around 100 rides/day.

Table 8 shows the total monthly ridership figures through the pilot project and the relevant mean values. Appendix E lists total ridership for each day during the project.

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*In some sections of this report ridership totals are used which reflect slightly less than the full project duration.

**In operations continued beyond formal pilot project completion, weekday ridership grew beyond this to an average total of 303 rides/day for November 13-17, 1972.

TABLE 8

TOTAL PROJECT RIDERSHIP BY MONTH

Month	Total Rides	Inbound	Outbound	Other[1]	Weekday Mean	Saturday Mean
September, 1971 (Sept 22-30 only)	609	334	275	-	78	63
October	2971	1510	1394	67	120	92
November	4773	2216	2168	389	198	150
December	4602	2221	2182	199	181[2]	145
January	4919	2452	2361	106	224	107
February	4908	2256	2396	256	214	109
March	4998	2179	2394	425	207[2]	107
April	4300	1841	2076	383	191	96
May	4649	1991	2186	472	193	94
June	4407	2057	1818	532	173	139
July	3841	1723	1607	511	174	71
August	3854	1731	1576	547	154	73
September, 1972 (Sept 1-16 only)	2539	1053	1164	322	224	98
Total Project	51370	23564 (45.8%)	23597 (46.0%)	4209 (8.2%)	182[3]	104[3]

Notes: (1) "Other" is defined as all trips not between the service area and either the downtown loop, hospital/university stops, or Slauson Junior High. Included are intra-service area trips, intra-downtown trips, and trips to or from Westgate, Maple Village, and Veterans' Park Pool. This column is thus a measure of the number of non-standard trips requiring routing different from the normal "tour".

(2) December and March means are depressed by, respectively, two weeks and one week of low ridership from holiday vacations.

(3) Excluding startup, November, 1971-September, 1972 mean values are 198 weekdays, 106 Saturdays.

The General Work Program (Phase I) for Ann Arbor Dial-A-Ride contains specific criteria for evaluation of total system ridership (see Section H-II, pp. 11-13) with which these results may be compared. Directly quoting from that document:

> "The desired objective is to reach 300 to 420 demands per average weekday with the three-vehicle fleet..... If there is no change in service area, available destinations, or other aspect of the service which is successful in generating average weekday ridership in excess of 200 per day, the experiment will be termed "unsuccessful." Average weekday ridership between 200 and 300 per day will be deemed "moderately successful," and in excess of 300 per day 'successful'".

With a demonstrated weekday average ridership of 224 rides/day in the last partial month of the project and winter weekday averages in excess of 200 rides/day, the Dial-A-Ride pilot project can be termed "moderately successful." These levels have been attained in the face of a lower-than-expected average usage rate of the system per household, by expansion of the service area at little cost in deterioration of service quality.

7.2 TIME VARIATION OF DEMAND

7.2.1 Seasonal Effects

A rather strong monthly variation in project ridership is evident from inspection of Table 8. These figures, however, do not truly reflect seasonal demand changes because additions to the service area during the project altered the base from which ridership was drawn. A more accurate

picture is shown by the trip generation rate* for a fixed base area over the course of time. Table 9 and Figure 9 present trip generation rates for service area sections A and B from mid-winter to mid-summer. Table 9 shows total trips, and Figure 9 illustrates factored rates to the downtown loop and the hospital/university area. Note that Figure 9 is therefore not simply a graph of the information presented in Table 9, but illustrates two factors of the several which total to the entries in Table 9.

TABLE 9

DIAL-A-RIDE TRIPS PER HOUSEHOLD-WEEK

(Sample Weeks from Origin-Destination Analysis: January-August, 1972)

To and From	Jan	Feb	Mar	Apr	May	June	July	Aug
S.A. Section A	.43	.40	.38	.34	.30	.26	.23	.18
S.A. Section B	.26	.28	.31	.26	.27	.28	.23	.26
Sections A & B (Combined)	.37	.36	.35	.31	.29	.27	.23	.21

Service area Section A shows a strong seasonal demand variation, with summer trip generation less than half its winter peak, while Section B shows no significant monthly changes in trip generation. Suggested (but not proved) reasons for this difference are:

1. Section B is, on the whole, considerably further from downtown destinations than Section A. The resulting trips are therefore longer and may be perceived as a better value in marginal or good weather; diversion to walking or bicycling may be higher for Section A in better weather.

*Trip generation rate is defined as the number of trips (per week) with either origin or destination in the area in question divided by the total number of households within that area (not just the number of households actually using the service).

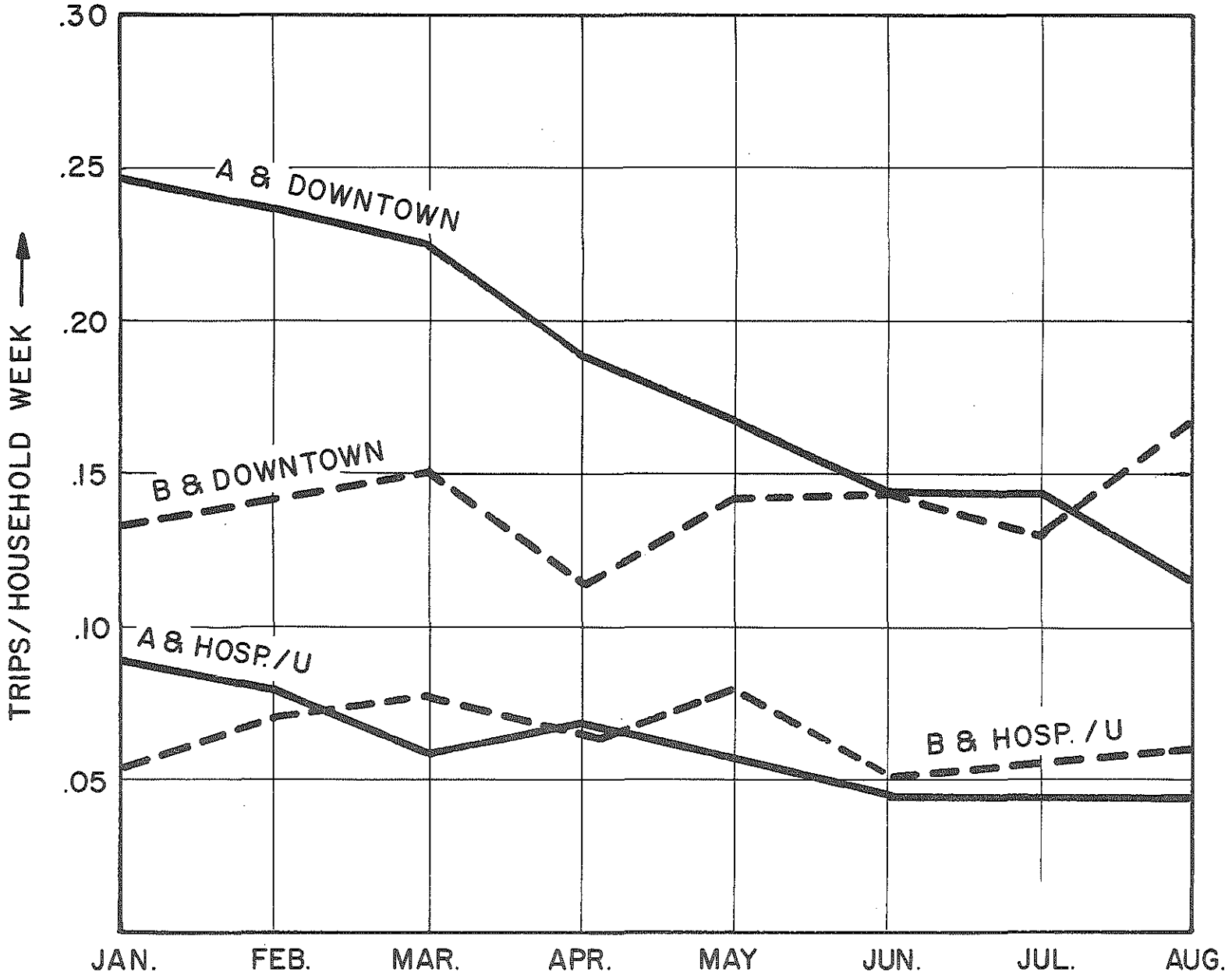


FIGURE 9 -- SEASONAL CHANGE IN TRIP GENERATION RATES
(Trip Generation Between A & B and Downtown
and Between A & B and the Hospital/University)

2. Many of the households in Section B (northwest part) are apartments presumably with fewer school-age children per household. Ridership loss at the end of the school year would thus be much less. This reasoning draws strength also from the fact that summer trip generation in Section A is close to the nearly constant rate for Section B, leading to the suggestion that the bulk of the higher winter rate in Section A is school ridership which is gradually diverted and finally eliminated as weather improves.

The last line of Table 9 represents the best available cross-sectional measure of Dial-A-Ride usage by season, and indicates a summer ridership of approximately 62% of the winter peak. In comparison, ridership on Ann Arbor's fixed-route buses (including school trippers) declines in summer to about 55% of the winter peak. This summer decline was expected: the Dial-A-Ride Phase II Work Program included an estimate of seasonal loss which can be summarized as resulting in a prediction that summer ridership from service area Sections A and B would be approximately 67% of winter peak.

7.2.2 Day of Week

The percentages of passengers riding each day of the week for three sample months in different seasons, chosen to avoid distortions from holiday periods, are shown in Table 10, with comparison figures for fixed-route ridership in Ann Arbor the same months.

TABLE 10

RIDERSHIP BY DAY-OF-WEEK

(Percentages)

(Dial-A-Ride versus Ann Arbor line routes; average weekday ridership for each month = 100 Per Cent)

Month	Service	Mon	Tues	Wed	Thurs	Fri	Sat
Feb, 1972	Dial-A-Ride	96	101	98	104	101	51
	Line Bus	101	100	101	98	100	-
Apr, 1972	Dial-A-Ride	101	101	102	96	100	50
	Line Bus	102	101	102	99	96	-
Aug, 1972	Dial-A-Ride	95	101	102	104	96	47
	Line Bus	99	102	99	101	98	-

Except for Saturdays, ridership did not vary substantially by day of the week. No single day showed a significantly greater number of riders on either Dial-A-Ride or the line route system.

7.2.3 Hourly Demand

Figure 10 presents histograms of hourly demands for service for three seasons during the project year. The plots reflect "request for service" times, not pick up times, and therefore, some smoothing of peaks in actual service is experienced. Special quasi-scheduled runs to and from Slauson Junior High School are included but their contribution is hatched to indicate its different nature. Winter and spring demand patterns are quite similar; aside from the demand peaks caused by Slauson shift changes, each has morning and late afternoon peak periods with relatively slack time during mid-day. Both also show an unexplained peaking of demand in the period 2:30 - 3:00 p.m., that was, in the dispatchers' observation, regular and characteristic. The dashed line through each histogram indicates

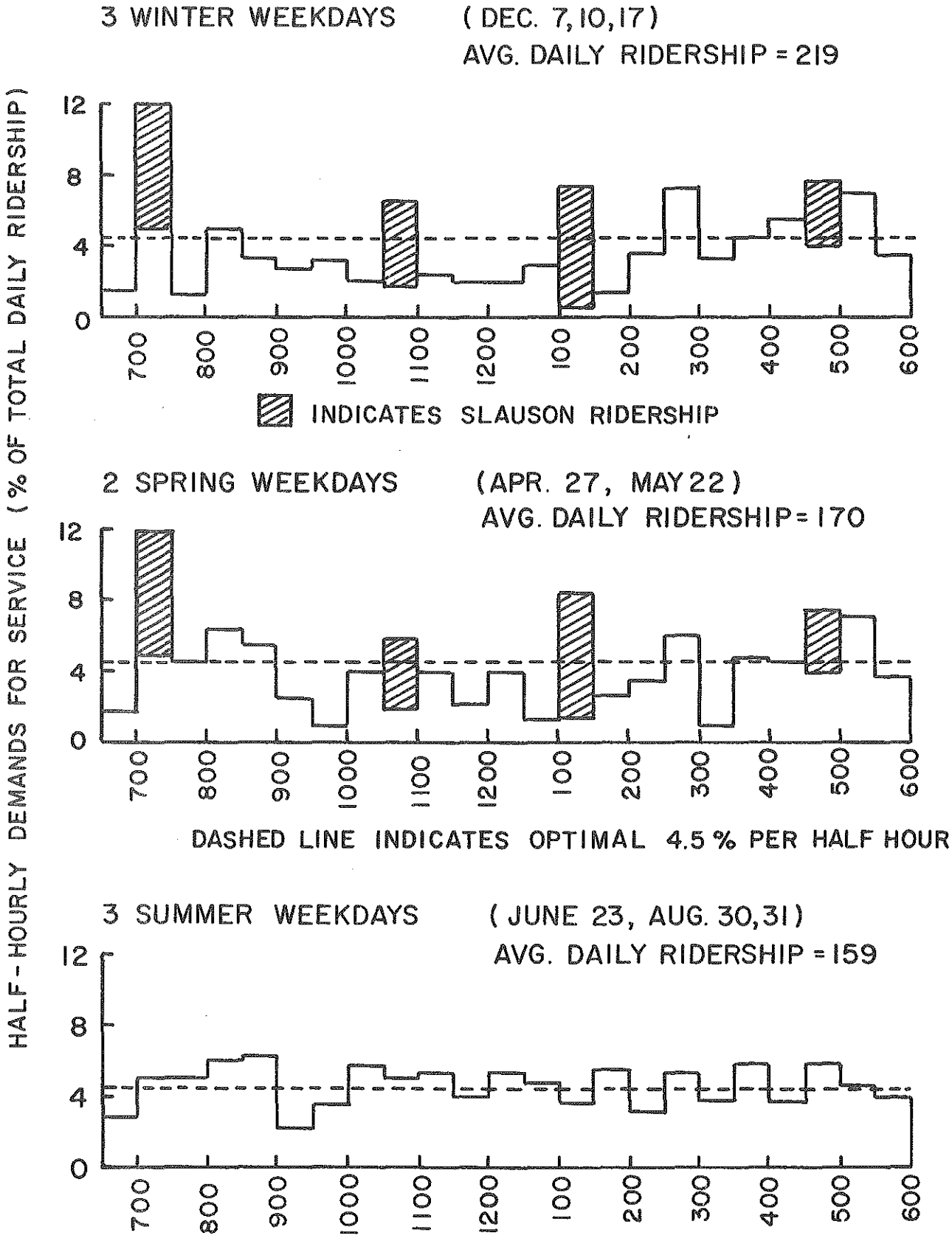


FIGURE 10 -- HOURLY DEMAND PATTERNS

the level of constant demand which would result in the same daily total; deviations above this line exactly balance those below, and since each period's graph is normalized, this line is at 4.5% of the average total ridership in each case. In one sense, this line would represent a optimal demand level for steady-state system performance.

The demand pattern for summer is strikingly different from winter and spring, rather closely following the constant-demand line. This contrast can be emphasized by computing the percentage of total ridership carried in the five mid-day hours 10:00 - 3:00 (comprising 43.5% of total operating hours) for each period:

Winter - 24% (excluding Slauson) - 53 average passengers

Spring - 27% (excluding Slauson) - 46 average passengers

Summer - 45% - 71 average passengers

Note that actual passengers carried mid-day increased during summer as well as the percentage of the daily total.

A serious concern of the Dial-A-Ride project management was to increase off-peak (i.e., mid-day) ridership to alleviate the mid-day slump evident in the winter demand pattern. Specially directed to this end were the additions of Westgate, Maple Village, and Veterans' Park as destinations and service area Section C (senior citizens' buildings). A slight response to the additional destinations may be evident in the spring pattern. Service area section C was added June 1, 1972. Summer demand, while deficient in total quantity, was distributed nearly evenly, and thus can be taken as evidence of improved off-peak utilization. However, since a portion of summer mid-day ridership was undoubtedly school-age children who will not be able to travel during mid-day

through the school year, it remains to be seen whether an evening out of hourly demand can be maintained during the fall and coming winter*.

7.3 GEOGRAPHIC TRIP PATTERNS

For each month in the period January through August, 1972, one sample week was chosen to allow a full week of typical service and a complete tabulation of all trips by origin (e.g., service area Section B) and destination (e.g., downtown loop) was made for that week. Each such tabulation, organized into a matrix form, shows the proportionate distribution of all trips among the many (up to 81) possible trip patterns available on Ann Arbor Dial-A-Ride, and by summation the contribution of each service area section and destination to total ridership. Comparisons among these matrices for different months were used to show the changes in geographic ridership patterns as a function of time. A detailed analysis of origin-destination matrices revealed the following:

Conclusion (1): As might be expected from the lack of public school ridership in the summer, winter and spring destination patterns differed from summer. Specifically, the average pattern of non-home destinations on Dial-A-Ride was, for winter and spring:

53% - Downtown Loop
20% - Hospital/university stops
18% - Slauson Junior High
9% - Other (composed of 6% intra-service area and 3% Westgate-Maple Village)

} Winter-Spring Travel Pattern

*An hourly demand analysis for one high-ridership day beyond project completion (December 1, 1972) reveals a demand pattern similar to spring. Ridership excluding Slauson for 10:00 - 3:00 was 101, higher than previous values, but only 32% of the day's total.

For summer the destination pattern was:

59% - Downtown loop
20% - Hospital/university stops
2% - Slauson Junior High (summer school)
19% - Other (composed of 10% intra-service area, 8% Westgate-Maple Village, and 1% Veterans' Park)

} Summer Travel Pattern (raw)

Since gross summer weekly ridership was 70.5% of the winter-spring mean, it is of interest to re-normalize the summer destination pattern to the winter-spring ridership base, thus providing a comparison of the actual number of passengers riding to and from the above points between winter and summer. The summer destination pattern to the winter ridership base was:

41.5% - Downtown loop
14.0% - Hospital/university stops
1.5% - Slauson Junior High
13.5% - Other (7% intra-service area, 5.5% Westgate-Maple Village, 1% Veterans' Park)

70.5%

} Summer Travel Pattern (to same ridership base as winter-spring)

This tabulation shows an absolute increase in riders to "other" destinations during summer, and an absolute decrease in ridership to downtown destinations.

Conclusion (2): The different service area sections showed some variance in trip-making patterns (since Section D was included only after June 1, only summer comparisons for all sections could be made).

Service area Sections A and B showed no significant differences in trip patterns, except that Section A generated proportionately about 40% more Slauson passengers during the school year. This was an expected disparity because school ridership is primarily from single-

family dwellings. Section A is almost wholly single family houses, whereas Section B consists of approximately 60% apartments and 40% single-family houses. Since 94% of all trips tabulated were from residents of Sections A and B, the average destination patterns shown in Conclusion (1) above can be taken as characteristic of these sections.

Dissimilar neighborhoods showed remarkably similar ridership. The two demographically different and physically separated parts of service area Section B could not be distinguished by their riding pattern or overall frequency. Middle-income apartments and high-income private homes showed, except for school trips, essentially the same ridership pattern on Dial-A-Ride. Figure 11 illustrates this result (the divergence in April is almost certainly traceable to small sample size).

Area Section D, demographically most similar to Section A but mostly at shorter distances from downtown, showed moderate variance from Sections A and B, with fewer trips to the downtown loop but about the same proportion to the hospital/university stops, and considerably higher "other" trips (29% due almost completely to a greater number of intra-service area trips).

Area Section C, the two senior citizens' residences, showed the most divergent trip pattern. In this case of zero school-age riders, the winter trip pattern could reasonably be expected to be close to the summer pattern, which was:

47% - Downtown loop

11% - Hospital/university stops

42% - Other (26% intra-service area, 16% Westgate-Maple Village).

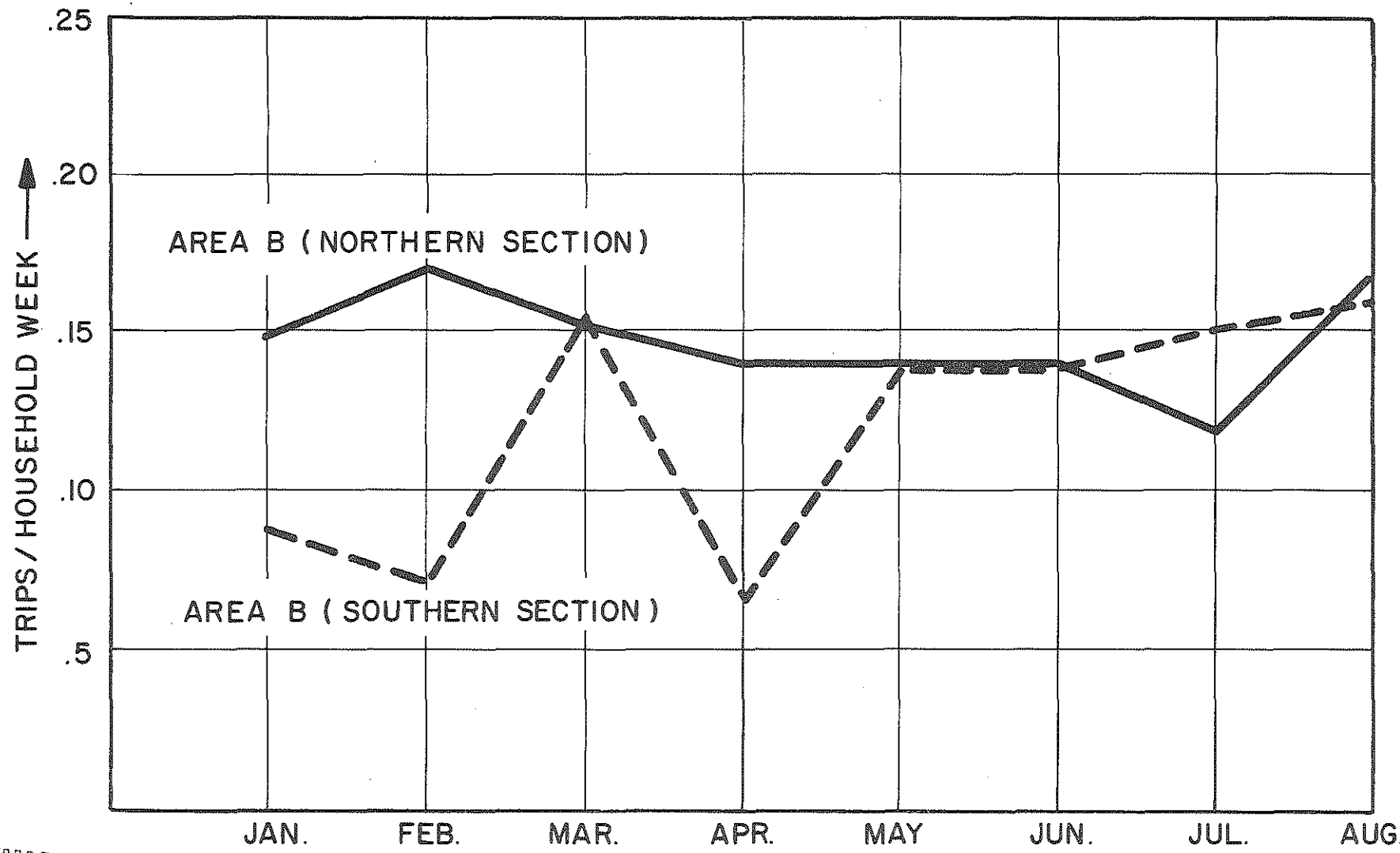


FIGURE 11 -- TRIP GENERATION RATES FOR DISSIMILAR NEIGHBORHOODS
(Trip Generation to Downtown in the Northern Part of Area B Compared to the Southern Part of Area B)

This destination pattern would be consistent with the hypothesis that work and school trips were negligible and only shopping, social, and medical trips were served.

Conclusion (3): The trip generation rates (trips per week per household (see footnote on page 67) for each service area section varied considerably. The summer mean trip generation rates by service area section were:

A - .23
B - .26
C - .17
D - .06,

} Summer trips on Dial-A-Ride per average household in area (users plus non-users) per week.

from which it is evident that Section D residents used the service very little. There was no growth in demand for Dial-A-Ride from Section C and D over the summer, despite the fact that service to those sections was begun May 1 and June 1, respectively. Demand levels very quickly reached the low values reflected above and stabilized there. For Section C, the achieved level may represent a better response than simple comparison indicates, since service there was offered only 6 hours a day. If one makes the perhaps questionable assumption that ridership from Section C would increase proportionately if service hours were expanded to include the entire operating day, then Section C would actually show a higher trip generation rate than any other area section. For Section D, the combination of shorter ride distances being perceived as a lesser value for the fixed fare and an extremely limited promotion effort in comparison with that undertaken for Sections A and B may help to explain the very low trip generation.

Conclusion (4): A clear test of the ridership increment induced by two (effectively one, because of their proximity) additional shopping destinations was made by the introduction of mid-day service to Westgate and Maple Village shopping centers on March 1, 1972. No other system parameters were changed at that time, and weather remained relatively constant. No additional ridership was induced, either from households already using Dial-A-Ride or from others who had not used the service. The sole effect was a small change in trip patterns resulting in 4.7% (approximately 10 per day) of March trips apparently diverted from other destinations to the two shopping centers. These statistical results concur with the dispatchers' impressions at the time.

It is not clear whether other destinations might have been chosen to yield greater demand, or whether a more dramatic increase in destinations served would be necessary to induce additional ridership. The substantial increase in "other" destinations as service area Section D was added (from 9.8% of total rides in May to a summer mean of nearly 19%) suggests that desired trip lines are highly scattered, rather than being concentrated on obvious activity centers, and thus that fairly wide-area many-to-many service would be most successful in generating ridership.

7.4 DIAL-A-RIDE AND LINE ROUTE RIDERSHIP

The Dial-A-Ride neighborhood (Figure 2, Section 4.1) is served by a portion of one of the Ann Arbor Transportation Authority regular routes (Orange line, west side). During the project, this line continued to be run through the neighborhood as a competing transit service with no significant changes in route or scheduling, except as discussed below.

Route mileage through the original Dial-A-Ride service area is about one half of the Orange line west side and one-sixth of total Orange line mileage. One of Ann Arbor's two major high schools (Pioneer) is located within the Dial-A-Ride service area poryion of the Orange line route. Almost all of the ridership generated by this high school consists of transfer riders coming from relatively distant residential areas of the city. As a consequence, the substantial ridership increment (80 rides per day on winter school days) traveling on the Orange line to and from this school is discounted in this discussion, because almost none of those passengers could have been served by Dial-A-Ride.

During the entire course of the Dial-A-Ride project, no effect on Orange line ridership was evident to Ann Arbor Transportation Authority personnel. No precise information on previous ridership levels for this factored part of the route is available, although daily revenue figures from the entire Orange line exist. From this total daily revenue, an average proportion of total ridership carried on the West side, and average fare, the daily riders on the Orange line west side (excluding Pioneer High) remained at 140-270, showing normal seasonal variation. The best estimate available for the mean Orange line west side ridership during the Dial-A-Ride project is 190 passengers per day, over the period October, 1971 to May, 1972, when Dial-A-Ride was carrying a mean of 191 passengers per weekday. For September-October, 1971, before Dial-A-Ride had generated significant ridership, the directly comparable estimated Orange line ridership mean was 198. Undoubtedly some diversion from line bus to Dial-A-Ride existed in the target neighborhood, but its effect was very small. It is likely that Dial-A-Ride captured most of the growth increment of the competing line route, but did not decrease the base ridership level.

A careful study of line route riders through the Dial-A-Ride service area was conducted on February 10, 1972, and revealed a total Orange line west side passenger count of 197 (1% over February mean), excluding riders from Pioneer High. Of these, 108 got on or off within the then-effective Dial-A-Ride service area (Sections A and B). On that day, the Dial-A-Ride operation carried 238 passengers (11% over February weekday mean). Thus on that day, from the same area, Dial-A-Ride served 2.3 times as many passengers as the line route.

Mean daily ridership by month for the Orange line west side and for Dial-A-Ride were nearly identical from November, 1971, through July, 1972, although the Dial-A-Ride service area was only a portion of the area served by the Orange line west side until June 1, 1972. It would be conservative to state that Dial-A-Ride generated additional transit ridership from the service area at least equal to the total generated by line route service, for a net 100% increase in total transit ridership.

Monday, June 19, 1972, saw two conditions change that would be expected to affect Orange line west side ridership: that was the first weekday following the end of the public school year; and line route service, which had previously run one-hour headways from 10:15 a.m. to 2:15 p.m., was suspended during those hours. The few passengers who had been riding during those times were asked to use Dial-A-Ride.

Surprisingly, no significant ridership change resulted on either Dial-A-Ride or the line route. Two-week means of weekday ridership before and after that date vary by less than three riders for both types of service. The only significant change was that the number of "other" trips within the constant total for Dial-A-Ride increased by 73%. Many hypotheses could be advanced to explain this result, but there is no information available to decide among them.

CHAPTER 8

SURVEY RESULTS

8.1 SUMMARY OF METHODS AND RESULTS

The research effort for Ann Arbor Dial-A-Ride included several surveys designed to (1) measure customer reactions to the service, (2) construct a partial demographic profile of Dial-A-Ride users, and (3) investigate their riding habits. The first was a three day, on-board survey (January 27, 28 and 29, 1972) in which 298 valid returns were obtained. The second was a telephone survey of one and two-time users of the Dial-A-Ride service. The third was another on-board survey conducted on June 22, 23 and 24, 1972. Appendix F contains survey forms and details of the methods used.

Besides these surveys conducted as part of the work program, Michael Berla (Ann Arbor Transportation Authority member and Ph.D. candidate in Urban and Regional Planning at the University of Michigan) conducted extensive research into the socio-economic, marketing, and political factors behind Dial-A-Ride usage. This research included one mail-back survey used to establish base socio-economic and attitude data, and was followed up by in-depth home interviews.

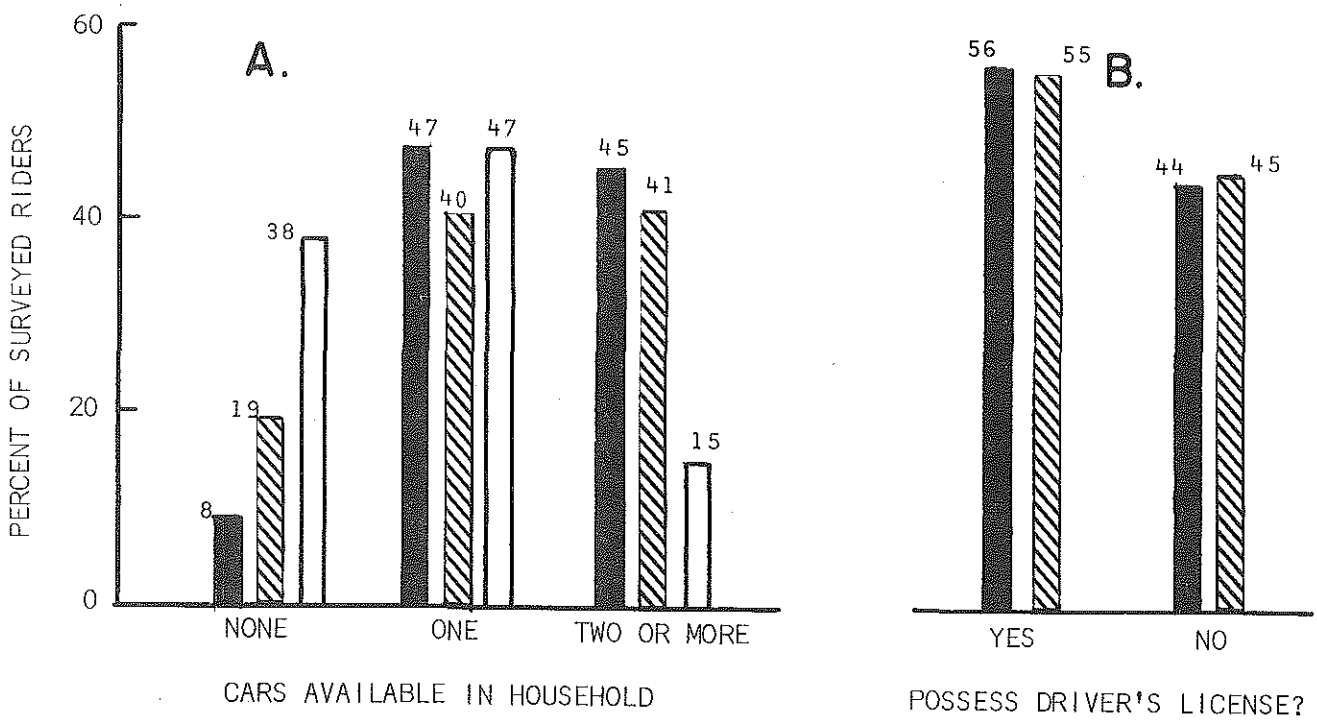
Summary results from these various surveys have established the following general points:

1. Dial-A-Ride drew on the average a different sort of rider from that carried on Ann Arbor's regular fixed-route buses. Although not precisely measured, it is evident that Dial-A-Ride carries a much higher proportion of "choice" as opposed to "captive" riders than do line buses.
2. Trip purpose showed a high percentage (48%) of non-routine trips on Dial-A-Ride, compared to those carried on fixed-route buses.

3. For trips made on Dial-A-Ride, about 50% of users formerly drove cars or were driven in cars. Only 12% would have used the regular bus for their trip if Dial-A-Ride had not been available.
4. Most Dial-A-Ride users have not been regular riders. Approximately 70% of the persons who use the service in a month ride only once a week or less. About half are one-way riders who find another mode better serves the other leg of their trip.
5. Occasional and irregular riders were specifically surveyed to find if their infrequent use was a result of dissatisfaction with the service. Their responses indicated that on the whole they found the service excellent, but that they perceived Dial-A-Ride as a secondary, backup means of travel. All direct measures of customer response showed passengers to be pleased with the service.
6. Of all service quality issues, passengers are most sensitive to waiting time and its reliable estimation by the dispatcher.
7. Aside from waiting time, the availability of additional destinations and a lower fare were the most desired service improvements.
8. In a survey of 675 households in the service area, of which only about 30% had used the service, almost two-thirds were willing to support expanded Dial-A-Ride service with additional tax dollars.

8.2 RIDER CHARACTERISTICS AND ATTITUDES

The two on-board surveys contained questions about the rider's age and sex, whether or not the rider had a driver's license, and the number of cars in his or her household. Direct responses to some of these questions are shown in Figure 12. Each graph (A, B, C) of Figure 12 shows two bars in each category which represent responses on the first and second on-board surveys, respectively.



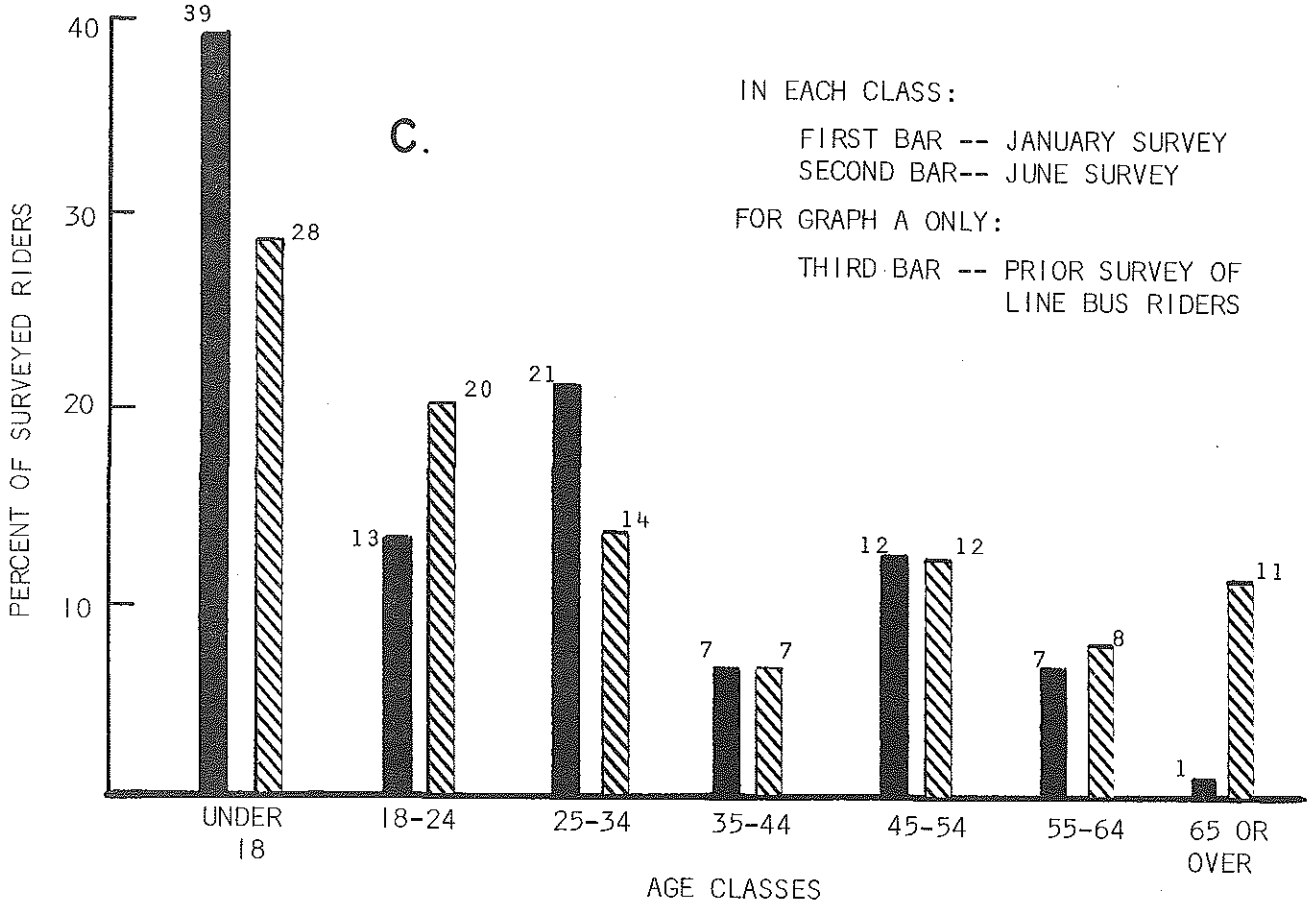


FIGURE 12 -- PROFILE OF USERS

In addition, Figure 12A shows the comparable results (open bars) for a similar ridership survey conducted two years previously on Ann Arbor's line buses. (The small number by each bar in Figures 12, 13, 14, and 15 in this chapter represents the actual percentage of responses recorded in each category, rounded to the nearest whole percentage point.) Not shown on Figure 12 is the distribution by sex: in both surveys riders were approximately 70% female and 30% male.

Figure 12A shows a large increase in riders from zero-car households between January and June, a direct result of the addition of the senior citizen residences to the service area on May 1, 1972. The large number of riders from households with two or more cars on both Dial-A-Ride surveys illustrates both the general affluence of the service area and the high level of diversion from auto travel on Dial-A-Ride. The open bars in Figure 12A show a strikingly different pattern of car availability for the relatively captive ridership of the regular city buses.

Figure 12B shows that a constant slight majority of Dial-A-Ride passengers possessed driver's licenses. Comparison of these results with the age distribution of Figure 12C suggests that almost all of the riders without driver's licenses can be identified as those under 18 years of age, plus probably some of those over 65. It would appear that virtually all of the adult passengers on Dial-A-Ride possessed driver's licenses.

Figure 12C shows that children and teen-agers were the largest single group of riders, and also indicates a large increase in riders over 65, following the extension of service to the senior citizen residences comprising service area section C.

There is no indication that any particular group within the service area population used Dial-A-Ride much more than proportionately, except that female riders greatly outnumbered males -- a common condition on all public transit.

Riders from zero-car households showed a slightly greater frequency in the surveys than in the general service area population; this effect could be due in part to reverse commuting of domestics into the service area, which is known to have occured, and in part to higher than average Dial-A-Ride usage among those service area senior citizens who did not have autos available.

In a separate but parallel investigation, 886 citizens in Ann Arbor's Fourth Ward, including 675 households in the Dial-A-Ride service area, were asked to express their attitudes toward public transportation in general, and Dial-A-Ride in particular.

1. Respondents were asked whether they agreed or disagreed with the following statement: "Ann Arbor really doesn't need a public transit system."

   Responses were: (Number answering: 886)

Disagree strongly	75%
Disagree somewhat	13%
Disagree somewhat/ agree somewhat	5%
Agree somewhat	2%
Agree strongly	3%
Don't know, no answer	1%

2. The interviewer then asked how the respondent thought transit service could best be improved in Ann Arbor.

   Answers (885) were tabulated as follows:

. Improve bus lines	8%
. City-wide Dial-A-Ride only	25%
. Combined Dial-A-Ride and line service	61%
. No bus service	1%
. Other suggestions (rapid transit, etc.)	3%
. Don't know	2%

3. The question was then asked:

   "Suppose that the Transportation Authority could provide Dial-A-Ride service throughout the City -- from any point within the City limits to any other point, at a cost of $5 per person per year plus the money

collected in fares. In other words, one half million dollars per year in City subsidies for city-wide Dial-A-Ride service. Would you vote for or against such a proposal?"

Responses were as follows: (885 answering)

For	$500,000 annual subsidy	63%
Against	$500,000 annual subsidy	24%
Don't know		13%

These results indicate substantial support in the Fourth Ward for public transport in general and for Dial-A-Ride in particular. While only a minority of the families surveyed had actually used the service, and while most of those were only occasional users, almost two-thirds of all households surveyed were willing to support city-wide Dial-A-Ride service with tax dollars.

8.3 TRIP PURPOSES

One question asked on the two on-board rider surveys was "What is the purpose of your trip today?" Figure 13 presents the responses to that question.

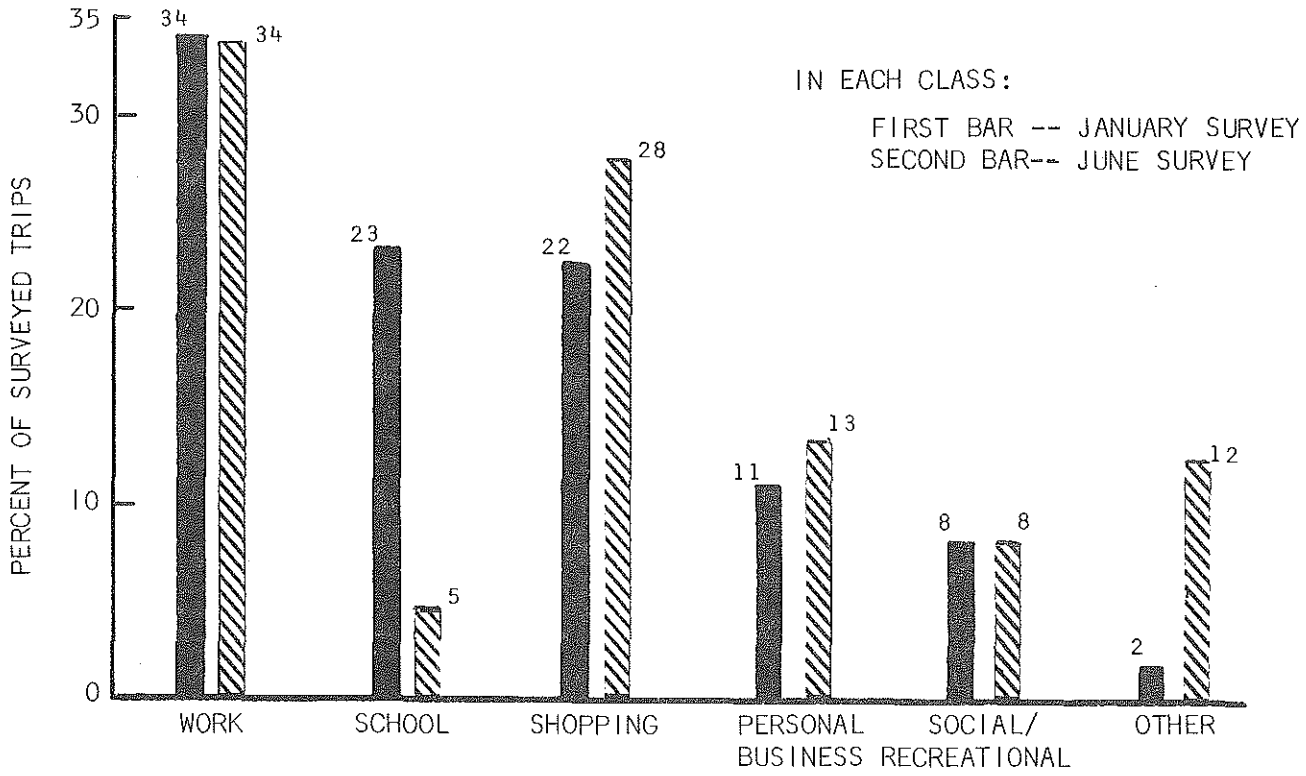


FIGURE 13 -- TRIP PURPOSES

Figure 13 shows that the most common use of Dial-A-Ride was for work trips, followed by shopping, personal business, and social and recreational travel. The first survey was taken during the peak season for school travel and showed almost a quarter of all passengers using Dial-A-Ride for travel to and from school, including the University of Michigan. The second survey, taken in early summer, showed a small residue of school trips from University and Slauson summer sessions, with a large increase in "other" trip purposes which may represent joy riding on the part of school-age children.

A similar survey of passengers on regular Ann Arbor bus lines conducted two years before the time of these Dial-A-Ride surveys revealed a somewhat different pattern of trip purposes. On a total ridership basis, projected to Spring 1972 by inclusion of the known changes in school contract riders, the regular bus line riders indicated the following trip purposes:

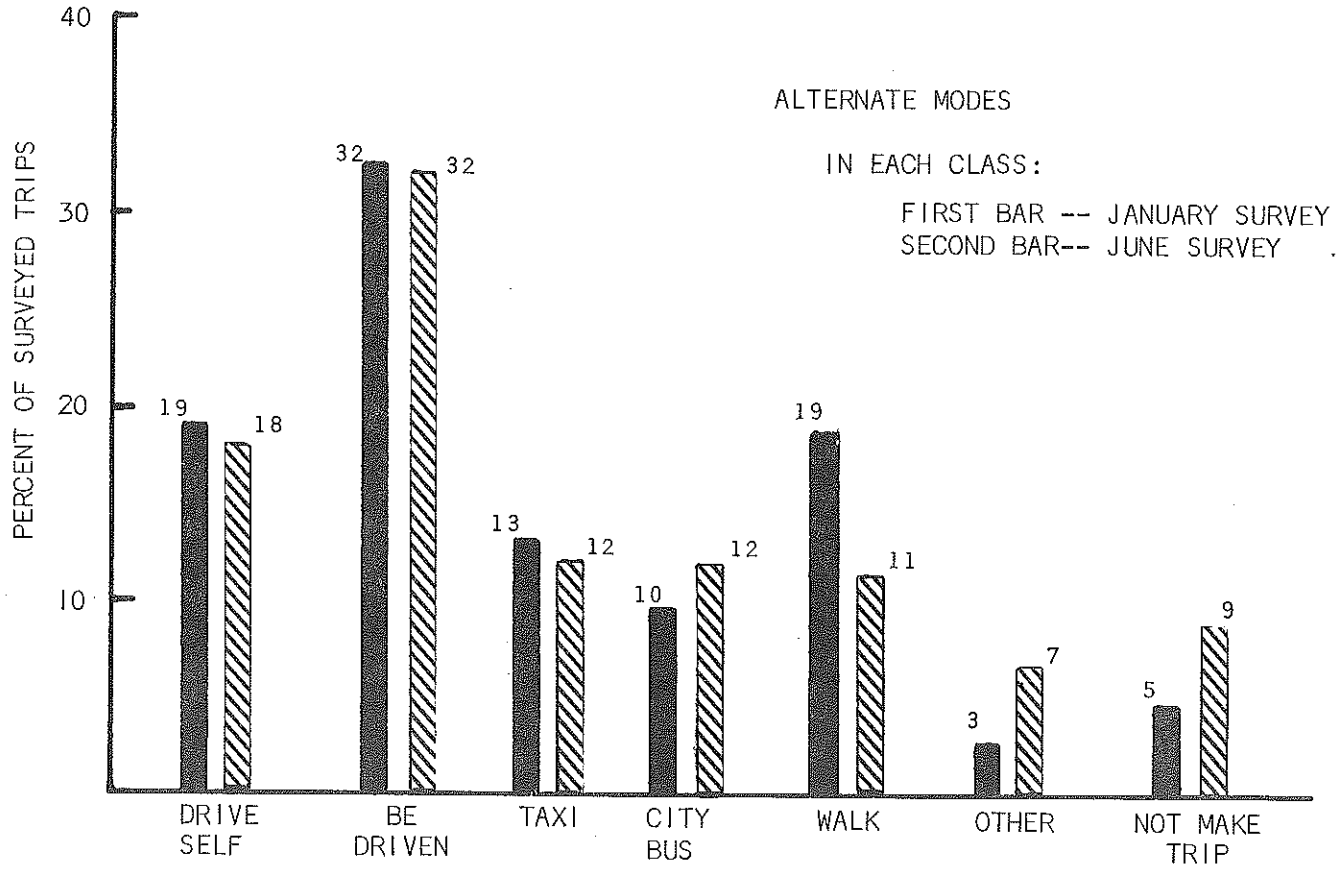
Work	46%
School	25%
Shopping	11%
Recreation	4%
Other	14%

Trip purposes for riders of regular bus lines

In comparison to the winter Dial-A-Ride results illustrated above, these figures indicate that only 29% of line bus riders versus 43% of Dial-A-Ride customers are traveling for purposes other than work or school, indicating a considerably greater proportion of non-routine trips on Dial-A-Ride.

8.4 ALTERNATE MODES AND ROUND TRIPS

During the on-board surveys, passengers were asked what other means (alternate mode) they would have used to make the trip they were currently making, if Dial-A-Ride had not been available. The top part of Figure 14 shows their



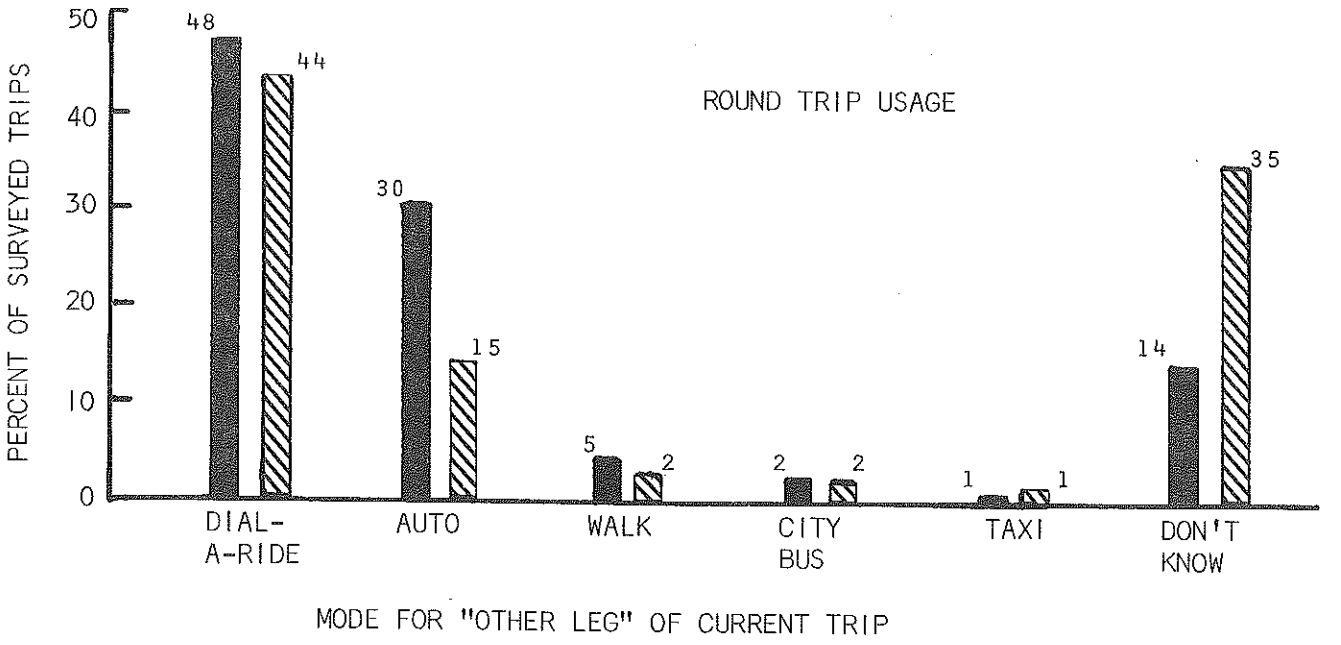


FIGURE 14 -- ALTERNATE MODES AND ROUND TRIP USAGE

responses in the two surveys, from which the most important result is that almost exactly 50% of the passengers would have traveled by automobile, either driving themselves or riding as passengers in a car. Approximately 23% would have ridden either in a regular city bus or a taxi (with about an equal number using each of those modes), about 20% would have walked or used some other means, and about 7% would not have been able to travel at all without Dial-A-Ride.

A rough calculation of the implications of these results (assuming that of those who indicated they would otherwise be passengers in a car, half would have been chauffered in a car that would make a round trip to serve their one-way travel, and half would merely have caught a ride in a car that would have made a trip anyway) indicates a net reduction of vehicle traffic in and out of the service area (cars that would have traveled minus Dial-A-Ride vehicle trips) of approximately 50 vehicle trips per day at a weekday ridership level of 200 per day. This represents a negligible (less than 1%) net impact on area traffic volume for the pilot system.

A cross-tabulation between trip purposes and alternate modes (Table 11) reveals that for any trip purpose, at least 42% of passengers would have traveled by automobile in the absence of Dial-A-Ride, and that approximately 13% of all shopping trips served would not have been made if Dial-A-Ride had not been available.

The on-board surveys also asked of those passengers making a round trip what means of transportation they had used or were expecting to use for the other leg of their journey; their responses comprise the lower part of Figure 14. The second (summer) survey showed a very high number of unspecified or "don't know"

TABLE 11

ALTERNATE MODES VS. TRIP PURPOSES

(From summer on-board survey; percentage of those traveling for each trip purpose who would have used the alternate mode listed in the absence of Dial-A-Ride service, to nearest whole percent.)

Trip Purpose	Alternate Mode: Total Auto	Taxi	City Bus	Walk	Other	Not Make Trip
Work	49	13	13	12	8	4
School	42	0	8	17	25	8
Shopping	48	13	15	6	4	13
Personal Business	45	18	12	18	0	6
Social or Recreational	70	0	0	10	10	10
Other	51	10	10	13	3	13

responses, but in both surveys it was clear that somewhat over half of the passengers would or did not use Dial-A-Ride both ways. Travel by car was the most common mode other than Dial-A-Ride for the "other leg."

8.5 RATING OF SERVICE

Three surveying methods were used to determine riders' response to the quality of Dial-A-Ride service. In one instance, riders were directly asked to check their opinions on a set of rating scales on a printed questionnaire during their ride. In the second case, several samples of both users and non-users were asked what change in the service would most strongly induce them

to use it more frequently, thereby gaining a measure of customers' perceived difficulties in traveling on Dial-A-Ride. In the third method, customers were asked during a telephone survey to express their complaints.

Direct questioning of riders while in transit is likely to lead to misleadingly favorable responses. Not only is a sample of actual riders at any given time naturally biased, (those who have been dissatisfied will probably not be riding), but embarrasment, haste, and a feeling that Dial-A-Ride is somehow a "good thing" that should be encouraged could be expected to produce disproportionately positive replies. Whether disproportionate or not, the results of these survey questions were indeed highly favorable. On a scale of zero to five, with number five representing the most favorable rating possible, between 72% and 90% of passengers rated the service either "4" or "5" in the four service factors: convenience of use, dependability, dispatcher-driver courtesy, and vehicle comfort and appearance. Only dependability resulted in a non-negligible "zero" response, with 3% of passengers calling service "very unreliable." Figure 15 provides a graphic summary of these results.

The second, indirect approach to customer response consisted of various questions, phrased both positively and negatively but covering approximately the same range of possible service improvements and, conversely, perceived service deficiencies. These results are likely to give a more candid picture of public reaction to Dial-A-Ride service and are summarized in Table 12.

Three conclusions may be drawn from Table 12:

1. Dial-A-Ride users are most sensitive to waiting time and its reliable estimation. This is in accord with the dispatcher's subjective observation and represents an important point for service refinement.

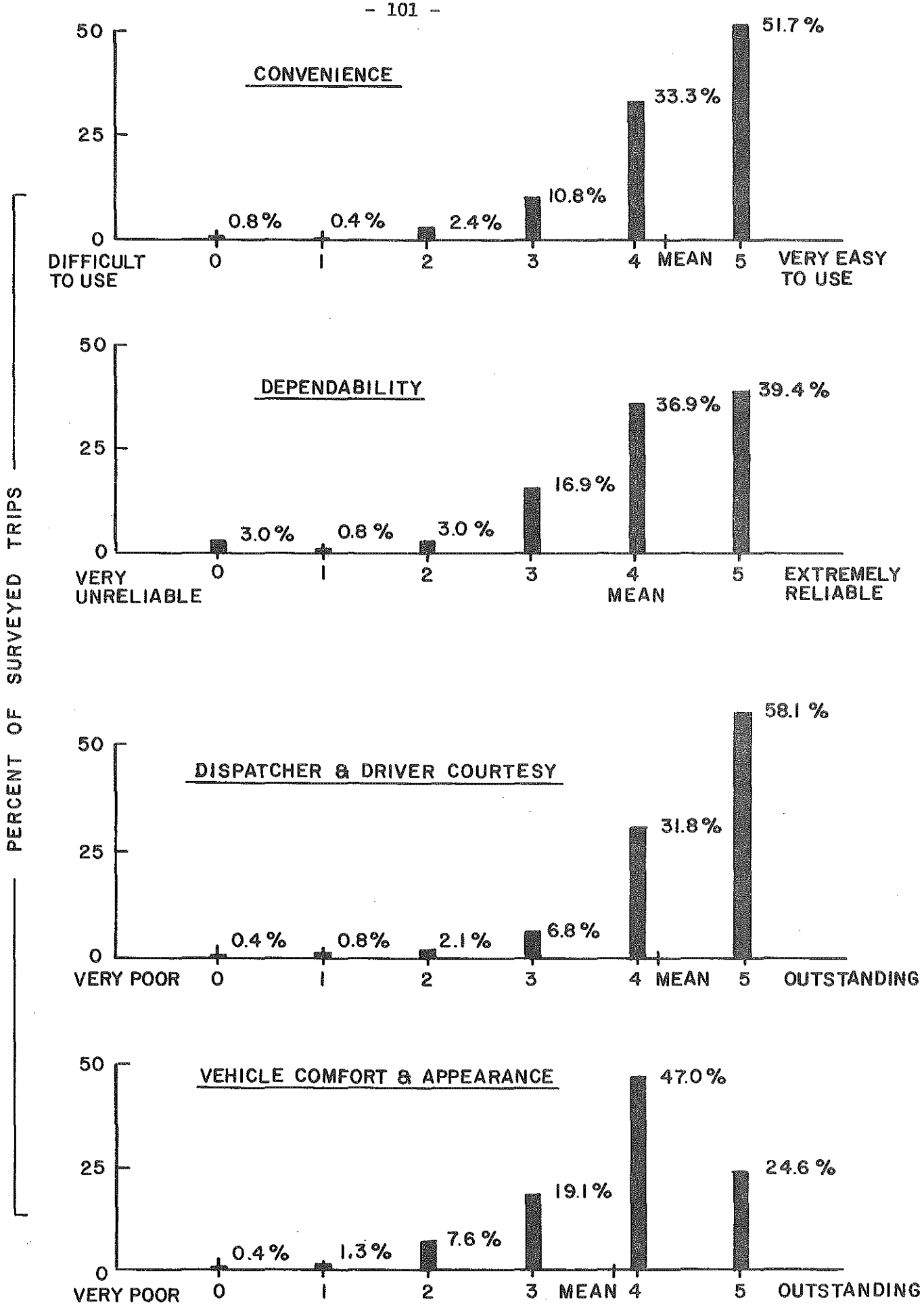


FIGURE 15 -- DIRECT RATING OF SERVICE

TABLE 12

DESIRED SERVICE IMPROVEMENTS

Sample:	Jan. 1972 On-Board Survey 100% Users	June 1972 On-Board Survey 100% Users	Feb. 1972 Telephone Survey 52% Current users, 48% no longer users	Dec. 1971 Home Interview Survey Users	Non-users
Total Sample Size	298	248	102	204	463
Respondents on this Issue (% of Total Sample)	85.5%	83.1%	35.3%	54.5%	21.4%
What Improvement Would Make Me Use Dial-A-Ride More?	**Percentage of Respondents Desiring Improvement:**				
Shorter wait times and/or more accurate wait time prediction	38.0%	36.6%	19.5%	- not asked -	
More available destinations	22.2%	20.3%	25.0%	62.2%	49.5%
Lower fare and/or change made on bus	23.2%	19.8%	11.1%	18.0%	12.1%
Shorter ride time	10.9%	9.8%	11.1%	- not asked -	
Extended service hours	- not asked -		8.3%	9.9%	11.1%
Other factors	5.7%	13.5%	13.9%	0.9%	13.2%

2. Non-users, and a significant number of users as well, would most like to be able to travel to a greater number of places than the downtown area served. Expansion to a city-wide system should induce added Dial-A-Ride usage in the area already served by the limited system.
3. Although users indicated some preference for a lower fare, non-users did not indicate that a lower fare would greatly induce them to ride. From this it follows that large numbers of potential riders were not being kept off Dial-A-Ride by its higher fare relative to line route buses.

A telephone survey in part designed to identify areas of customer dissatisfaction was carried out midway in the project (Table 13). Trained interviewers asked 102 persons who had used Dial-A-Ride infrequently but at least once: "What particular aspect of Dial-A-Ride service did you find unsatisfactory?" Of the responses, 82 (80.5%) indicated that they found nothing unsatisfactory. The remaining 20 (19.5%) had the following complaints (22 mentions from 20 replies), here reproduced to give the tone and variety of negative responses.

Waiting time is again identified from these responses as the single most important point of desired improvement in customer service. (See Chapter 9 of this report for quantitative information on wait times.)

In general, it has been rather difficult to elicit negative rider responses to Dial-A-Ride service in Ann Arbor. Those who have used the service seem to regard it as a kind of "discount taxi" operation, and some first-time users have had unrealistic expectations for response times as a result of that image. However, it has been gratifying to the project staff to observe how quickly most riders have come to realize and accept the limitations inherent in a small shared-ride system, and how pleased the majority are with the service.

TABLE 13

NEGATIVE USER RESPONSES

General Category	Specific Response	
"Waiting Time"	Waiting time for home pickup too long	- 4 responses
	Waiting time for return pickup too long	- 3 responses
"Return Trip Convenience"	Bus passed me, had to wait for another	- 1 response
	Want more downtown stops-cannot always hail down bus on loop	- 1 response
	Telephone inconvenient to pickup point for return trip	- 1 response
	Confused regular city bus with Dial-A-Ride vehicle	- 1 response
"Fare"	Fare too high	- 2 responses
	Exact change inconvenient	- 2 responses
"Riding Time"	Dislike detouring to pickup others, expressed objection to riding through certain neighborhoods	- 1 response
	Riding time too long (one mention of late arrival at destination)	- 3 responses
"Other"	Doesn't cover enough area	- 1 response
	Did not drop children exactly in front of destination-had to cross busy street	- 1 response
	Radio on bus failed, resulting in some (unspecified) inconvenience	- 1 response

8.6 THE OCCASIONAL USER

Survey results establish that most Ann Arbor Dial-A-Ride users have not been regular riders. The two on-board surveys included a question concerning frequency of use, for which the responses are tabulated in Table 14.

This tabulation does not include corrections for sampling error. In two surveys, each covering three days, a large number of Dial-A-Ride users who ride only infrequently could have been missed because they did not ride at all

TABLE 14

RIDER FREQUENCY OF DIAL-A-RIDE USE: SURVEY RESPONSES

Survey Time	Everyday	At Least Once/ Week	Occasionally Once or Twice Per Month	First Time
January	30.8%	27.5%	27.9%	13.8%
June	16.8%	29.1%	32.0%	22.2%

during the survey period. Given plausible assumptions about how the frequency of use is distributed within the survey classes above, the raw survey data can be combined with ridership information to give a more nearly true picture of how often people use Dial-A-Ride in Ann Arbor. A number of such calculations were made, embodying different assumptions in detail, but all giving results within the same range:

A. The total number of individuals who use Dial-A-Ride at least once a month is 800-1100.

B. Of these:

1. Approximately 100 (60 in summer) are everyday users,
2. Approximately 120 (perhaps as many as 200) ride at least once a week but not every day,
3. The remaining 600-900 are very infrequent users, riding less often than once a week.

If we call persons who travel at least once a week on Dial-A-Ride "regular" customers and those who travel less frequently "occasional" riders, then of all the people who use the service in a month, only 20%-30% are regular customers and 70%-80% are occasional. It should be noted that with this definition even a "regular" customer might be riding only once a week.

On any given day, regular customers comprise a much larger percentage of the ridership total than these figures would suggest, because only a few of the much larger number of occasional riders are traveling that day. A rough breakdown of the daily passenger ridership count reveals about 50% everyday riders, 30% once-or-more-a week riders, and 20% less-than-once-a-week riders.

The vast majority of service area residents who have tried Dial-A-Ride use it very infrequently. On-board survey evidence has not produced any significant indication of dissatisfaction with the service. (Section 8.5) However, the question remains as to why so many persons have not used Dial-A-Ride more frequently.

The project consultants carried out a telephone survey of a sample of the households who had used Dial-A-Ride only once or twice during a two-month period in order to test the hypothesis that there was some aspect of the service that was totally unsatisfactory to these persons; i.e., that they found their first or second experience with Dial-A-Ride so bad that they would never try it again.

The hypothesis as stated above was not supported. Only 3.9% of the survey respondents could be categorized as "turned off" toward Dial-A-Ride. A majority of the respondents had used Dial-A-Ride again since the last posting of the household file, and 8.8% had become regular users. Just over half were in the "generally satisfied, will use again on occasion" category. A somewhat smaller category (34.3%) were even more indifferent toward Dial-A-Ride service. They were so completely satisfied with the transportation available with their own automobiles that they either perceived absolutely no need to use Dial-A-Ride again (18.6%) or felt that they would use it only under extreme circumstances (15.7%). Typical comments from this group:

"We only used Dial-A-Ride once, because we didn't want to park downtown on Saturday morning. We wanted to try out the service, as we had heard so much about it. It was excellent but we have no need for regular use."

"We only used Dial-A-Ride because our car had a flat tire. Dial-A-Ride was very punctual; we got to home within seven minutes."

These results suggest that most families in the service area view Dial-A-Ride as a backup or secondary mode of transportation, to be used only in rare cases where the auto is not available or inconvenient. There is no evidence that poor service is responsible for the relative infrequency or most families' use of Dial-A-Ride.

Tables 15 and 16 present cross tabulations among frequency of use, cars per household, trip purposes, and alternate modes which clarify some of the factors related to the use of Dial-A-Ride as a generally secondary mode of transportation.

These cross-tabulations are from the summer survey only; cross-tabulations for the winter survey are not available.

TABLE 15

FREQUENCY OF USE VS. CARS PER HOUSEHOLD

Percentage of those in each frequency of use class who come from households with the given number of cars available, to nearest whole percent:

Frequency of Use	Cars per Household: 0	1	2 or more
Every day	18%	53%	29%
At least once/week	24%	31%	44%
Once or twice a month	12%	35%	53%
All Riders	19%	40%	41%

TABLE 16

CARS PER HOUSEHOLD VS. TRIP PURPOSES AND ALTERNATE MODES

Percentage of riders from households with zero, one, or two or more cars available who (A) were traveling for the listed purpose, and (B) would have traveled by the listed alternate mode in the absence of Dial-A-Ride, to the nearest whole percent:

A. Trip Purpose

Cars Available in Household	Work	School	Shopping	Personal Business	Social or Recreational	Other
0	37	4	28	17	4	9
1	42	4	26	8	9	10
2+	25	6	30	15	7	16

B. Alternate Mode

Cars Available in Household	Auto	Taxi	City Bus	Walk	Other	Not Make Trip
0	24*	22	28	11	11	4
1	51	10	10	12	5	13
2+	60	9	6	11	6	7

*all listed as riding in another's car

Inspection of Table 15 reveals that riders from households with two or more cars were more than proportionately occasional riders, and less than proportionately everyday riders, although the effect is not outstanding. Interestingly, a slight majority of every day riders were from one-car households, more than the portion of all riders from such families. Finally, riders from zero-car households (38% of whom were senior citizens, from

another cross-tabulation) tended to ride modally* once or more a week, but not every day as might be expected.

Table 16 reveals no striking differences in trip purposes for different household classes, but a rather strong differential preference in alternate mode. The regular city bus would have been the travel mode for 28% of riders from zero-car households, but only for 6% of riders from households with two or more cars. Conversely, 60% of those from multiple-car households would have ridden by car, but only 24% of those without cars would have been able to catch rides in another's car.

*51% of riders from zero-car households, excluding first-time riders, characterized themselves as riding once or more a week, but not every day.

CHAPTER 9

SYSTEM PERFORMANCE

This chapter contains several sections which jointly evaluate the technical performance of the Ann Arbor Dial-A-Ride pilot project. Included are an analysis of the level of service given system riders and discussions of system efficiency as revealed by productivity, system capacity, and vehicle performance under the special conditions of Dial-A-Ride usage.

9.1 WAITING AND RIDING TIMES

Passenger satisfaction with Dial-A-Ride is very directly related to meeting the public's expectations for waiting and riding times. Based on measured service times for 1223 trips (2.4% of total trips during project year) during six intensive monitoring periods, the average customer waiting time for Ann Arbor Dial-A-Ride was 10.8 minutes from time of telephone call until vehicle arrival. Including advance reservations for pick up and hail stops, the overall average waiting time was 8.55 minutes. Average riding time was 12.6 minutes (average trip length was approximately 2 miles), for an overall average total travel (wait plus ride) time of 21.2 minutes from time of call until arrival at destination. These times are clearly acceptable, and compare favorably with regular line bus riding times. However, averages do not tell the whole story, and it is desirable to analyze waiting and riding times from several standpoints.

In general, the level of service for public transportation is stated as a ratio of total travel times, the standard usually being direct driving time (which includes walk time at the destination). The average total travel time for fixed-route service from the service area to downtown is 35 minutes -

15-minute wait, 13-minute ride, and 7 minutes total for walking on the two ends of the ride. A comparable time for automobile trips is 15 minutes - 10-minute drive and 5-minute walk. Thus, the level of service ratio (travel time by public transportation divided by travel time by automobile) for fixed-route service is 2.3. Total average peak-hour travel time for Dial-A-Ride access to downtown is 24 minutes - 8-minute wait, 14-minute ride, and 2 minutes for walking at the destination, giving a level of service ratio of 1.6. Thus, the Dial-A-Ride level of service is superior to that provided by the conventional fixed-route service and compares favorably with automobile access time.

9.1.1 Sampling Method

Waiting and riding (i.e., service) times were measured for all trips on each of ten days during the pilot project, resulting in a total sample of 2.4% of all Dial-A-Ride trips made in the project year. The time at which a call is received in the dispatch center was recorded on the dispatch log or in the case of a standing order (regular pick up everyday at the same time) or time call (request for pick up at a specific later time), the requested pick up time was recorded. These service demands were transmitted via two-way radio to the drivers of the vehicles, who in turn recorded their individual assignments on a driver's log. When a pick up was made, the driver recorded the time (synchronized with the clock in the dispatch center) on his log. The same was done for drop offs. These times were later transferred to the dispatch log, and the appropriate subtractions made. A degradation of service on the order of five to fifteen seconds per stop was caused by the process of measurement in a few cases; however, most of the times were recorded while the passenger was boarding or leaving the bus.

In subsequent analysis of service time data, two independent tabulations of waiting time were made: one including those values recorded

as zero, and one excluding those values. Zero waiting times were recorded for:

1. Standing orders and time calls picked up ahead of time or on-time.
2. Passengers boarding at intown stops who did not telephone in. This category is particularly important in evening outbound service. Passengers walking to a regular stop and seeing others waiting for Dial-A-Ride often would not bother to call.
3. Hail-stop passengers.

Subsequent analysis of mean values and standard deviations in this report includes both waiting time tabulations. Waiting times including zero values are the best measure of overall system performance, but those excluding zero values are the truest measure of waiting times for customers who call for the next available vehicle. These mean values are a slight under statement of true waiting times, because the zero waiting times recorded for passengers in number (2) above must in reality have been some finite length of time, and because instances did occur (but very rarely) when passengers were not found when a vehicle arrived, and had apparently "given up" because of an unduly long wait.

9.1.2 Stratification of Sample by Non-Home Trip End

The range of available Dial-A-Ride trip destinations was discussed in Section 4.2. Because these destinations vary in location with respect to the service area, it is informative to stratify service times by non-home trip end, as tabulated in Table 17.

TABLE 17

MEAN SERVICE TIMES BY NON-HOME TRIP ENDS
(all values in minutes)

Non-Home Trip End	Waiting Time Including Zero Values			Waiting Time Excluding Zero Values			Riding Time		
	No. of Observations	Mean	Std. Deviation	No. of Observations	Mean	Std. Deviation	No. of Observations	Mean	Std. Deviation
Downtown Loop	765	8.75	7.37	647	10.35	6.91	765	12.08	5.10
Hospitals and University	241	9.89	8.19	212	11.25	7.81	241	14.88	5.47
Slauson Junior High School	151	4.06	6.97	50	12.26	6.78	151	13.80	5.57
Westgate/ Maple Village	20	24.50	22.06	Insufficient Data			20	9.20	3.44
Intra-Service Area & In-town Circulation	46	5.85	6.15	34	7.91	5.89	46	6.15	3.02
Average All Services	1223	8.55	8.33	960	10.79	7.53	1223	12.58	5.44

Inspection of Table 17 leads to the following observations:

1. Although mean values are low, standard deviations of waiting times for all services are quite high. Section 9.1.3 below contains a detailed discussion of the implications of this result.

. Downtown loop passengers received somewhat better service than hospital/university passengers: This is logical because the distances are greater to the hospital/university stops, both to send empty vehicles for pick-up and actually to carry passengers.

. Waiting time (including zero values) for passengers to Slauson Junior High School is exceptionally low. This reflects the high proportion on on-time pickups in the semi-scheduled subscription service that was the predominant mode of travel to that destination.

. Westgate/Maple Village passengers waited much longer than either intown or hospital/university passengers, but had shorter rides. The net result was a mean travel time some 12 minutes longer than the average for all passengers.

. Intra-area and circulation passengers received excellent service.

A complete summary of the methods and results of service time analysis comprises Appendix D.

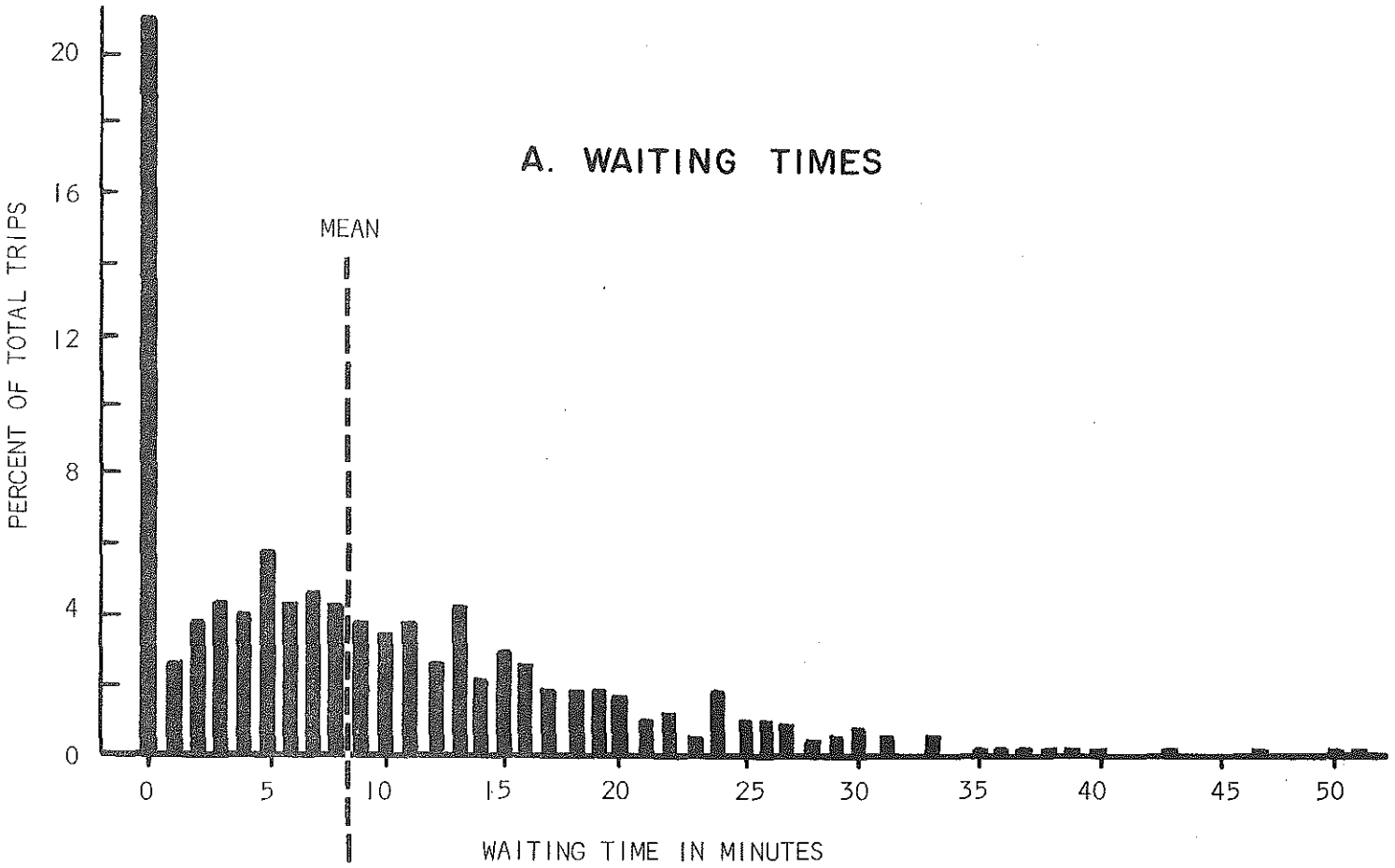
9.1.3 Distribution of Waiting and Riding Times

One of the most important factors in public acceptance of a demand-responsive service such as Dial-A-Ride is the reliability of vehicle arrival within a reasonable time from the request for service. The crucial factor

is not so much the average time required, but the maximum time encountered. Customers can usually compensate for whatever average time is expected to elapse before their pickup by calling somewhat in advance of the time they actually need to leave, but if they find that their pickup is often much later than expected, they will understandably become discouraged. Waiting time has been observed to be a more sensitive issue than riding time in rider satisfaction.

The only available statistical measure of variability of waiting times is their distribution around the mean value. Only part of the distribution in waiting times can be identified as uncertainty or unreliability in vehicle arrival times for a specific service request; a large portion of the indicated variability arises from unavoidable delays at high-demand times, and deliberate assignment of certain kinds of trips to lower priority, understood as such by the customer. These latter reasons result in much less rider dissatisfaction.

The standard deviations shown in Table 17 are an indication that the variability of riding time was moderate, but that waiting time variance was quite high. If the distributions of waiting and riding times were "normal" in the statistical sense, i.e., symmetric about their means in a simple fashion, twice the standard deviation could be used as an approximate upper limit for the times in each case. However, analysis has revealed the distributions of waiting and riding times are <u>not</u> normally distributed but rather are chi-squared distributions skewed to the right. The histograms of Figure 16 show the actual distributions for the total sample. Note that in a right-skewed distribution such as those shown, the mean value is lower than it would be for a normal distribution, but that simultaneously a few observations have large values. Service times stratified by destination, direction of travel, and observation period during the project all show similar distributions.



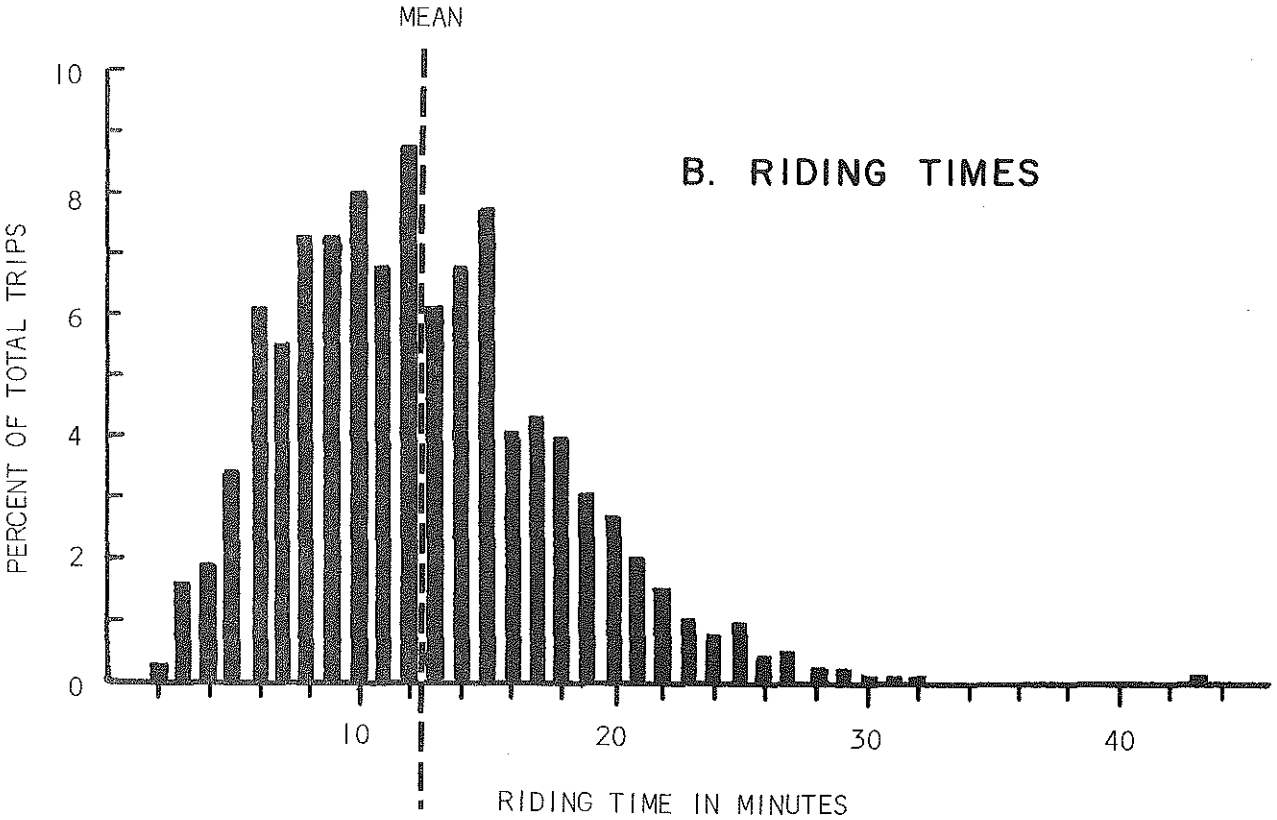


FIGURE 16 -- DISTRIBUTIONS OF WAITING AND RIDING TIMES

Examination of the histograms in Figure 16 reveals that 98% of all waiting times were less than 28 minutes and 98% of all riding times were less than 26 minutes. Since the combination of a maximum waiting time and a maximum riding time for any given ride was highly unlikely, more than 98% of all trips were completed (telephone call to arrival at destination) in less than 54 minutes. The variation in riding times is almost entirely due to different distances and passenger loads.

Project personnel observed that passengers desired maximum waiting time was approximately 20 minutes; 93.3% of all waiting times were less than this threshold. Since waiting and riding times in a demand-responsive system are true random variables within some distribution, depending on the system load at a given time, a number analagous to "per cent on time" cannot be developed. However, the mean and 98th percentile waiting times for Ann Arbor Dial-A-Ride of less than 11 and 28 minutes respectively compare favorably with taxi service and with Dial-A-Ride systems in operation elsewhere.

9.14 Stratification by Direction of Travel

For downtown and hospital/university trips, an analysis by travel direction for the entire sample resulted in the following service times:

TABLE 18

EFFECT OF TRAVEL DIRECTION ON WAITING AND RIDING TIMES

	Inbound (Service Area to Downtown & Hospital/University)		Outbound (Downtown & Hospital/University to Service Area)	
	Mean	Std. Deviation	Mean	Std. Deviation
Wait Time (zero values included)	9.53	7.76	7.16	7.44
Ride Time	12.76	5.01	13.02	5.72
Total Travel Time	22.39	NA	20.18	NA

Shorter waiting times for outbound trips reflect the large number of walkup passengers who do not telephone in the evening rush hour. The difference in riding times is not statistically significant. Standard deviations were essentially identical by direction.

9.1.5 Stratification by Sample Period

Samples of waiting and riding times were taken over the duration of the project, with significant differences showing in some of the sample periods as follows:

TABLE 19

WAITING AND RIDING TIMES BY OBSERVATION PERIOD

Observation Period	Mean Wait Times (Zero Values Included)	Mean Ride Time	Number of Passengers Carried in Observation Period
October 15 & 19, 1971	6.2	11.0	277 (138/day)
December 10, 1971	10.7	16.6	209
February 18, 1972	8.0	13.5	209
May 30, 1972	7.0	12.9	176
June 1, 6, & 7, 1972	9.0	12.6	568 (189/day)
August 30 & 31, 1972	10.0	11.9	297 (149/day)

Examination of Table 19 reveals that riding times have generally improved gradually over the course of the project, while waiting times have changed little. Noteworthy is a comparison between the mean times for December and February for the same daily passenger load. The considerable decrease in service times is probably traceable to improved dispatcher and driver skill at handling heavier winter travel demands. Service time improvements with decreasing summertime passenger loads were mostly unrealized because less direct trip patterns tied up vehicles that could otherwise

have serviced inbound-outbound demand (see Section 5.2).

9.1.6 Comparison with Predicted Performance

The mean service times shown in Tables 17-19 are clearly acceptable, averaging 10 minutes or less waiting, about 13 minutes riding, and 23 minutes total. A theoretical system performance model used in system design predicted total times in the range of 15-29 minutes for downtown loop service, depending on demand, and successfully predicted that inbound service times would exceed outbound.

9.1.7 Dwell Times

System riders have a direct impact on service times through the time they take to respond to a vehicle arrival at their homes. "Dwell time" is the time interval elapsed while the vehicle is stationary, waiting for passengers to board or disembark. Wide variations in dwell time can result from problem passengers (although the elderly should naturally be allowed extra time for boarding). Dwell times were measured on a few sample days, resulting in:

Mean Dwell Time, Pick Up	0.51 minutes
Mean Dwell Time, Drop Off	0.15 minutes

The time a passenger takes to appear at his or her door after a vehicle arrives is the major component of the difference between inbound and outbound service times.

9.2 PRODUCTIVITY

Productivity, defined as passengers carried per vehicle hour or a related measure, is the key system variable relating farebox revenues (or social transportation benefits) to operating costs, and is thus a primary measure of system cost-effectiveness or efficiency. Dial-A-Ride systems in general can be expected to have lower productivity than

optimally-utilized line haul transit, as a direct result of the smaller vehicles used and more circuitous routing necessary in doorstep service. Productivity is affected by nearly every system performance variable.

Over the 12-month duration of the pilot project, the average productivity was:

Passengers per vehicle hour	6.04
Passengers per driver hour	5.26
Passengers per labor hour (includes dispatching)	3.78

The values for passengers per driver hour and per total labor hour are smaller than that for passengers per vehicle hour because of driver lunch breaks and show-up times, and because of dispatcher labor. All further productivity figures will be given as passengers per vehicle hour. Average weekday productivity was 6.28; the Saturday average was 5.13. Productivity was highest during winter (high ridership), with a peak average weekday value of 8.25 for January 17-21, 1972; the lowest average weekday productivity other than during startup was 4.57, for July 3-7, 1972. Average weekday productivity for each week during the project is shown in Appendix H. Table 20 shows the average weekday productivity for each month during the project.

TABLE 20

AVERAGE WEEKDAY PRODUCTIVITY BY MONTH

Month	Weekday Passengers/ Vehicle Hour	Month	Weekday Passengers/ Vehicle Hour
Sept-Oct. 1971	4.24	Apr. 1972	6.79
Nov. 1971	6.13	May 1972	6.51
Dec. 1971	6.68	June 1972	5.79
Jan. 1972	7.67	July 1972	5.24
Feb. 1972	7.69	Aug. 1972	5.16
Mar. 1972	7.43	Sept. 1972 (partial)	6.83

Productivity reaches much higher levels than these average figures on busy weekdays and during peak hours. Table 21 illustrates hourly productivity during a typical December day.

TABLE 21

TYPICAL HOURLY PRODUCTIVITY, WINTER

Time (24 Hour Basis)	Demands (Incoming Calls & Advance Orders Coming Due	Demands Per Hour	Number of Vehicles In Service	Productivity: Demands Per Vehicle Hour (3)
0630-0700	3	6	1	6.00
0700-0830	38	25.3	3	8.44
0830-1030	23	11.5	2	5.75
1030-1100	14	28 (1)	2	14.00
1100-1300	19	9.5	2 (2)	4.75
1300-1330	16	32 (1)	2	16.00
1330 1430	11	11	2 (2)	5.50
1430 1500	16	32 (1)	3	10.67
1500 1630	29	19.3	3	6.44
1630 1800	39	26	3	8.67

Notes:

(1) These sharp mid-day surges in demand are caused by Slauson School shift changes.

(2) During these periods, drivers may take lunch breaks, such that the actual number of vehicles available is not two for the entire time period.

(3) Because of some multiple passengers per demand, passengers/vehicle hour would be slightly above these figures.

The discussion of system capacity in Section 9.3 below results in a figure of 40-45 demands/hour for the three-vehicle system, which translates to an attainable sustained productivity of 14-16 passengers/vehicle hour. Note that at peak times shown in Table 18, productivity attained that level. As the system approaches capacity ridership, productivity naturally increases significantly. Table 22 illustrates the effect on productivity measures of the "free day" on May 1, 1972.

TABLE 22

PRODUCTIVITY FOR HIGH AND LOW RIDERSHIP
"Free Day" Compared with Two Normal Days of Operation the Same Week

	"Free Day"	May 3, 1972	May 5, 1972
Total Passengers	390	181	169
Passenger/Vehicle Hour	10.96	6.22	5.99
Passenger/Driver Hour	10.29	5.64	5.36
Passenger/Labor Hour	8.41	4.10	3.88

Productivity in a many-to-one or many-to-few demand-responsive system can be crucially dependent on the time needed for the express run from the service area to the destination or destinations served. Subscription or semi-subscription service over short-to-moderate distances can result in considerably higher productivities than attained in normal operation. The dedicated runs to and from Slauson Junior High School during the pilot project routinely attained productivity levels of 25 passengers per vehicle hour for the vehicle involved, a direct result of the shorter travel time between the service area and Slauson as compared to the downtown area.

9.3 ULTIMATE CAPACITY

The ultimate daily trip-serving capacity for the Ann Arbor Dial-A-Ride system was never reached during the course of the pilot project,

although on one extraordinary day it was probably approached. A system design model predicted a total capacity of 50-60 demands per hour for reasonable service times. Over the 11-1/2 hours of weekday operation, allowing for fewer than the maximum number of vehicles during early morning startup, this would indicate an ultimate capacity in excess of 500 demands per day, or approximately 550 riders per day, allowing for multiple riders for some demands. As discussed below, this is undoubtedly an optimistic estimate.

A second, empirical approach to the question of ultimate capacity was developed by the project consultants through an analysis of tour times. A linear regression for vehicle tour times in sample days as a function of the number of inbound and outbound passengers resulted in the equation:

$$\text{Tour Time} = 25.36 + 3.17\ N_I + 2.15\ N_o$$

where N_I = number of inbound stops, N_o = number of outbound stops, and times are measured in minutes.

This equation can be used to predict demand service capacity of approximately 13 demands/vehicle hour, which can then be multiplied by the 32 vehicle hours in three-vehicle weekday service to yield an empirical system capacity of 416 demands/day; or again allowing for multiple riders per stop, approximately 450 rides/day. This empirical projection of total system capacity is considerably lower than the theoretical projection above primarily because it is based on the actual demand density* experienced, whereas the theoretical prediction is based on a considerably higher demand density estimate. Actual demand densities registered during the pilot project have ranged from 6 demands per hour per square mile at summer low ridership levels to a high of 13.5 demands per hour per square mile on peak winter days. The demand densities

*Demand density is defined as the number of service requests per square mile per hour. It is a measure of how closely together stops are spaced. If stops are more tightly grouped, vehicle productivity will be higher and thus system capacity will be greater.

assumed in the (theoretical) system design model were 20-40 demands per hour per square mile.

A review of operations during the "free day" suggests that the ultimate capacity for the system, especially vehicle operating capacity, was approached during the afternoon hours, and that the realistic ultimate capacity for Ann Arbor Dial-A-Ride as installed is somewhat over 400 passengers per day, with the part-time aid of a fourth vehicle during peak times. This allows for unavoidable variations in demand, resulting in some under-capacity operation at times. In operations continued beyond the closing date of the pilot project (November, 1972), loads in the neighborhood of 320 passengers per day have been carried with some frequency.

In drawing conclusions about Dial-A-Ride system capacity, it is important to distinguish between the demand-handling capacity of the dispatching system and the actual passenger-carrying capacity of the vehicles in operation. In Ann Arbor the dispatching capacity, for one dispatcher with occasional telephone-answering help, is considerably above the actual capacity of the vehicles to transport passengers. In normal operation, this excess dispatching ability has been "soaked up" in other tasks that have accrued to the dispatcher: answering lengthy information calls, giving information on line route schedules to other information calls, dispatch functions for the line route system, and miscellaneous office record-keeping that in a "pure" dispatch center would be done by other personnel. However, any estimate of dispatching capacity must allow time for handling emergencies and extraordinary peak demands which might appear to be "excess" during routine operation. The project consultants' best estimate for the ultimate capacity of a single dispatcher, with occasional telephone-answering help, responsible only for Dial-A-Ride operation, is approximately 600 demands per 12-hour operating day (50 demands/hour). This figure is applicable for the present mix of pre-booked

and real-time orders; a greater proportion of pre-booked calls for service would allow even greater capacity.

Passenger-handling capacity in vehicle operations is most importantly dependent on service area demand density: the greater the demand density, the higher the vehicle capacity per hour. Other system design variables can slso have an important effect, for example:

- vehicle size
- connectivity of service area street pattern
- traffic flow and congestion along connecting arteries
- handling of driver relief and lunch scheduling
- vehicle and radio reliability: frequency of on-the-road breakdowns

The empirical tour-time equation and operating experience during the "free day" indicate a practical passenger-carrying capacity for Ann Arbor Dial-A-Ride of slightly over 400 passengers per operating day, or approximately 40 demands per hour on a sustained basis.

9.4 VEHICLE USE

Over the one-year test period, a total of 102,075 vehicle miles were recorded. Approximately 85% of these were run on the three converted vans dedicated to Dial-A-Ride service, and 15% were run by the transit coach backup vehicles. This comes to an overall average of 1.99 miles per passenger.

A total of 8505.2 vehicle hours were recorded, and the average speed (total vehicle miles divided by total vehicle hours) was 12.0 mph. This average speed includes standby and break time, during which the vehicles were idle. Actual average speed of Dial-A-Ride vehicles while in service has been recorded at 14-16 mph*. During typical tours, maximum speeds of 35-40 mph were reached.

*One vehicle was fitted with a recording tachograph (speed-distance-time instrument). A great deal of raw data concerning speed and time in motion is available from the tachograph disks but has not yet been analyzed.

Vehicle operating costs were sampled and averaged $1.19 per hour for the three Dial-A-Ride vans; 25% of this cost is for fuel and lubricants, 45% for maintenance and repair parts and labor, and 30% for insurance. During the one year of operation, there was heavy maintenance work (brakes, transmission rebuild, differential rebuild) required; hence, this cost is a reasonable figure to use for vans in Dial-A-Ride service. Seasonal variations are also covered in the one-year test period. Section 6.3 contains a more detailed discussion of costs.

In-service failures of vehicles posed operational difficulties. When a spare vehicle had to be substituted during a regular run, passengers were inconvenienced and waiting customers were not picked up when promised. Problems of various sorts requiring on-the-road substitution of vehicles occurred 3 to 5 times a week throughout the project. Causes included minor accidents, running out of fuel, exhaust, gasoline, and battery fume leakage, brake problems, broken springs, and door operating mechanism failures. These in-service failures can be attributed to three reasons:

- Two of the three vehicles had over 40,000 miles at project startup and were two years old.
- A thorough preventive maintenance program for the vehicles was not implemented.
- Vans are basically autotive-type vehicles and are not specifically designed for the rigors of stop and go transit service.

Undoubtedly the Ann Arbor Dial-A-Ride pilot project would have run more smoothly with three all-new vehicles, built to Dial-A-Ride specifications. However, the available fleet allowed acceptable operations at a reasonable cost.

CHAPTER 10

CONCLUSIONS AND IMPLICATIONS

The Ann Arbor Dial-A-Ride pilot project has successfully met all of its objectives as stated in Section 2.1 above:

Objective: "Evaluate market response to doorstep public transportation service in selected neighborhoods, and demonstrate the economic feasibility of the new service concept, breaking ground for a larger system."

Market response has been excellent, although falling short of the initial goal of 300-420 demands per average weekday. It appears that the initial target calling for more than a 150% increase in total transit ridership was unrealistically high for the limited-destination one-year experiment in an area of such high auto availability. However, the project has demonstrated a 100% increase in total transit ridership at a premium fare, with continued ridership growth after a year of operation.

Most Dial-A-Ride passengers are apparently new users for any form of public transit in Ann Arbor; the system drew substantial ridership from the service area without significantly affecting ridership on the regular bus route through the area. Dial-A-Ride passengers appear to be "choice" rather than "captive" riders. Half of Dial-A-Ride passengers would have used automobiles for their trips if Dial-A-Ride had not been available.

The large majority of persons who use Dial-A-Ride are infrequent passengers, riding only a few times a month. Survey efforts specifically directed at this group have revealed that they are not dissatisfied with the service, but perceive it only as an auxiliary mode of transportation. Non-users and infrequent riders indicate that a greater number of destinations would be

the strongest inducement for them to ride more frequently; however, ridership statistics suggest that response to a few additional shopping destinations is small, but that a larger area for many-to-many service has been effective in eliciting additional demand. Serving a larger proportion of desired trip lines should increase demand density significantly.

Operating cost per ride for Dial-A-Ride is substantially greater than for a fixed-route system with reasonable utilization. Overall pilot project operating cost has been $1.74 per ride. If a higher demand density had been encountered -- a condition that seems likely in a system with greater coverage -- operation closer to system capacity would have resulted in a lower operating cost per ride. For example, a demand level of 300 rides per day (such as experienced in late 1972) would have resulted in an operating cost of approximately $1.10 per ride.

The small pilot system had some unavoidable excess dispatching capacity. Economies in spreading dispatcher labor over a greater number of vehicles and in operating refinements could reduce per-ride cost somewhat below $1.10 in a larger system, but it is unlikely that Dial-A-Ride or a Dial-A-Ride based system could ever operate at a cost per ride sufficiently low to be covered by an acceptable transit fare. High quality demand-responsive service comes at a higher cost and higher subsidy level than fixed-route service.

Objective: "Provide improved public transportation to particularly dependent segments of the community."

The Ann Arbor Dial-A-Ride pilot system served a largely affluent neighborhood.* A conspicuous exception was service to two high-density senior citizens' residences. Riders 65 years of age or older constituted 10.8% of

*The first proposal for a Dial-A-Ride pilot application (June, 1970) in Ann Arbor was for service to the Model Neighborhood, but it was never implemented.

those surveyed in June, 1972, and persons from households with no cars available were found in higher proportion among Dial-A-Ride patrons than the total service area population. Persons under 18 years of age comprised about 38% of riders served.

Objective: "Address operating and management issues for implementation of a new system."

Dial-A-Ride operations have been integrated smoothly into the existing Authority service, and system personnel have performed well at all levels. Experience gained has been invaluable in planning an expanded system, and the relevant system performance variables have been identified for continuing evaluation and adjustment.

Demand-responsive operations require a high level of system coordination and management flexibility. An upgraded marketing effort, using the opportunities for wider media coverage in a city-wide system, should be adequately staffed and funded in any expanded system. An improved vehicle maintenance procedure has also been determined to be an important element of a new system design.

Objective: "Test dynamic dispatching."

Manual dynamic dispatching has been demonstrated to be fully feasible, and has resulted in an acceptable level of service to the public. Average waiting time has been about 10 minutes, and riding time has averaged about 13 minutes. The system has worked: no obvious "weak links" have appeared, and the dispatching system has shown substantial reserve capacity with little deterioration of service, even while handling extra dispatch functions for the line route system which were not originally expected. Five individuals of widely varying backgrounds have successfully performed as full-time dispatchers, and have spontaneously refined the initial system design. Facets of the

dispatching system susceptible to technological improvement in a larger system have been identified: notable are a rapid digital communications capability and an on-line computer data bank of service times for improved estimates of vehicle arrivals.

Objective: "Avoid irrevocable commitment to high-cost fixed facilites which cannot be modified to meet changing demand patterns."

Inherent in any demand-responsive system which does not require exclusive rights-of-way, this objective has been met to a greater extent than originally planned. Capital expense has been minimal, involving only communications equipment and refurbishment of existing and loaned vehicles.

Objective: "Establish economic criteria for determining optimum allocation of fixed bus routes and dynamically-routed service areas, in order that efficient utilization of both technologies can be made for a city-wide system."

Feasible productivity values for various conditions of demand have been derived to serve as a guide to the number of vehicles necessary by zone within the city and by time of day for a city-wide system. The project consultants have developed a proposal for a city-wide system incorporating Dial-A-Ride feeder service to high-capacity, limited-stop express routes and flexible subscription services at peak times, and expanded-area direct Dial-A-Ride coupled with express lines for off-peak hours. Operating experience and system performance results from the pilot project have been key inputs to the ridership, capacity, and budget estimates of the proposal.

APPENDIX A

PROPOSAL FOR TELTRAN

PROPOSAL FOR AN EXPANDED COMMUNITY-WIDE PUBLIC TRANSPORTATION SYSTEM

Prepared For

ANN ARBOR CITY COUNCIL AND THE CITIZENS OF ANN ARBOR

By the

ANN ARBOR TRANSPORTATION AUTHORITY

January 18, 1973

I. INTRODUCTION

In Ann Arbor, as in most American cities, virtually all of the urban area travel is accomplished by automobile. The total mobility provided to individuals by the car is unsurpassed by any other system of personal transportation. Auto travel is fast, direct, reliable, private and comfortable.

Despite these individual user benefits, the automobile extracts a very high social cost from Ann Arbor residents. Approximately 2500 acres, or 23.8% of the city's present developed land is devoted to streets and roads. Although no published tally is available, we estimate that at least another 10% is devoted to parking and support facilities for the automobile inventory.

Automobiles contribute a majority of our total air pollution. Traffic noise intrudes on many human activities. Cars, not people, seem to dominate much of our community living and activity space. Traffic accidents take a substantial annual toll in deaths, severe personal injuries and property damage. Traffic congestion - downtown and on many of Ann Arbor's major arteries - makes moving around the city an unpleasant chore at times.

Those without access to automobiles - the poor, the handicapped, and the elderly - are deprived of its mobility benefits. Finally, the automobile is expensive. Regardless of income class, most Ann Arbor familes spend in excess of 15% of their income to support automobiles.

If the emphasis in Ann Arbor's public investment can be shifted, <u>increasing</u> the relative importance of public transportation while <u>decreasing</u> citizen dependence upon the automobile, substantial community benefits may be realized. This change in emphasis can be more readily accomplished if a public transportation system which approaches the automobile in comfort, convenience, reliability and speed can be implemented.

The Ann Arbor Transportation Authority proposes to implement just such a system. Here are the major highlights of the plan:

1. Door to door service virtually anywhere within the city limits.

2. Service in response to a telephone call, or previously booked order, independent of time tables and route maps.

3. Highly personalized, direct home-to-work and home-to-school service.

4. Ridership target: double that carried by the existing bus service for the first year, with a fifth year target of diverting at least 5% of all intra-Ann Arbor trips to public transportation.

5. Low fare - 25¢ cash; unlimited use, individual monthly passes at $10.00 per month, and unlimited use family passes at $15.00 per month. Senior citizens and low income families would benefit from even lower fares.

The proposed plan calls for combining the door to door convenience of Dial-A-Ride with the high capacity and efficiency of limited stop express bus service connecting major activity centers.

In order to accomplish the objective of reducing dependence on the private car by upgrading public transportation, the Ann Arbor Transportation Authority is requesting approval of a city charter amendment which will permit a 2.5 mill property tax assessment. The 2.5 mills will produce an annual revenue of about $1,500,000. The proposed system will cost approximately $2,000,000 annually to operate (including capital equipment amortization). It is estimated that approximately $400,000 per year will be produced in revenues, and an additional $200,000 can be obtained from the State of Michigan's recently approved transportation package.

On the following pages, details of the Authority's proposed city-wide public transportation system are presented. A full budget is presented on pages 14-18.

II. THE PAST

Ann Arbor, like virtually every city in America, experienced a decline in public transportation useage in the decades following World War II. Increasing incomes led to increasing automobile ownership and use. This reduced public transit ridership, while simultaneously inflation drove costs upward. In 1946, with a population of approximately 40,000 the Ann Arbor city bus system carried 1,700,000 passengers. By 1954, ridership had dropped to 700,000 passengers despite a population increase to 55,000. Finally, in May of 1968, the last of a succession of private companies was forced to give up attempting to run city public transit service as a profit-making business.

The Ann Arbor Transportation Authority was created on July 15, 1968. A short term (June '68 - February '69) operating contract with an outside firm was negotiated, and finally city operation commenced in the spring of 1969 with four minibuses. As an interim measure, used transit buses were purchased in August of 1969 when the minibuses could not keep up with demand. Half-hour regular service was then restored.

The Authority purchased 16 new air conditioned buses in 1970. Two-thirds of the cost of these vehicles was provided by a grant from the U.S. Department of Transportation, Urban Mass Transit Administration.

III. THE PRESENT

The Ann Arbor Transportation Authority now operates service on 6 lines throughout the city from 6:45 a.m. until 6:15 p.m. Half-hour service frequency is offered during peak morning and evening hours, with hourly service mid-day. The buses operate Monday thru Friday. Cash fare is 35¢ for adults, 20¢ for school children. Buses from all 6 lines meet together at a common downtown point, and transfers between lines are free.

In the 1971-72 fiscal year, the bus system carried approximately 650,000 passengers. Total operating cost was $450,000, with revenues accounting for $216,000 and the remainder of $234,000 provided out of the city's general fund.

The present bus system is posting ridership gains of between 10 & 15% per year, but still accounts for less than 2% of the total travel in Ann Arbor. Many kinds of people use the bus service, including persons unable to drive (for a variety of reasons), school-age children, and many concerned citizens who share the Authority's desire to decrease use of the private automobile within the city.

IV. DIAL-A-RIDE PILOT PROGRAM - 1971-1972

Dial-A-Ride is a system of small, centrally dispatched buses which provide doorstep service to users on a demand-responsive basis. Instead of operating with regular routes and schedules, the vehicles are radio dispatched to serve specific requests for service. Passengers are taken where they want to go, when they want to go. From its formation, the Authority expressed interest in Dial-A-Ride and movement toward a field test of the concept began in 1970.

The Authority's Dial-A-Ride pilot program was launched in September 1971, with the financial support of the State of Michigan Bureau of Transportation and the technical backing of Ford Motor Company's Transportation Research & Planning Office. The objective of this program was to field test this innovative door to door public transportation system, measuring both public response and operating feasibility. The program was small, involving only three vehicles serving approximately 16% of the city's population. The one year test period is completed, and although state funding is exhausted, the Authority is continuing to operate the basic three vehicle system in the southwest section of the city.

The one year test period produced several important findings:

1. Total transit trip making from the target neighborhood more than doubled, compared with previous stadium bus route ridership. During one sample week in February 1972, Dial-A-Ride carried 1183 passengers; the Stadium route picked up or dropped off approximately 940 passengers in the same service area, for a total of 2123 transit passengers. Without showing any adverse affect on regular bus ridership, Dial-A-Ride demonstrated that high quality doorstep service can add to the base transit ridership in a typical Ann Arbor neighborhood.

2. Many Dial-A-Ride passengers were lured from their automobiles: according to surveys taken in January and June 1972, 50% of the users formerly were auto drivers or passengers before Dial-A-Ride became available. (The other alternate modes indicated were: Taxi, 12%; regular city bus, 10%; walking, 15%; other, 5% with approximately 7% indicating they would not have made the trip otherwise).

3. Dial-A-Ride reached many persons who do not use public transit regularly. Over a typical month, approximately 70% of the individuals who travel on the system ride less than once a week. Surveys verify that this is not due to dissatisfaction with the service, but rather to the feeling that Dial-A-Ride is a backup or auxiliary transportation system. This suggests that if a system can be made permanent, some of these occasional users will ride more regularly.

4. Service delivered was excellent. The average waiting time (telephone call to doorstep pickup) was 10 minutes and the average riding time (pickup to dropoff) 13 minutes. All four surveys conducted during the project indicated that the public in the test service area is very satisfied with Dial-A-Ride. A home interview survey also showed widespread citizen support for system expansion based on a tax increase.

5. Dial-A-Ride is operationally feasible under Ann Arbor conditions. Direct operating cost over the test year came to $1.74 per ride, for the three-vehicle system. Cost per ride for a larger system cannot be directly extrapolated from this figure, and should be considerably lower. Dial-A-Ride is substantially more expensive per ride than regular route bus service.

These test findings confirmed the Authority's initial hope that the public would find Dial-A-Ride more attractive than conventional service, and therefore would serve the basic objective of encouraging public transit useage over automobile travel. The cost findings indicated that a new source of funding would be required if Dial-A-Ride service were to be made available to Ann Arbor's citizens on a city-wide basis.

Similar operating experiences have been obtained in other communities where Dial-A-Ride has been tried. The Regina, Saskatchewan, Canada Telebus* operation is particularly significant for Ann Arbor. Regina (population 150,000) has the largest, most successful doorstep bus service found anywhere. Key elements in Regina's success have been:

1. Total reliance upon doorstep, radio dispatched service in target zones - elimination of competition within a given area between Telebus and regular route buses.

2. Coordinated transfers between Telebus vehicles and line buses connecting to other parts of the city.

3. Progressive transit system management dedicated to innovation and public service.

4. Unqualified taxpayer and city council support.

The Authority's technical consultant, Ford Motor Company Transportation Research & Planning Office, has been involved in several Dial-A-Ride systems including Regina's. They are offering The Authority full benefit of this experience in interpreting Ann Arbor's Dial-A-Ride test, and in extending the findings to a larger-scale plan for an improved city-wide transit system.

*Telebus is Regina's registered name for Dial-A-Ride.

V. PROPOSED CITY-WIDE PUBLIC TRANSPORTATION SYSTEM

Based upon Dial-A-Ride experience gained in the pilot test and in other communities, the Ann Arbor Transportation Authority feels that any significant diversion of trips from private automobiles to public transit will require a system with the following characteristics:

- Doorstep pickup and dropoff.
- Absolute minimum transfer difficulty.
- Telephone requests for service, with little or no requirement for public knowledge of schedules and route maps.
- Fare at present levels or lower.
- Shifting emphasis in service according to time of day and travel demand.

Several alternative systems have been considered. The final plan proposed consists of:

- Neighborhood Dial-A-Ride services with doorstep pickup and dropoff by telephone request. These neighborhood Dial-A-Rides provide point to point service within a given zone, and also act as feeders to express buses connecting with major trip attractors and other zones.
- Express trunk line services, connecting major shopping centers, employment areas, all senior high schools, the university, community college, hospitals and other major trip generating points.
- Coordinated, no-wait transfers between neighborhood Dial-A-Ride vehicles and express busses.
- Regular subscription service for daily work and school trips, with doorstep pickup and dropoff at the same time every day, serving those locations with adequate demand to justify dedicating a bus to that run.

This proposed system combines many of the best features of the existing line bus system and the Dial-A-Ride pilot project. The experience of Regina, Saskatchewan in using Dial-A-Ride as a feeder is drawn upon heavily.

VI. WHAT ALTERNATIVES WERE CONSIDERED?

Expansion of conventional bus service was considered, because it is efficient from an operational standpoint and is familiar to users. However, many neighborhood homes, particularly in new residential areas, cannot be reached by bus routes. Other cities which have tried to gain dramatic ridership increases with conventional service improvements, such as Madison, Wisconsin and Erie, Pennsylvania, have failed to duplicate the ridership increase record established by Ann Arbor's pilot Dial-A-Ride project. Finally, bus service suffers from a poor image in the minds of much of the public. This option was therefore rejected in the Authority's planning.

Much attention has recently been given to automatic, personalized rapid transit, with vehicles running on exclusive rights-of-way, or "guideways". Such systems hold great promise for high demand density areas such as large city centers and airports. However, Ann Arbor's only current high demand corridor is served by the University of Michigan free bus system. Future development in Ann Arbor seems most likely to proceed in a predominantly dispersed pattern, which is hard to serve with an inflexible, fixed route system. Costs for guideways are currently estimated at between $2 & $5 million per mile. Therefore, despite the automatic, personal rapid transit system's benefits of high capacity, electric propulsion and low operating cost, the Authority was forced to reject this type of system for present implementation.

The pilot Dial-A-Ride project showed great promise from a public response standpoint, but the relatively high cost led to consideration of ways to improve the operating efficiency. It was estimated that city-wide, point-to-point Dial-A-Ride service would be prohibitively expensive, because of the relatively long runs required to connect outlying east side residential areas with major activity centers in town and to the west. A combination of Dial-A-Ride with line bus routes was then developed, which incorporates doorstep service in residential neighborhoods with high capacity and efficiency on line runs between major trip attractors.

VII. WHAT ARE THE BENEFITS OF THE PROPOSED SYSTEM?

If substantial numbers of people can be convinced to use public transportation instead of automobiles, all citizens of Ann Arbor will realize significant benefits:

- Less land devoted to streets, parking and related uses; hence more land on tax rolls.
- Reduced air and noise pollution.
- Decreased peak hour congestion on major arteries.

- Increased job opportunities in the public transit system.
- Fewer traffic accidents, injuries and fatalities.
- Increased mobility for non-drivers - poor, old, young, handicapped.

There is individual economic incentive as well. Estimates for the annual cost of owning and operating a second car range from $1000 to $1500 per year. A typical family of four would be able to use the proposed public transportation system for many of their trips at a cost of less than $400 per year, and not require a second car at all. This $400 includes the tax assessment at 2.5 mills, plus purchase of two passes monthly.

IX. HOW DOES THE PROPOSED SYSTEM WORK?

In the simplest terms, with the proposed system it is possible to travel anywhere within Ann Arbor by telephoning the dispatcher and requesting service. The dispatcher will ask where you wish to be picked up, where you want to go, and if you need to arrive at a specific time (such as for work or a doctor's appointment). The dispatcher will tell you when to expect the bus, where to board (if you are at a large building or other location not having a specific address) and exactly how to transfer if a transfer is required. Users do not need to know anything about the system beyond the telephone number. Such technical information as zone numbers, peak hour and off peak variations, and transfer points are used by the operating staff.

The service offered varies according to the change in demand pattern by time of day. The following descriptions explain the basic kinds of trips that can be made and how they are accommodated.

A. Peak-Hour Weekday Service - Regular Pre-booked Subscribers

Many regular peak hour riders will be served by premium subscription service. For example, customers living on the west side who must be at work in the northeast Ann Arbor research industrial complex (Bendix, Parke-Davis, Climax, CHPA, EPA, Highway Safety Research) at 8 a.m., would be picked up at the same time everyday at their homes in one bus. This bus would proceed directly from home to home, picking up regular subscribers for that area only, and proceed express to the destination points. Passengers would be dropped off where they work.

At the end of the shift, a single bus would meet the same group of riders at their workplace exit, and distribute them to their homes. Workers not wishing to return directly home on a specific day could call the dispatcher for alternate arrangements. Similar premium subscription service runs will be organized for any group of people traveling to and from a common point at a specified time.

B. Peak Hour Weekday Service - Non Subscribers

In Ann Arbor, many peak-hour travelers do not follow a regular commuting pattern. Regular demand-responsive service is available for these travelers. The operating system for dynamically scheduled service during peak hours is portrayed in Figure 1.

During the period from 6:30 to 9:00 a.m. and from 3:00 to 6:00 p.m., the system is oriented to serve work and school trips, with a priority placed upon on-time arrival in the morning. The city is divided into 11 zones. Each zone is served by 2, 3 or 4 Dial-A-Ride vehicles. Each zone has at least one transfer point for connections to express line buses.

For morning inbound trips, passengers call to be picked up at their homes by a small bus. The small bus proceeds to the transfer point for that zone. Passengers bound for in-town or remote destinations transfer from the small bus to a larger express bus. Transfers are fully coordinated; the Dial-A-Ride feeder bus meets the express bus at the transfer point, and passengers simply walk from one vehicle to the other. There is virtually no waiting outdoors for these transfers.

These express vehicles stop to board and discharge passengers only at the transfer points and trip generators shown on the map; otherwise they proceed non-stop from point to point, achieving higher running speeds than would be possible for a regular bus stopping every block. Most major destination points can be reached without a second transfer, as express bus stops are located at the following points:

1. 4th & Huron
2. 4th & Liberty
3. 5th & William
4. State & William (Main campus)
5. State & Liberty
6. Ann & Ingalls (St. Joseph's Hospital)
7. University Hospital
8. Glen & Catherine (St. Joseph's Hospital)
9. Broadway & Plymouth (near Kroger)
10. North Campus Shopping Plaza
11. Plymouth Road Shopping Center
12. Clague Junior High*
13. Huron High*
14. South University & Forest
15. Washtenaw & Cambridge
16. Tappan Junior High
17. Lamp Post Shopping Plaza
18. Arborland Shopping Center

19. Washtenaw County Service Center
20. Washtenaw Community College
21. Carpenter & Packard (Topps)
22. Platt & Packard
23. Georgetown Plaza
24. Packard & Anderson
25. Packard & Wells
26. Packard & State (Campus corners)
27. State & Stimson
28. Briarwood
29. South State Research Park*
30. Slauson Junior High*
31. Dexter & Huron
32. Maple Village Shopping Center
33. Westgate Shopping Center
34. West Stadium Shopping Center*
35. Pioneer High*

The dispatcher makes sure that passengers board the proper express bus at transfer points. For example, the express bus leaving Platt & Packard at 8:10 a.m. may provide direct service to Campus, downtown and Maple Village. The bus leaving at 8:20 a.m. might provide direct service to the hospitals and the Northeast Industrial Park area.

Outbound evening trips would be taken in reverse fashion, by riding the express bus to the transfer point serving the passenger's zone. There, a Dial-A-Ride feeder vehicle will be waiting to take riders getting off the express bus to their homes. Users will normally want to telephone for outbound service and direct line telephones will be provided at express bus stops for these requests. Because the express buses will run on a schedule, it will also be possible to walk and wait for a bus; however, the user will find it more convenient to call in most cases in order to avoid the outdoor wait.

An additional feature of the peak hour system is the large intown zone. Point-to-point Dial-A-Ride is provided anywhere within this zone, combining the features of a downtown shuttle with door to door service. Normally, Dial-A-Ride to express line transfers will be accommodated within the service zone. As an exception, trips originating close to downtown in the northwest zone and the Pontiac Heights-Island Park zone will use the 4th & Huron transfer point.

Operating strategies for all of the many services described here undoubtedly sound complex . All of the concepts have been demonstrated, either in Ann Arbor or elsewhere and can be designed into a single coordinated system. From the user's standpoint, it must be stressed that door to door service can be obtained simply by calling the dispatch center. In most cases, either no-transfer or single coordinated transfer service will accommodate the requested journey.

* These 6 points are used on the peak hour system only. All others are used both peak and off-peak.

PEAK - HOUR SYSTEM

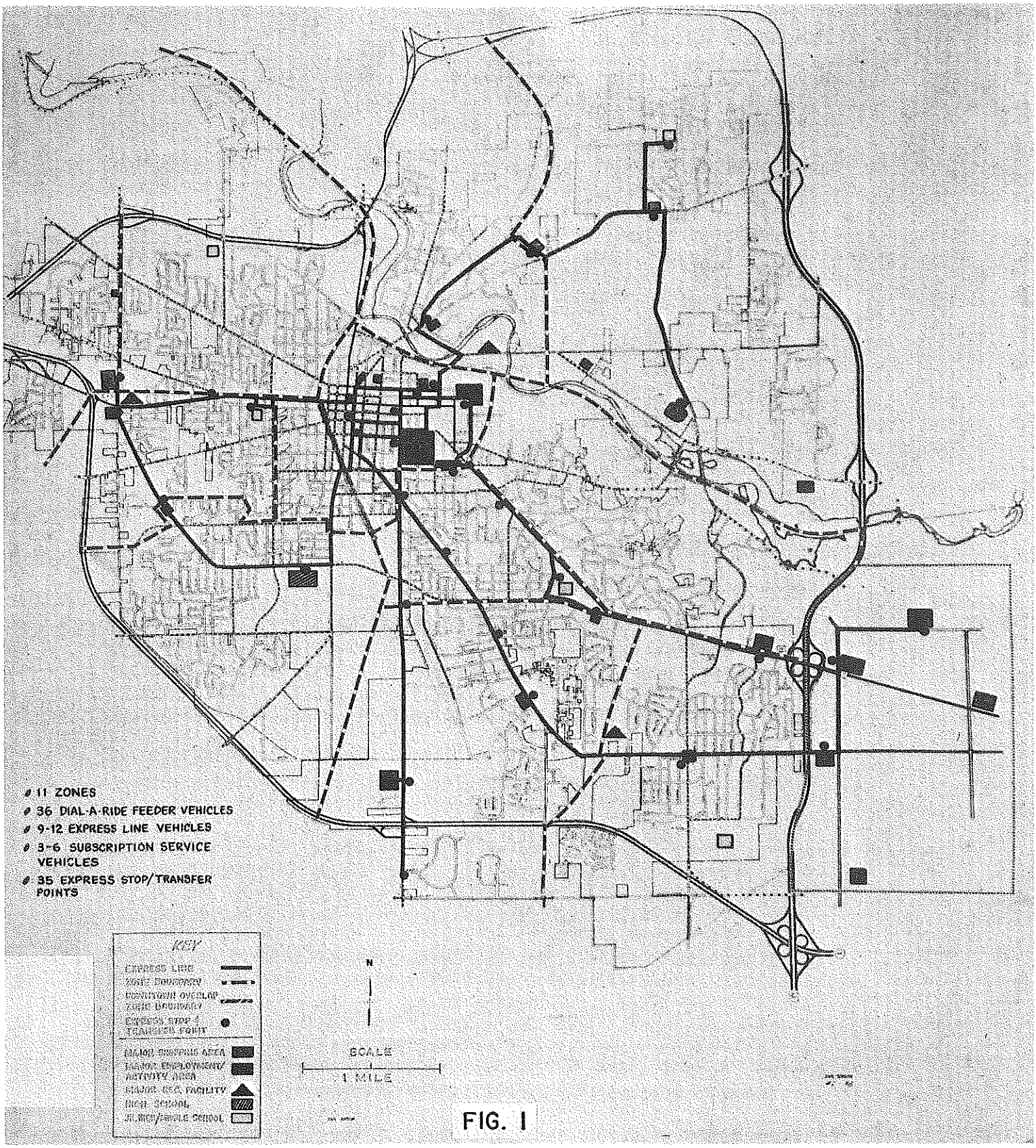


FIG. 1

C. Peak Hour School Service

The expanded city-wide transit system will offer special services to junior and senior high schools. Experience with the Slauson Junior High school special runs which are operated as part of the Dial-A-Ride pilot project has been excellent. In the expanded system each junior high school will be served by one or more dedicated buses operating in a door to door mode similar to subscription service. The junior highs which draw students from more than one feeder zone are also served by the express bus lines. In some cases, the service area zone boundaries correspond closely with junior high school district lines. Where they do not, the junior high special runs will cross zone boundaries as required.

The two major high schools - Pioneer & Huron - are included in the express bus routings during the peak hour periods. Individuals traveling to the high schools will normally use Dial-A-Ride feeders from their home to an express line transfer point, and continue their trip to the school on a through routed express bus. School-to-home travel is just the reverse. Residents of the southwest service zone will be able to take Dial-A-Ride directly to Pioneer High without transfer. Residents of the Plymouth-Earhart, East Ann Arbor and Ann Arbor Hills zones will have direct, no-transfer service to Huron High during peak hours.

D. Off-Peak Weekday System

During the mid-day hours of 9 a.m. to 3 p.m., the service will be oriented toward shoppers and more casual riders. This service is portrayed in Figure 2. Six large zones, each served by 3 to 5 vehicles, are established. Door to door Dial-A-Ride service is available within any zone. Each zone contains at least one major retail shopping facility. Except for two outlying zones on the far east side, service areas also overlap in the downtown area, including the campus and the hospitals. This latter feature allows no-transfer downtown Dial-A-Ride service from most points in town.

Express lines are retained between major activity centers, operating at less frequent intervals than during peak hours. Fully coordinated transfers with express vehicles to all parts of Ann Arbor are provided at transfer points shown on the map. Transfers between Dial-A-Ride vehicles operating in adjacent zones are also possible. Those few trips between points in different non-adjacent zones where the ultimate destination is inconvenient to a transfer point will be served by a Dial-A-Ride to express line transfer and a second transfer to a Dial-A-Ride vehicle to complete the trip. Work trip subscription service will not be available off-peak, but school shift changes will be accommodated by special runs where appropriate.

WEEKDAY OFF-PEAK SYSTEM

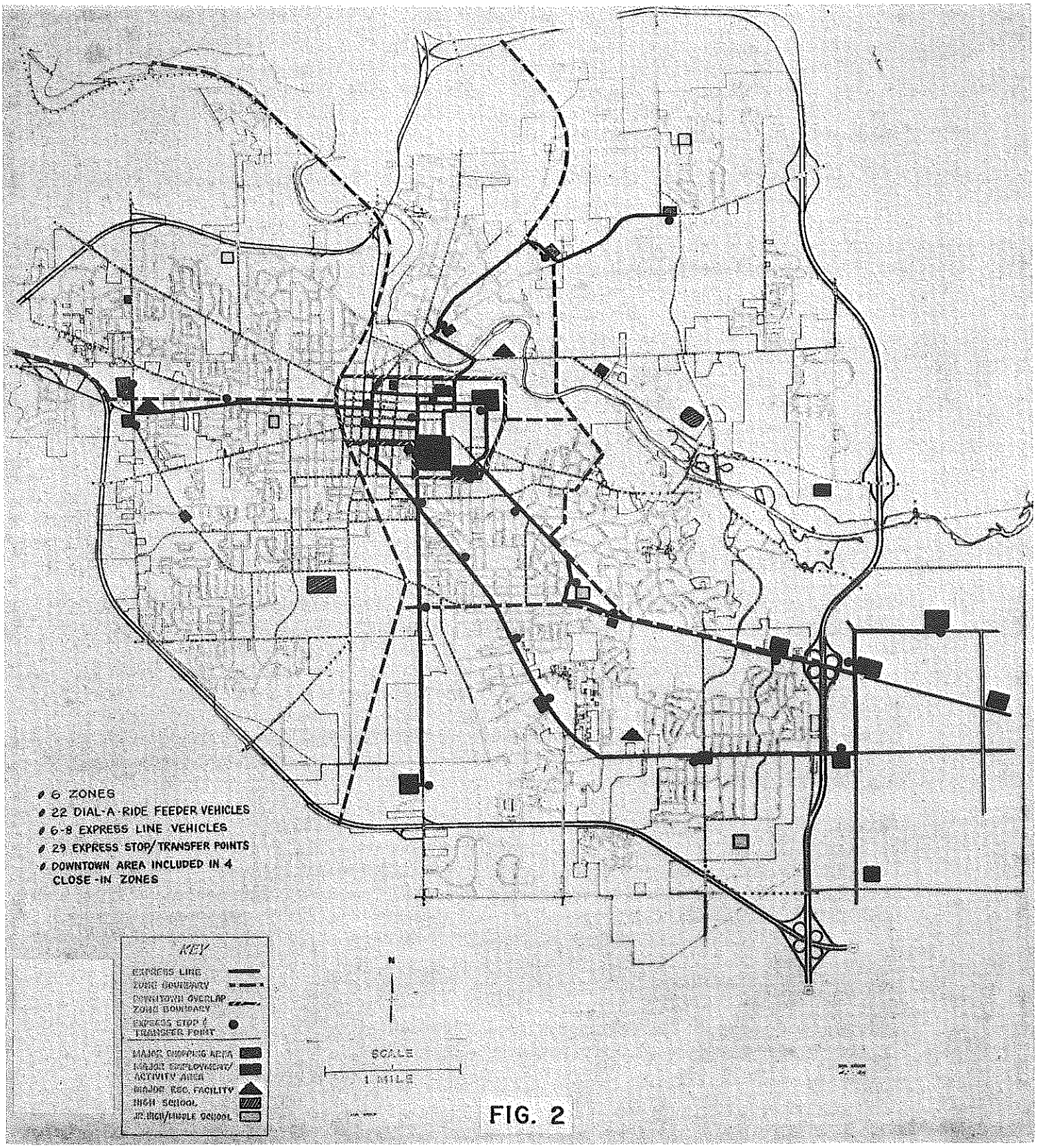


FIG. 2

E. Saturday Service

Ann Arbor presently has no Saturday public transportation except in the Dial-A-Ride test area. The proposed system offers city-wide doorstep service from 8 a.m. to 6 p.m. on Saturdays. There are four large zones, similar to the off-peak service on weekdays. Doorstep pickup and dropoff is available anywhere within a zone, including major shopping centers. The system layout for weekend and evening service is portrayed in Figure 3.

On Saturday there are no express line services. Inter-zonal transfers are accommodated downtown at convenient points, between Dial-A-Ride vehicles. The downtown area is included in all zones. Door to door service is thus available from any point to any other point within Ann Arbor. Because Saturday ridership will probably be less than half of normal weekday levels, fewer vehicles are required. Customer waiting times may be longer than on weekdays, and it will not be possible to guarantee fully coordinated downtown transfers for inter-zonal travel. No subscription service will normally be offered on Saturday, unless there is a concentrated demand which could efficiently be served by a single vehicle run.

F. Evening Service

This will be similar to Saturday service, offered from 6 p.m. to 11 p.m. on weeknights. Four large zones would be used. Point to point Dial-A-Ride service within each zone will be available, plus inter-zonal service via downtown transfer connection. Again, downtown is included in all zones.

G. Sunday Service

Ann Arbor presently has no Sunday public transportation. The proposed system offers city-wide doorstep service from 8 a.m. to 6 p.m. Sundays. There are four large zones similar to Saturday service. This service will emphasize travel to churches, recreational areas and shopping centers. Technical details of the system will be similar to the Saturday and evening operations.

H. Service Extensions To Be Considered

In the spirit of expansion and experimentation which has characterized AATA planning to date, consideration will be given to extending service hours on weekends beyond 6 p.m. and beyond 11 p.m. during weekday nights.

X. RIDERSHIP ESTIMATES

The present city bus system carries approximately 650,000 passengers per year, or 2500 passengers per day. Based on the Dial-A-Ride pilot program results, a first year estimate of 1,300,000 passengers has been made for the new system, which factors to 5,000 passengers per weekday. This is a conservative estimate for an annual average - summer ridership will be less, winter ridership higher. Weekend and evening patronage may raise this figure.

WEEKDAY NIGHT AND SATURDAY SYSTEM

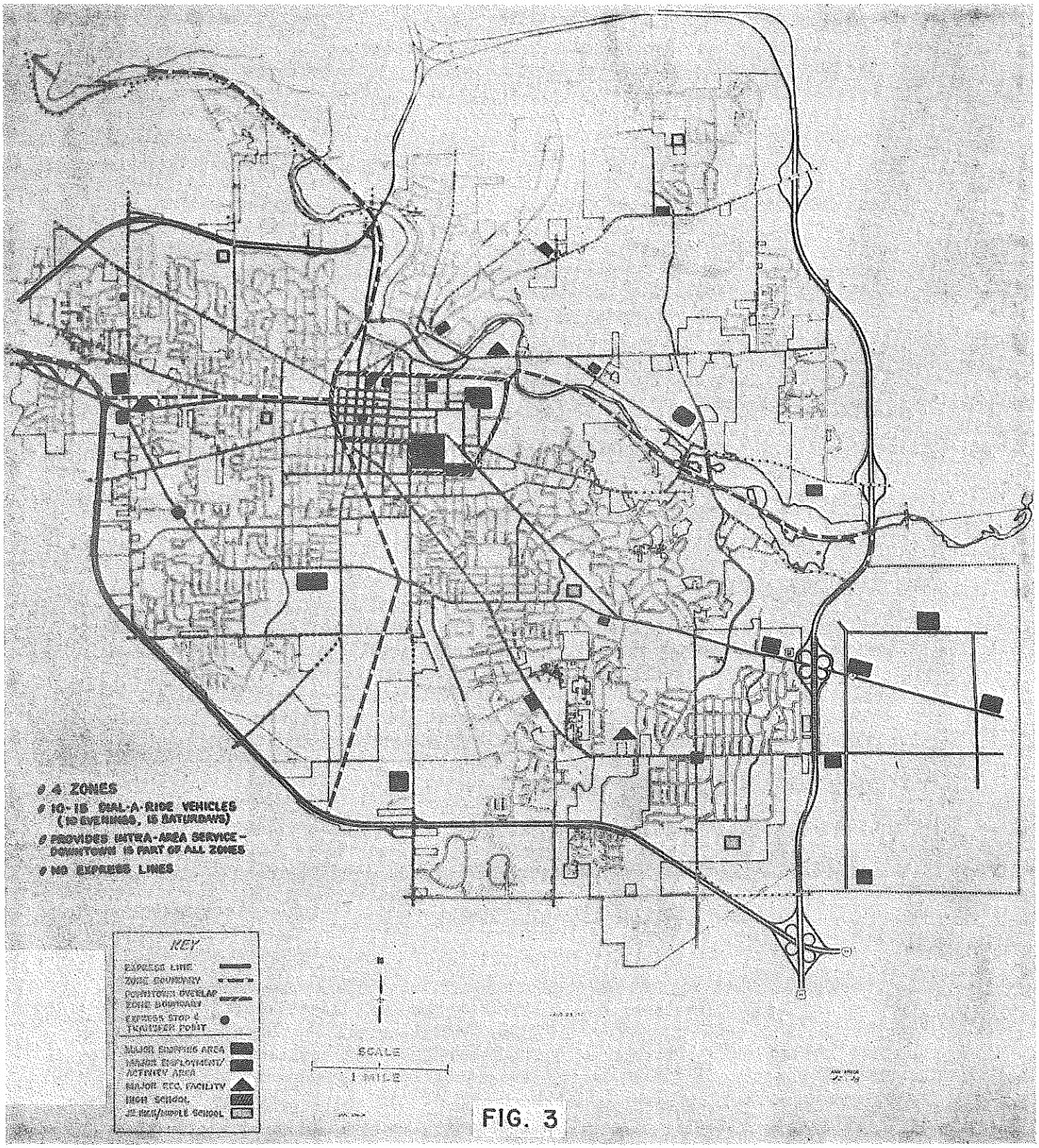


FIG. 3

In planning for the peak-hour and off-peak systems, hourly demand rates of 540 passengers in the peak and 330 in the off-peak have been used. The system as proposed here has an ultimate capacity of approximately 1.6 million passengers, which is 23% above the demand estimate for the first year. Expansion beyond this level requires purchase of additional vehicles and an increased operating budget. Experience gained as operations are phased in during the first year will reveal when, where, and how subsequent expansion should take place.

XI. WHAT IS THE GEOGRAPHIC COVERAGE OF THE EXPANDED SYSTEM?

Dial-A-Ride service area zones extend to the city limits in all cases. One possible service zone outside of the city limits is in Pittsfield Township, consisting of the high concentration of apartments bounded on the north by Huron River Drive, on the east by Golfside Road and on the south by Ellsworth Road. If this area is to be included, some method of equitable financing should be worked out such that City of Ann Arbor taxpayers are not being asked to subsidize a service which benefits non-residents.

The Authority will undoubtedly wish to continue negotiations with City of Ypsilanti officials concerning a coordinated system serving both cities.

XII. VEHICLES, EQUIPMENT AND SUPPORT FACILITIES

The proposed system requires a vehicle fleet of 15 express buses and 40 Dial-A-Ride vehicles, of which 5 are anticipated to be specially equipped for handicapped passengers. In addition, the existing fleet of sixteen 1970 model buses will be retained. In order to support and garage these vehicles, a new maintenance facility is needed. This will require about two acres of land, construction of a 35,000 sq. ft. storage garage, a 5000 sq. ft. office area and a 5000 sq. ft. maintenance facility. Special tools and equipment to outfit the maintenance garage are also required.

Additional support facilities required include:

- Fare boxes for all vehicles
- Staff cars, service trucks and tow truck
- Radio communications equipment for dispatching
- Money collection and counting equipment
- Shelters at major transfer points

The project budget in Section XIII includes capital expense for all of the foregoing items.

The Authority plans to give serious study and consideration to use of alternative fuels and innovative power sources that promise to reduce or eliminate pollution from the vehicles used in this system.

XIII. FINANCIAL ANALYSIS

The costs of operating the proposed system are calculated to be approximately $2 million per year, including all management, overhead, marketing, insurance and capital equipment depreciation.

A basic system operating from 6:30 a.m. to 11 p.m. weekdays and from 8 a.m. to 6 p.m. Saturdays calls for 141,000 vehicle hours. Expansion to a 8 a.m. - 6 p.m. Sunday service calls for 148,800 vehicle hours.

The following hourly cost calculations are based on current experience with both Dial-A-Ride and fixed-route operations, plus projections for the new system in the areas of management, marketing and building overhead.

OPERATING COST PER VEHICLE HOUR

(1973-4 Wage Estimate, 148,800 Vehicle Hrs/Hr)

	Dial-A-Ride Feeder	Express Bus
Driver Wages	$5.17	$5.17
1972 base $4.40/hr 89% straight time, 11% overtime 6% projected 1973 wage increase Driver hours @ 105% of vehicle hours		
Dispatcher Wages (Dial-A-Ride only)	1.30	-
1972 base $4.55 89% straight time, 11% overtime One dispatcher & $\frac{1}{4}$ call taker per 5 vehicles 6% projected 1973 wage increase Disp. hours @ 102% of vehicle hours		
Fringe Benefits @ 25%	1.62	1.29
Other Future Benefits @ 11%	0.71	0.57
Vehicle Operation & Maintenance	1.51	1.51
Fuel @ $0.18/gal or $0.31/hr. Parts and labor @ $1.10/hr. including 7 mechanics and one parts man for fleet Washing @ $1.00/bus/day or $0.10/hr		
Direct Supervision	0.35	0.35
4 supervisors, $52,000/yr.		
Management & Staff Support	1.28	1.28
Payroll @ $190,000/yr.		
Overhead	0.30	0.30
For new office/garage building; heat, light, janitor's salaries, building maintenance and repairs, telephone charges, insurance, postage and office supplies, $44,800/yr.		
TOTAL	$12.24	$10.47

Total Yearly Operating Cost

For service from 6:30 a.m. to 11 p.m. Monday through Friday, and from 8 a.m. to 6 p.m. Saturday and Sunday.

	Annual Hours	Operating Costs
Dial-A-Ride vehicles ($12.24/hr)	113,800	1,393,000
Express Buses ($10.47/hr)	35,000	367,000
Dial-A-Ride Vehicle Amortization 40 units at $9000/each 3 yr life - 6% interest		45,500(1)
Express Bus Amortization 15 units at $40,000/each 7 yr. life - 6% interest		34,400(1)
Office, Maintenance Garage & Passenger Station Amortization $775,000 at 20 yrs. - 6% interest		22,400(1)
Service Trucks, Radios, Staff Cars & Equipment Amortization $200,000 at 7 yrs. - 6% interest		11,600(1)
Insurance		75,000
	148,800	1,948,900

(1) Represents amortization for local portion of capital investment. It is assumed that Federal grants will be available when equipment replacements are required based on present formula of 1/3 local funds plus 2/3 Federal funds.

Funding is projected from three sources to cover these costs; the State Transportation package gasoline tax rebate, the assessment of the 2.5 mill property tax, and revenues from fares. These sources break down as follows:

Total Annual Capital and Operating Budget (7 days/week service)	$1,948,900
Less State Transportation Package Operating Subsidy	-200,000
Less 2½ Mills Property Tax, 1973 Assessed Valuation & Allowing 5% City Growth	-1,500,000
Remaining Cost To Be Covered By Revenue	$ 248,900

The Authority has debated many alternative fare plans, ranging from a zero-fare policy to the present Dial-A-Ride fare of 60¢ cash. The Authority's final recommendation is the following schedule of fares:

Cash	$0.25
Monthly Family Pass	$15.00
Monthly Personal Pass	10.00
Senior Citizen and low income	
Personal Pass	5.00
Family Pass	7.50

The basic feature of this policy would be a flat fare per total ride of $0.25.

The personal pass is a renewable picture-pass useable by only one person at all times. The $10 charge would be equivalent to 5 round trips a week for four weeks at the 25¢ cash fare. Since there are slightly more than four weeks a month and the pass would be unlimited in use, it does represent a small discount over cash ridership, as well as convenience. This form of pass is proposed to be the only form of admission to subscription service (a premium, direct service) except perhaps for a trial cash-ride period of perhaps two weeks.

The family pass is non-picture, issued to a household, and useable by any single member of that household or to any number of people in the household making the same trip. The transferability and multiple-rider features justify the higher price.

This plan generates approximately $364,000 in revenue, based on a system ridership of 1,300,000 passengers/year. This is broken down by sources as follows:

Cash rides:	670,000	x	$ 0.25	=	$167,500
Pass sales:	7,500	x	10.00	=	75,000
	7,500	x	15.00	=	112,500
	1,000	x	5.00	=	5,000
	500	x	7.50	=	3,750
Total Ridership Revenue					$363,750

This revenue is adequate to permit weekday operation until 11 p.m. and 8 a.m.to 6 p.m. service on weekends, which is recommended by the Authority as the final operating plan.

The Authority feels that some fare must be charged, though it is lower than present line bus fares (35¢). Collection of fares will eliminate some "joy riding" by young people, which will otherwise tend to overload the system to the detriment of those depending upon the reliability of service. The users will perceive that the system has some value; there is evidence that free services are not considered as having any worth. Dial-A-Ride experience in the Columbus Model Cities area suggests that low income people there appreciate the dignity afforded in paying a modest fare, rather than riding a free "welfare" service.

The 25¢ cash fare is low enough that it should not be an impedement for any population group to use the service. It is high enough to place a value on the service in the minds of users. The reduced fare pass plan for senior citizens and low income persons (O.E.O. & Medicare definition) meets this special need and also answers state requirements that off-peak fare for these user groups be no higher than 50% of regular fares. The Authority recognizes that certain groups of persons such as the blind and physically handicapped have exceptional mobility problems, and is considering special fare compensation for these groups.

XIV. SYSTEM IMPLEMENTATION

This plan has been developed by the Authority's consultants - Ford Transportation Research & Planning Office, and A.H. Simsar, working in conjunction with the Authority's staff, and in response to citizens' opinions in a public hearing. It is developed in sufficient detail so that accurate descriptions of the service rendered can be made and so that a realistic budget can be developed. A detailed operating plan is not yet developed.

Much design work by the consultants remains to be done, providing the Ann Arbor electorate approves the required funding. System design tasks that remain include:

- Definition of dispatching algorithms
- Design of aids for manual and automated dispatching
- Specification of communications equipment
- Development of customer service procedures
- Delineation of areas of low telephone penetration and specific planning for provision of telephones for those areas
- Development of specific operating procedures
- Assignment of vehicles to runs
- Development of driver and dispatcher manpower allocation scheme, run cutting and assignment board
- Development of a marketing program
- Design of maintenance procedures and facilities
- Design of information - gathering procedures to allow close supervision and evaluation for system adjustment and evolution

In addition, if funding is approved, the Authority must hire and train system personnel, procure a site and build a garage and maintenance facility, as well as obtain vehicles and other equipment.

Prepared by:

A. H. Simsar
K. W. Guenther
M. E. Dewey

APPENDIX B

OTHER DIAL-A-RIDE SYSTEMS

As of this writing there are approximately 20 operating Dial-A-Ride systems in North America, and four in Great Britian. Several more in the United States are known to be in planning. All are relatively small systems, with fewer than 10 vehicles. The table on the next page shows key parameters for six well established systems in comparison with Ann Arbor Dial-A-Ride.

Dial-A-Ride and systems based on demand-responsive service have demonstrated their viability as a part of the spectrum of public transit. Pioneer systems such as Ann Arbor's have helped clarify operating issues and refine design strategies to complete the first phase of Dial-A-Ride applications research. Ann Arbor and at least two other North American cities are now planning considerably larger systems based on pilot project results, thereby moving into the next phase: full-scale Dial-A-Ride based transit systems.

DIAL-A-RIDE OPERATING SYSTEMS

Sept., 1972

Available Data Date / Host City	March, 1973 Ann Arbor, Michigan	March, 1973 Bay Ridges, Ontario (Metro Toronto)	March, 1972 Batavia, N.Y.	June, 1972 Columbia, Md.	Sept., 1972 Columbus, Ohio	Haddonfield, N.J. and Suburban Camden Co.	Sept., 1972 Regina Saskatchewan
Host City Population (1970 Census)	99,800	2,280,000 (Metro Area)	17,300	17,300	533,418	40,000 est.	137,000
Application	Neighborhood M-F & M-M Internal	Suburb - Transit Feeder & M-M Internal	City-Wide, Subscription plus M-M	City Wide M-M Slack Hours Only	Neighborhood M-M (Inner City)	Suburb - Transit Feeder & M-M Internal	Neighborhood Line Feeder & M-M Internal
Startup Date	Sept. 22,'71	July, '70	Oct. 25, '71	Jan. '71 Revised Aug.'71	Oct. 11,'71	Feb. 20,'72	Sept. 7, '71
Funding Sources (Not including Revenue)	Local 37% State 63% for pilot,now Local 100%	Province 100% for test, now Township 100%	Local 100%	Local 100%	H.U.D. 100% (Model Cities)	D.O.T. ~ 80% State ~ 20% $1.7 million	Local 100% (Fed. & Prov. Funding - Research Only)
Service Area Pop. Area	17,000 est. 2.4 mi^2	13,700 1.34 mi^2	17,300 4.75 mi^2	17,300 6.0 mi^2	55,000 est. 2.5 mi^2	35,000 est. 6.5 mi^2	30,000 2.75 mi^2
Vehicles in Service Peak/Mid-Day	3/3	4/2	5/3	2/1	4/3/2	10/5/1	8/3
Typical Weekday Ridership	270 (6:30am- 6pm)	600 (6 am - 1 am)	455 (Feb.'72) (6 am - 6 pm)	54 (6:30 - 8:30 am, 5:30 - 11:00 pm)	485 (Feb.'72) (6 am - 9:30pm)	530 (Sept.'72) (24 hours)	1000 (6:45am-11:30pm
Typical Weekday Vehicle-Driver Hrs.	28	41	45	12-1/4	51	100	80
Dispatcher Hrs.	12	20	24	6	26	60	24
Demands/Day/Mi^2	112	430	96	9	194	52	365
Productivity Per Vehicle-Hr.	8.0	11.3	10.1(6.7 DAR only)	4.4	9.5	5.0	12.5
Per Total Labor Hr.	5.35	7.6	6.6	3.0	6.3		9.5
Approx. Cost/Ride	$1.25 (No Capital)	$0.60	$0.61	Not Available	$1.50	$1.75	$0.71
Fare	50¢ Avg.	30¢	50¢ Avg.	50¢	20¢	50¢ Avg.	32¢ Avg.
Approx. Labor Rate	$4.40 + 25% (Disp -$4.55+)	$3.19 + 4% (Disp-$3.30+4%)	$3.00 + 20% (Disp-$2.25+5%)	$3.00 + 10%	$4.00 + 33%	$5.00 + 33% (Disp-$3.40)	$3.83 + ? ($4.75 Disp.)

APPENDIX C

STATE OF MICHIGAN

IN THE CIRCUIT COURT FOR THE COUNTY OF WASHTENAW

MASAO KON, et al.,

Plaintiffs,

vs. No. 5967

CITY OF ANN ARBOR,

Defendant.

TRANSCRIPT OF THE OPINION OF THE COURT in the above entitled cause, before HON. ROSS W. CAMPBELL, Circuit Judge, at the Courthouse, Ann Arbor, Michigan, on Tuesday, September 7, 1971.

APPEARANCES:

Mr. James Crippen,

Appearing on behalf of Plaintiffs

Mr. Jerold Lax,

Mr. D. Pollard,

Appearing on behalf of Defendants

MR POLLARD: Could I approach the bench.

THE COURT: Yes.

(Mr. Pollard handed paper to the Court)

THE COURT: We will take about a 15, 20 minute recess, gentlemen, if you could return to the courtroom at 3:30, I will appreciate it. The Court is in recess.

(Recess was taken)

THE COURT: Gentlemen, I apologize for being much longer than I had anticipated, but in deference to the amount of work which counsel has put into the case, the numerous serious questions presented and their complexity, required more time to decide the matter than I had anticipated and I wanted to be able in rendering my decision to make the opinion as detailed as the complexity and number of issues required.

First of all, I would like to comment that this, indeed, is a most unfortunate situation. The public through their duly elected officials and government are trying to develop and improve less expensive system of transportation for the people of the community and the changes they are attempting to introduce, at least experimentally, necessarily compete and threaten the livelihood of those who are established in providing additional service. The situation is somewhat reminescent of the dislocation that we know accompanied the advent of the industrial revolution many years ago, a process which is still in evolution, but this is a case is not so much a conflict between the municipal and private enterprizes, but rather a matter of mutation and experimental change in the form of public transportation service, as I see it.

Let us assume for a moment, without deciding that a dial-a-ride is a taxi service under Chapter 85, Article I, Section 7:1511.11, of the Ann Arbor City Code and that if operated by a private person, or a corporation, it would fall within the taxi ordinance, chapter 85, Article 3, Section 7.161 of the Public Code which requires a certificate of public convenience.

The Court does not interpret chapter 85, article 3, Section 7.161 of the City code as applying to the City itself. It would be patently useless and circular to require a city to obtain from itself a certificate of public convenience and necessity before it could operate a taxi cab service itself. The provision of the ordinance was or -- or the code, was obviously intended to apply only to persons other than the City itself. So, I find first that that provision of the City Code does not apply to the city itself should it undertake to operate a taxi service.

Secondly, I would find that there is no estoppal operating against the defendants as viewing the complaint in a manner most favorable to the plaintiffs.

Turning to the third point. There is no allegation that an individual passenger in the vehicles which the transportation authority would be operating would have the power, as they would in a taxi cab, to limit the number of passengers who could be in that cab, again viewing the complaint in its own light, that is there is no allegation that the passengers, or anyone passenger could hire the entire vehicle with one fare and deprive other persons, other members of the public from occupying empty seats in it.

There is further no allegation in the complaint that the vehicle could be hired to take any particular route that the passenger wishes, but instead that it must follow a fixed route. Now these are not the only indicia, and it would be difficult to conceive of a taxi as such at least within our traditional concept of a taxi cab where a passenger did not have those two rights.

Now even if these vehicles are otherwise classed as taxi cabs, even if they are small, even if they are ordinary taxi vehicles which the City should choose to utilize, I don't understand that they do, but even assuming for the purpose of this argument, this opinion, that the City were to utilize ordinary types of vehicles used as taxi cabs for this purpose, I would not find on the pleadings that they are vehicles which are otherwise -- correction -- I would find that they are vehicles within the words of the ordinance are furnishing mass transportation service, and the furnishing of mass transportation service is not dependent upon the configuration, the geometry, size, number of seats, or the color of the vehicle which is used for that purpose. As such I find that these vehicles are expressly exempted from the definition of taxi cab under Chapter 85, Article I, Section 7.151 of sub-paragraph eleven of the Ann Arbor Code.

My third finding then, is that these vehicles are not taxi cabs, within the definition of this section of the code.

Now, there is no question but what the dial-a-ride system will compete with the plaintiffs, but does

the -- does it constitute what is known as unfair competition within the technical definition of that phrase as grounding an action under the law. To do so there must be traditionally a passing off, or pawning off the goods or services of one person as to those of another. It is not every competition no matter how hard it may be on the person who is not used to that competition, not every competition which falls within the legal definition of unfair.

There is no allegation here of any passing off, or pawning off of the services provided by the proposed transportation authority as being those of any of the plaintiffs, individual or corporate; and, accordingly my fourth finding is that there is no unfair competition within the legal definition of such a phrase as capable of grounding a cause of action.

Does the city licensing, or do the city licenses issued to plaintiffs constitute a contract which prevents the city from going into the taxi business itself. If so, such a contract exists only by implication. I would quote from page 993 of the United Railroads against the City and County of San Francisco, as follows: "the construction of the Legislative enactment of ordinances and of contractural relationship which directly concerns the public, the doctrine which controls as announced in Knoxville Water Company against Knoxville, 200 U. S. 22, 26 Supreme Court 224, 50 Lawyers Edition 353, "A municipal corporation when exercising its functions for the general good, is not to be shorn of its powers by mere implication, if by contract or otherwise, it may in particular circumstances restrict

the exercise of its public powers, the intention to do so must be manifested by words so clear as not to admit of two different or inconsistent meanings."

"The general rule, or this general rule, is but another form of stating a principle that statutory grants by way of franchise or property in which the government or public has an interest, are to be constructed strictly in favor of the public, and whatever is not unequivocally granted is withheld; nothing passes by implication."

I find nothing in the law making such a franchise as was granted to the plaintiffs in this case an exclusive one pro tonto and under these circumstances I must accept the reasonable interpretation of the language used in the ordinance under consideration here as not showing any deliberate purpose to make a surrender of the city's rights, nor as a conferring of such an exclusive right to the plaintiffs as against the City as would enable them to ground this action, even on the theory of a covenant or contract by the city not to compete.

I would point also to the Appellate Court opinion growing out of the case which I just cited, this would be entitled in the same manner, United Railroads, San Francisco, against the City and County of San Francisco, 249 U. S. 517 at page 520, but in any event it is decided by Knoxville Water Company against Knoxville, 200 U. S. 22, that a covenant by a city not to grant to any other person or corporation a privilege similar to that granted to the covenantee does not restrict the City from itself exercising similar power.

Mr. Crippen has well made his point here that the City originally put this contract, or system, out for bids and might very well have contracted with a private agency for this purpose, but that is not the question before us here, and we will not address ourselves to that. What we have here is a case where a municipal authority itself will be operating the transportation system. Accordingly, the fifth finding of the Court is that the franchise issued by the City to the plaintiffs, does not constitute a contract by the City not to compete.

The plaintiffs complain of deprivation of property without due process. The kind of damage which constitutes deprivatinn of property without due process and ground an action on that basis is damage which results from contract -- strike that -- from conduct, that like taking or appropriation would be tortious in and of itself unless in proceedings in eminent domain, or under some other law authorizing it on the conditon that damages be paid. In this connection I would again cite United Railroads at page 521, "Mere competition alone does not ground such a right or claim for damages. Mere competition alone is not such a taking, tortious taking, as to ground such an action." Accordingly, my sixth finding is that there is no violation of the constitutional provision forbidding the taking of property without due process, viewing the allegations of the complaint in their most favorable light.

The complaint further alleges that the Ford Motor Company is giving the City a free vehicle and technical

services in exchange for the city permitting the Ford Motor Company to do certain things. The decision as to the adequacy of consideration is in the first instance one for the duly elected representatives of the City to determine. Their decision and the terms of the contract in this case does not appear to the Court to be so inadequate as to be evidence of fraud or to shock the conscience of the Court. My seventh finding is that I do not find the consideration inadequate nor any evidence whatsoever of fraud from the face of the complaint.

For the same reasons that I have herein before stated, my eighth finding is that I find no denial of equal protection to the plaintiffs; and, ninth, I do not find that the actions of the City constitute an unreasonable, arbitrary or capricious exercise of police power.

For the reasons stated, the motion for summary judgment is granted. Court is adjourned.

dial-a-ride NEWS no. 5

Service Area Expands Nov. 1

With this issue of Dial-a-Ride News, we welcome a new group of Dial-a-Ride customers, living just to the north of the original residential service area. These customers are receiving a special supplement to this issue of Dial-a-Ride News, presenting the same detailed explanation of the service that was provided to our original group of customers in mid-September.

As of November 1, the residential service area is being expanded to include addresses on the north side of Pauline, west of Stadium, Federal Blvd, Commerce Dr., and Arbordale, Evelyn, Lennox, Raymond, Sherwood and Northwood plus Virnankay Circle. We are also adding addresses on both sides of Scio-Church Rd., and within the triangle formed by Scio Church, Saline and the expressway.

Dial-a-Ride is pleased to be able to service a larger number of Ann Arbor residents at this time. We have found that the first five weeks of operation went so smoothly that we are able to expand service considerably earlier than we had originally anticipated. With the cooperation of both our "old" and our "new" customers, we should be continuing to improve service and to announce other services, in succeeding weeks.

Add Hospitals, North & South University Stops

Effective Monday, November 1, Dial-a-Ride is adding the following stops, available as destinations and origins for service in addition to the intown loop: St. Joseph Mercy Hospital; University Hospital (Ann Street entrance); corner of Church and North University streets; and corner of Church and South University streets. We believe that these additional service points will make Dial-a-Ride even more attractive to residents of the newly-expanded service area.

Because trips to these points may take a different route than those to points along the original intown loop, we advise customers to allow a few more minutes lead-time, in scheduling such trips. Also, at least in November, service will not be available between these new service points and destinations along the intown loop. The new service points are only intended as the terminals of trips beginning or ending in the residential service area.

Finally, as with other questions, please feel most welcome to call the Dial-a-Ride number (663-4292) for answers to any questions you may have regarding the expanded service being offered in November.

Dial-a-Ride Box Score

Total Passenger Trips (First 24 Days)	2299
Average Daily Ridership	95
Best Single Day (Friday, Oct. 15)	143
Total Passenger Trips, Week of Oct. 11-16	694
Increase from Preceding Week	21%

CITY OF ANN ARBOR MICHIGAN

O F F I C E O F T H E M A Y O R

Dear Ann Arbor Resident:

We wish to take this opportunity to announce an exciting experiment in public transportation in Ann Arbor. We refer to "Dial-a-Ride", the innovative new door-to-door transit system which will soon be serving part of Ann Arbor's Fourth Ward.

After two years of active study and planning, the Ann Arbor Transportation Authority is ready to start Phase I of its new public transportation concept. As you will learn in other articles in this newsletter, Dial-a-Ride offers something new and different in service to Ann Arbor residents. It is a transit concept which has been implemented in fewer than a half-dozen cities in the nation. With the support of both state and city governments, it is now ready to go in Ann Arbor.

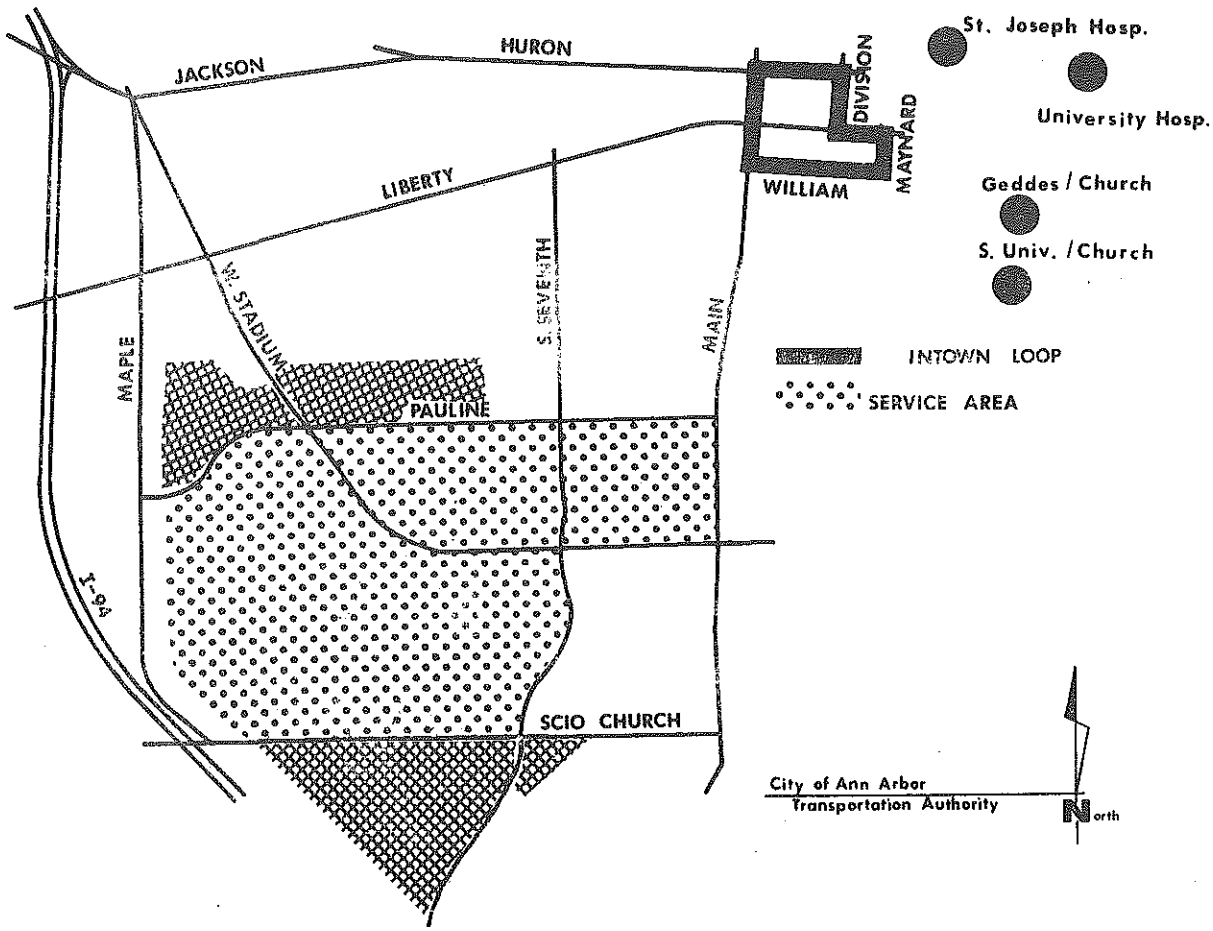
We believe that, in addition to the promise of first-class service to the residents in the first test neighborhood, Dial-a-Ride offers a new hope, both for Ann Arbor and for other cities throughout our country. Most citizens have come to believe, by now, that a reduction in the number of vehicles on city streets is vital to the future of most of our metropolitan areas. Dial-a-Ride may be a way to move toward this universally-desired goal.

If you reside in the test neighborhood, we hope that you and your family will avail yourselves of the opportunity to help make transportation history in Ann Arbor. We also urge you to communicate your reactions to the service to the Ann Arbor Transportation Authority, who are committed to providing first-class public transit to the citizens of Ann Arbor. With your cooperation, the first phase of the Dial-a-Ride project may well prove to be the beginning of a new way of life--in Ann Arbor as well as in cities across our country. At least, this is our hope, and the hope of all who are involved in bringing this new service to our city.

Robert J. Harris
Mayor

James E. Stephenson
Mayor pro tem

R E S E A R C H C E N T E R O F T H E M I D W E S T



Dial-a-Ride Service Here November 1

At 6:00 A.M. Monday, November 1, the Ann Arbor Transportation Authority will begin a new service in your part of the city. Dial-a-Ride, a new concept in public transportation, will begin. The concept is a relatively simple one, yet Ann Arbor is one of the first cities in the nation to implement it.

Dial-a-Ride will provide door-to-door transportation between service area residences and all points along an in-town service loop plus the main entrances of St. Joseph's and University Hospitals. The in-town loop is anchored in the Main and State Street Shopping and campus areas.

A telephone call to the Dial-a-Ride dispatch center (663-4292) will send one of the Dial-a-Ride minibuses to any address within the service area. From homes in the service area, residents can obtain transportation to the doors of many in-town locations.

The one-way Dial-a-Ride fare is 60 cents--exact fare--or fifty cents when strips of 10 or more tickets are purchased at one time. An introductory offer of unlimited service for one month is also available to households in the service area for $10. (See page 4.)

Dial-a-Ride minibuses will make stops at any address included in this service area. They will also stop at any street intersection within the service area. Persons who live on adjoining streets may call Dial-a-Ride and ask for pickups at such intersections, or delivery back to them.

The area has been designed to make rapid and convenient service possible to all of its residents, without undue delay. Please do not ask drivers to make special trips outside of the service area, as they have been instructed not to comply with such requests.

Now, the in-town portion of the Dial-a-Ride service:

Leaving the residential service area, buses will travel directly and non-stop to the in-town loop. They will circle this loop in a counter-clockwise direction, dropping patrons off at the exact address, along the in-town loop, they wish to go to.

The loop consists of: William Street from Main Street east to Maynard. Maynard Street north to Liberty, with an automatic stop at the eastern terminal, at Jacobson's on Maynard. Liberty west to Division. Division north to Huron. Huron west to Main. And Main Street south to William, with an automatic stop at the western terminal, in the 200 block of Main Street.

The eastern and western in-town terminals are automatic stops. Every Dial-a-Ride bus that goes past these points will stop there. So, if you're shopping along Main Street and you're ready to go home, you can walk to the western terminal, in the middle of the 200 block of Main, and a bus will pick you up. Likewise, if you're on the main University campus, or shopping in the State Street area, you can walk over to the eastern in-town terminal and hail the next Dial-a-Ride bus that comes by.

But, if you're at City Hall, or one of the hospitals--St. Joseph's or University--you can also call Dial-a-Ride (663-4292) and call for a stop at your location. Even if you're not presently on the in-town loop, you can call Dial-a-Ride and arrange for a pickup at the nearest point along the loop.

For example, the nearest point on the loop to the Farmers Market would be the corner of Fifth and Huron. You can arrange a delivery to that intersection, and, if you want, a pickup at that same intersection some time later, all on one phone call from home before you're ready to leave.

Dial-a-Ride Passes Frozen

It's time to buy November Family Dial-a-Ride passes. And here's the good news (for you if not necessarily for the Transportation Authority): Price of the monthly pass, for November, has been frozen at $10. At least until November 13, prices of all goods and services are frozen at the prices at which they were offered during the President's 90-day price freeze. So what was intended by the Transportation Authority as a one-time introductory offer is being retained for at least the month of November.

In October, some forty passes were in circulation in the system. We'd like to see this number rise drastically in November. With the traditional Michigan winter weather upon us, maybe this is the time to plan to use Dial-a-Ride regularly for trips to downtown, State Street, the main campus and the hospitals.

The passes will allow a family unlimited service for the month of November. By "unlimited service" we mean that there is no limit to the number of times, within the stated time period, that the pass may be used. And, on any given admission using the pass, there is no limit to the number of members of the purchasing household--sorry, no friends and neighbors carried free--who may ride free.

The one privilege we are unable to offer is multiple passes issued to one family for a one pass charge In other words, if dad regularly takes a Dial-a-Ride to work and home, and mother, riding at a different time, also wants to ride Dial-a-Ride, we are unable to offer her free rides while dad has the pass. On the other hand, if mother and the kids all want to go downtown at the same time, on a joint shopping-library trip, all may board the minibus on display of the unlimited service pass.

To order your family pass for November, simply fill out the coupon and attach a check, payable to Dial-a-Ride, in the amount of $10. That may well be Ann Arbor's leading bargain!

Dial-a-Ride
Ann Arbor Transportation Authority
5th Floor-City Hall
Ann Arbor, Michigan 48108

Enclosed please find check/money order for $10. Please send Dial-a-Ride unlimited service pass for month of November to:

Name_____

Street_____

Ann Arbor, Michigan 48103

Dial-a-Ride/AATA
5th Floor-City Hall
Ann Arbor, MI 48108

APPENDIX E

Daily Ridership

Total riders each day on Dial-A-Ride, September 22, 1971 through September 16, 1972

Week Beginning (Monday date)	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Week's Total
9-20	-	-	45	70	90	63	268
9-27	89	92	70	90	107	81	529
10-4	94	109	99	86	105	80	573
10-11	93	129	114	118	147	96	697
10-18	106	130	130	134	134	73	707
10-25	143	113	119	136	165	130	806
11-1	154	191	235	192	208	143	1123
11-8	199	222	219	207	221	162	1230
11-15	204	191	173	186	228	163	1145
11-22	200	193	200	Holiday	147	131	871
11-29	199	205	202	192	238	164	1200
12-6	213	208	208	199	209	155	1192
12-13	205	238	201	193	242	118	1197
12-20	216	185	170	128	97	Holiday	796
12-27	129	128	137	136	91	Holiday	621
1-3	191	195	194	192	201	102	1075
1-10	198	202	185	214	234	107	1140
1-17	238	232	207	233	250	89	1249
1-24	184	214	226	242	234	129	1229
1-31	226	194	188	220	212	119	1159
2-7	234	209	237	223	227	95	1225
2-14	203	229	209	199	209	113	1163

APPENDIX E
(continued)

Week Beginning (Monday date)	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Week's Total
2-21	174	225	208	228	223	111	1169
2-28	205	213	207	219	227	107	1178
3-6	185	202	204	183	209	95	1078
3-13	211	229	213	226	204	115	1198
3-20	227	202	215	218	201	111	1174
3-27	166	173	149	149	151	81	869
4-3	205	195	188	173	201	100	1062
4-10	194	182	210	181	195	109	1071
4-17	189	191	192	206	194	102	1074
4-24	183	204	190	170	175	90	1012
5-1	390	194	181	188	169	100	1222
5-8	177	201	184	177	170	103	1012
5-15	197	204	191	191	179	96	1058
5-22	172	180	179	181	186	85	983
5-29	Holiday	176	198	211	194	143	922
6-5	155	170	180	179	170	128	982
6-12	192	164	161	166	164	167	1014
6-19	149	155	164	210	176	137	991
6-26	192	178	167	181	154	57	929
7-3	118	Holiday	178	155	161	69	681
7-10	169	170	175	182	168	88	952
7-17	177	170	268	188	235	67	1105
7-24	158	169	178	162	137	72	876
7-31	170	184	182	173	131	80	920

APPENDIX E
(continued)

Week Beginning (Monday date)	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Week's Total
8-7	137	162	153	172	157	80	861
8-14	151	139	155	162	153	75	835
8-21	145	145	140	161	154	58	803
8-28	153	155	163	134	162	81	848
9-4	Holiday	218	205	213	223	123	982
9-11	254	203	263	234	270	90	1314

APPENDIX F

SURVEY METHODS AND FORMS

C.1 On-Board Surveys

Two on-board surveys were conducted in order to gain information about Dial-A-Ride passengers. During sample days, research assistants rode on the Dial-A-Ride vehicles and asked each passenger to fill out a questionnaire. Nearly every rider during the sample periods filled out a questionnaire, but each passenger filled out a questionnaire only once.

The first on-board survey was conducted January 27, 28 and 29, 1972, during the mid-winter period of heavy school ridership and bad weather. A second survey, employing the same questionnaire with modest refinements, was conducted June 22, 23 and 24, 1972. In both cases the three sample days were Thursday, Friday, and Saturday. Sample questionnaires from both surveys are included as Attachments F-1 and F-2.

Conditions in June differed from those in January in several important ways:

- No regular Slauson School runs were operating because of summer vacations.
- The University of Michigan was operating at a greatly reduced level of activity (summer term).
- The Lurie Terrace and Miller Manor Senior Citizen's apartments had been added to the service area.
- A larger number of destinations were available, with Westgate, Maple Village, and Veteran's Park available mid-day and on Saturday.
- An additional service area section of 2,050 households had been added June 1.
- Pleasant summer weather prevailed.

FIRST ON-BOARD STUDY FORM

ATTACHMENT F-1

Ann Arbor Dial-A-Ride On-Board Survey

Dear Rider: Please pardon the inconvenience; your help in answering the following questions will help us in improving and expanding Dial-A-Ride service. If you have already filled out one of these questionnaires on a previous ride, you need not do another. THANK YOU!

1. What is the purpose of your trip today? Please check one only, write in location.
   - ☐ To or from work at _____
   - ☐ To or from school at (name of school) _____
   - ☐ Shopping at _____
   - ☐ Personal business at _____
   - ☐ Social/recreational at _____
   - ☐ Other (please specify) _____

2. What other mode of transportation would you have used for this trip if Dial-A-Ride service was unavailable?
   - ☐ Auto driven by yourself
   - ☐ Auto driven by another household member, friend, or in car pool
   - ☐ Taxicab
   - ☐ Regular city bus
   - ☐ Walking
   - ☐ Would not have made this trip
   - ☐ Other (specify) _____

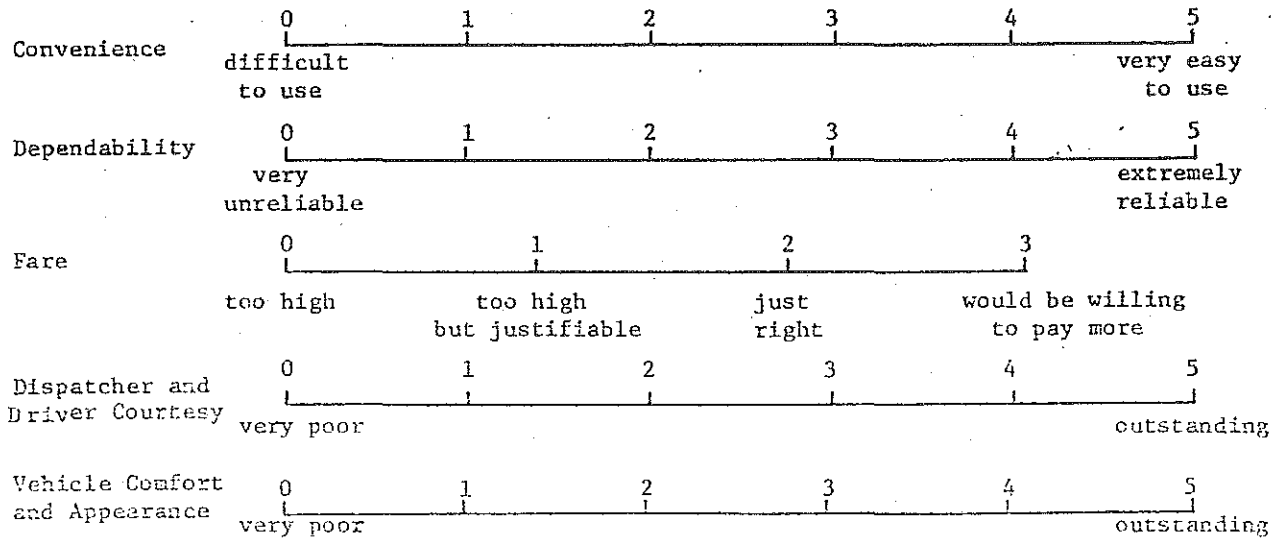
3. Will this be a round trip by Dial-A-Ride?
   ☐ Yes ☐ No The other portion of my trip is being made via _____(specify)

4. How frequently do you use Dial-A-Ride?
   - ☐ Everyday
   - ☐ At least once a week
   - ☐ Occasionally once or twice a month
   - ☐ This is my first trip

5. If you use Dial-A-Ride only infrequently, what influences you to use the service?
   - ☐ Bad weather
   - ☐ Only when car is not available
   - ☐ Other (Please specify) _____

6. Which one of these would be the single most important factor motivating you to use Dial-A-Ride more frequently?
   - ☐ Shorter waiting time after calling
   - ☐ More precise estimates of vehicle arrival by dispatcher
   - ☐ More available service points. Specifically, where? _____ (i.e., shopping centers, work places, etc.)
   - ☐ Other factor (please specify) _____
   - ☐ Shorter riding time-fewer detours for other passengers
   - ☐ Lower fare

7. How would you rate the Dial-A-Ride service? Place a circle at the point which best expresses your feeling.



8. How many cars available in your household? ☐ none ☐ one ☐ two or more

9. Do you have a driver's license? ☐ yes ☐ no

10. Sex: ☐ Male ☐ Female

11. Your address: _____(please include apart. no.)

12. Age: ☐ Under 18 ☐ 25-34 ☐ 45-54 ☐ 18-24 ☐ 35-44 ☐ 55-64

ATTACHMENT F-2

SECOND ON-BOARD STUDY FORM
Ann Arbor Dial-A-Ride On-Board Survey

Time_____

Dear Rider: Please pardon the inconvenience; your help in answering the following questions will help us in improving and expanding Dial-A-Ride service. If you have already filled out one of these questionnaires on a previous ride this week you need not do another. THANK YOU!

1. Home address:_____
2a. Trip origin:_____
2b. Trip destination:_____
3. What is the purpose of your trip today? Please check only one.

☐ Work
☐ School
☐ Shopping
☐ Personal business
☐ Social/recreational
☐ Other (specify):_____

4. What other mode of transportation would you have used for this trip if Dial-A-Ride service was unavailable?

☐ Auto driven by yourself
☐ Auto driven by another household member, friend, or in car pool
☐ Taxicab
☐ Regular city bus
☐ Walking
☐ Would not have made this trip
☐ Other (specify):_____

5. Will this be a round trip by Dial-A-Ride:

☐ Yes ☐ No
☐ Don't know

The other portion of my trip is being made via (specify):_____

6. How frequently do you use Dial-A-Ride?

☐ Everyday
☐ At least once a week
☐ Occasionally once or twice a month
☐ This is my first trip

7. Which one of these would be the single most important factor motivating you to use Dial-A-Ride more frequently?

☐ Shorter waiting time after calling
☐ More precise estimates for vehicle arrival by dispatcher
☐ Shorter riding time-fewer detours for other passengers
☐ Lower fare
☐ More available service points. Specifically, where?_____ (i.e., shopping centers, work places, etc.)
☐ Other factor (specify):_____
☐ No service improvement would make me use Dial-A-Ride more often.

8. How would you rate the Dial-A-Ride fare?

☐ Too high
☐ Too high, but justifiable
☐ Just right
☐ Would be willing to pay more

9. Method of fare payment:

☐ Cash ☐ Tickets ☐ Pass

10. How many cars do you have available in your household?

☐ None ☐ One ☐ Two ☐ Three or more

11. How many people in your household have driver's licenses?_____

12. Do you have a driver's license? ☐ Yes ☐ No

13. Sex: ☐ Male ☐ Female

14. Age: ☐ Under 16 ☐ 16-20 ☐ 21-24 ☐ 25-34 ☐ 35-44
☐ 45-54 ☐ 55-64 ☐ Over 65

C.2 Telephone Survey

In order to determine what could be improved in Dial-A-Ride service to promote greater repetitive ridership, a telephone survey was set up to contact one or two-time users, determine their reasons for dissatisfaction, and learn what could be done about it. The original target was to obtain a sample of 100 valid responses.

From the household log files, in which every Dial-A-Ride trip made between September 22 and December 18 was posted by household, a sample of 193 one and two-time users was drawn. The criteria for selection of these households was to look for one or two Dial-A-Ride trips between November 1 and December 18 (it was felt that those who used the service before November would have forgotten by February, when the survey was actually conducted).

A survey form was developed by the consultant, and trained interviewers were selected to do the telephoning. These interviewers had all gained considerable experience in both a home interview survey (not a part of the Dial-A-Ride program, but related research conducted in December, 1971), and the on-board survey conducted in January, 1972. They are affiliated with the University of Michigan Ph.D. Program in Urban and Regional Planning.

The first round of telephone interviews took place on Wednesday, February 9, in the evening. At a subsequent de-briefing, the interviewers expressed some dissatisfaction with the survey form. They seemed to feel that answers were too vague, and they were frustrated by a lack of ability to illicit responses indicating genuine dissatisfaction with Dial-A-Ride. Consequently, the second half of the form was revised to provide for tabulating responses more precisely, and to give interviewers three distinct chances to seek out negative feelings about Dial-A-Ride. A second round of telephone contacts, using the

revised form, took place on several subsequent evenings during the week of February 14. It was possible to re-classify all of the original survey forms into the format of the revised form, and thus utilize the first set of responses. The two survey forms used are included in this appendix as attachments F-3 and F-4.

ATTACHMENT F-3. ORIGINAL TELEPHONE SURVEY FORM

Telephone Survey for One and Two Time Users of Dial-A-Ride

Address _____ Household # _____

Family Name _____ Telephone # _____

Interviewer _____ Date/Time _____

Check: Did this household particpate in the home interview survey?

Area A, Unsurveyed (original service area) Area B, Unsurveyed (Nov. 1 additions)
Area A, Surveyed Area B, Surveyed

Record Dial-A-Ride use from household log:

Date	I/O	Non-Home Address	Comments/Spec. Data

1. "This is (your name) calling from the Ann Arbor Transportation Authority. Our records show that on _____ someone from your household used Dial-A-Ride service. Could I please speak with that party?"

   If possible, record identity of Dial-A-Ride user. _____
   Response: (check one)

   ☐ Party can be identified and is home. You now have desired person on telephone. ↓ ☐ Go to Question #2. ↓

   ☐ Party can be identified, but is not home. ↓ Call back at _____ and terminate.

   ☐ Refused
   ☐ Forgot
   ☐ No longer here ↓ Terminate interview

2. "Do you recall using Dial-A-Ride Service?
   Response: (check one)

   ☐ Yes (Go to Question #3) ↓

   ☐ No (Terminate interview)

ORIGINAL SURVEY FORM- PAGE TWO

3. "We are trying to improve our Dial-A-Ride service, and need your help. We were wondering what led you to try Dial-A-Ride once and discontinue your use?" (Let respondent talk; don't fish for answers unless there is no reaction to the question. If more than one reason, try to rank in order of importance. Don't try to fill in remainder of form until response is clear.)

Basic response:

☐ Not satisfied

Now check the reasons for dissatisfaction, ranking in order of importance.

☐ Poor service -- specifically:
- ☐ Wait time too long
- ☐ Ride time too long
- ☐ Didn't come when promised
- ☐ Didn't get to destination on time
- ☐ Dispatcher discourteous
- ☐ Vehicle shabby, uncomfortable

☐ Felt unsafe:
- ☐ Had accident ☐ Heard about accident

☐ Cost too much

☐ Service hours wrong:
- ☐ Need evening service
- ☐ Need Sunday service

☐ Doesn't go where I want to go:
- ☐ Westgate/Maple Village
- ☐ N. Campus/Research area
- ☐ Arborland
- ☐ Other, specify_____

☐ Don't like traveling with other people

☐ Absolutely prefer automobile and see no possibility of need for Dial-A-Ride type service

☐ Curiosity satisfied--no real need for Dial-A-Ride type service

☐ Other:_____

☐ Satisfied

Now check & complete one of these two categories:

☐ But will probably not use again because:

_____

_____

☐ Will use again on occasion.

"What circumstances might lead you to use Dial-A-Ride again? (Try to keep in order of importance.)

_____

_____

_____

_____

_____

When you are satisfied that the respondent has expressed his true feelings and you can categorize the response, terminate the interview:

"Thank you very much for your help. We will try to incorporate your suggestions into our operations."

ATTACHMENT F-4. REVISED TELEPHONE FORM

1. This is _____ calling for the Ann Arbor Transportation Authority. We're trying to contact Dial-a-Ride customers, to interview them briefly about their reactions to the service. Our records show that someone from your household used Dial-a-Ride on (dates). I wonder whether I might speak with that person.

[Correct R on phone] [Will get correct R]

(WHEN CORRECT R ON PHONE:)

This is _____ calling for AATA. We are trying to contact Dial-a-Ride customers, to interview them briefly about their reactions to the service. Our records show that someone from your household used Dial-a-Ride on (dates). I was told that you might be the person to interview. Is that correct?

[Correct R not available.]
[Call back at _____]
[Interview Refused]
[Correct R unknown or no longer available.]
TERMINATE

(NOW HAVE CORRECT RESPONDENT ON PHONE.)

2. First of all, were those your only Dial-a-Ride trips, or have you used it since then?

[Other trips]

[only trips]
GO TO QUESTION 4.

3. About how many times would you think you've used Dial-a-Ride since Christmas: once or twice, three to eight times, or as much as once a week or more?

[once or twice] [3 to 8 times] [once a week or more]

4. We are seeking information from people who have tried Dial-a-Ride and may be dissatisfiedd with the service. Could you please tell us whether there are any particular aspects of the Dial-a-Ride service that you have found unsatisfactory?

☐ Yes (Explain and rank, if possible -- use standard responses.)

_____

_____

_____

_____

_____

☐ No

5. "Is there some specific improvement in Dial-A-Ride which would induce you to use the service again or more frequently?"(Cross out one; use standard responses.)

_____

_____

_____

When you are satisfied that the respondent has expressed his/her true feelings, and you can categorize the response, terminate the interview.

"Thank you very much for your help. We will try to incorporate your suggestions in our future planning."

6. Now, categorize the general reponse as best you can and place this household in one of the following categories:

☐ Totally dissatisfied. Poor experience discouraged party from every trying again.

☐ Neutral (or even supportive) about Dial-A-Ride, but cannot perceive any possible future need for service. (Auto satisfies virtually all travel needs.)

☐ Moderately dissatisfied, (or even supportive) but might use again, under extreme circumstances (i.e., automobile disabled.)

☐ Dissatisfied with service but continuing to use on irregular basis.

☐ Satisfied with service, will use again on irregular basis.

☐ Satisfied, has become regular user.

APPENDIX G

STATISTICAL ANALYSIS OF WAITING AND RIDING TIMES

1. Analysis of Wait Time

262 out of 1,223 observations of waiting time were zero. This is 21.4%, implying a 21.4% overall probability of a zero wait (P_{zero}). The variable W1 includes all 1,223 observations. The variable W6 includes only non-zero times and also excludes one observation of 89 minutes from WG/MV. This was done in order to obtain a distribution which would be more conducive to parametric analysis.

2. Tests for Normality of Waiting Time Distribution

Two measures of deviation from normality were calculated. The first was a measure of skewedness given by the formula:

$$\Sigma \frac{X_i - \overline{X}^3}{S} \quad N$$

This value for W6 was 1.3133, and the attained level of significance for the hypothesis that SKEW6 = 0 was computed to be .0000. The normal distribution would be indicated by a score of zero, and since the value is positive it indicates the distribution is skewed right. A second measure of deviation from normality is kurtosis, a measure of the height of the tails of the distribution, given by the formula:

$$\Sigma \frac{X_i - \overline{X}^4}{X} \quad N$$

This value for W6 was 5.6279. The height of the tails of a normal distribution is three. The attained level of significance for the hypothesis that KURT6 = 3 was computed to be .0608, indicating a low probability of normal distribution, because the tails of the distribution are too high.

3. Stratification by Non-Home Trip End

Variable	N	Stratum	Mean	Standard Deviation	Standard Error of Mean	Stratified by
						Non-Home Trip End
W1	765	1	8.7516	7.3702	.26657	Downtown
W6	647	1	10.348	6.0965	.27152	Downtown
RIDETIME	765	1	12.083	5.1033	.18451	Downtown
		P_{zero}=.154				
W1	241	2	9.8942	8.1939	.52781	Hospital/University
W6	212	2	11.248	7.8149	.53673	Hospital/University
RIDETIME	241	2	14.884	5.4676	.35220	Hospital/University
		P_{zero}=.120				
W1	151	3	4.0596	6.9678	.56703	Slauson
W6	50	3	12.260	6.7848	.95951	Slauson
RIDETIME	151	3	13.801	5.5738	.45359	Slauson
		P_{zero}=.669				
W1	20	4	24.500	22.056	4.9319	WG/MV
W6	17	4	23.588	15.549	3.771	WG/MV
RIDETIME	20	4	9.200	3.4428	.76983	WG/MV
		P_{zero}=.100				
W1	46	5&6	5.8478	6.1499	.90675	Circ. + ISA
W6	34	5&6	7.9118	5.8949	1.0110	Circ. + ISA
RIDETIME	46	5&6	6.1522	3.0182	.44501	Circ. + ISA
		P_{zero}=.261				
W1	66	4-6	11.500	15.588	1.9188	WG/MV + Circ. + ISA
W6	51	4-6	13.137	12.490	1.7490	WG/MV + Circ. + ISA
RIDETIME	66	4-6	7.0758	3.4298	.42218	WG/MV + Circ. + ISA
		P_{zero}=.212				
W1	217	3-6	6.3226	10.891	.73931	Slauson+WG/MV+Circ+ISA
W6	101	3-6	12.703	10.037	.99877	Slauson+WG/MV+Circ+ISA
RIDETIME	217	3-6	11.756	5.8934	.40007	Slauson+WG/MV+Circ+ISA
		P_{zero}=.529				
W1	1223	None	8.5458	8.3292	.23817	All Destinations Comb.
W6	960	None	10.794	7.5258	.24290	All Destinations Comb.
RIDETIME	1223	None	12.577	5.4420	.15561	All Destinations Comb.
		P_{zero}=.214				

4. Stratification by Direction

Variable	N	Stratum	Mean	Standard Deviation	Standard Error of Mean	Stratified by
						Direction
W1	593	1	9.5337	7.7566	.31853	Inbound
W6	504	1	11.217	7.2034	.32086	Inbound
RIDETIME	593	1	12.764	5.0144	.20592	Inbound
		P_{zero}=.150				
W1	564	2	7.1613	7.4357	.31310	Outbound
W6	405	2	9.9728	6.9959	.34763	Outbound
RIDETIME	564	2	13.024	5.7182	.24078	Outbound
		P_{zero}=.282				
W1	13	3	23.462	15.565	4.3421	To WG/MV
W6	12	3	25.417	14.600	4.2148	To WG/MV
RIDETIME	13	3	8.6154	3.4044	.94420	To WG/MV
		P_{zero}.077				
W1	7	4	26.429	32.305	12.210	From WG/MV
W6	5	4	19.200	18.620	8.3271	From WG/MV
RIDETIME	7	4	10.286	3.4983	1.3222	From WG/MV
		P_{zero}=.143				
W1	37	5	5.9459	6.2670	1.0303	Circulation
W6	27	5	8.1481	5.9788	1.1506	Circulation
RIDETIME	37	5	6.5135	3.1677	.52077	Circulation
		P_{zero}=.2702				
W1	9	6	5.4444	5.9815	1.9938	ISA
W6	7	6	7.0000	5.9161	2.2361	ISA
RIDETIME	9	6	4.6667	1.7321	.57735	ISA
		P_{zero}=.222				

5. Tests for Normality of Riding Times

Ride Time - distribution

$$\Sigma \frac{X_i - \bar{X}}{S}^3 \quad N = .7777 = SKEW2$$

Attained level of significance ($\hat{\alpha}$) for H:SKEW2 = 0 is .0001

RIDETIME is skewed right

$$\Sigma \frac{X_i - \bar{X}}{S}^4 \quad N = 4.0497 = KURTZ$$

for H:KURTZ = 3; $\hat{\alpha}$ = .0000

The tails are too high for a normal distribution

6. Stratification by Sampling Period

Variable	N	Stratum	Mean	Standard Deviation	Standard Error of Mean	Stratified by
						Sampling Period
W1	191	1	6.1990	6.2645	.45329	Oct. 15-19, 1971
W6	142	1	8.3380	5.9093	.49590	Oct. 15-19, 1971
RIDETIME	191	1	11.047	4.3131	.31209	Oct. 15-19, 1971
		P_{zero}=.257				
W1	174	2	10.718	8.7572	.66388	Dec. 10, 1971
W6	150	2	12.433	8.2205	.67120	Dec. 10, 1971
RIDETIME	174	2	13.569	6.3948	.48479	Dec. 10, 1971
		P_{zero}=.138				
W1	186	3	7.9516	8.3480	.61211	Feb. 18, 1972
W6	123	3	12.024	7.5035	.67657	Feb. 18, 1972
RIDETIME	186	3	13.543	6.4524	.47311	Feb. 18, 1972
		P_{zero}=.339				
W1	131	4	6.9580	7.2804	.63609	May 30, 1972
W6	88	4	10.358	6.6015	.70373	May 30, 1972
RIDETIME	131	4	12.901	5.3398	.46654	May 30, 1972
		P_{zero}=.328				
W1	400	5	9.0225	8.9084	.44542	June 1, 6 & 7, 1972
W6	328	5	10.732	7.5278	.41565	June 1, 6 & 7, 1972
RIDETIME	400	5	12.551	4.9059	.24530	June 1, 6 & 7, 1972
		P_{zero}=.178				
W1	141	6	9.9504	8.4374	.71056	Aug. 30 & 31, 1972
W6	129	6	10.876	8.2291	.72454	Aug. 30 & 31, 1972
RIDETIME	141	6	11.922	5.1424	.43306	Aug. 30 & 31, 1972
		P_{zero}=.085				

All programs run on University of Michigan terminal system, MIDAS STATISTICAL PACKAGE. Printouts of all runs on file with project consultant.

APPENDIX H

Weekday Productivity by Week, Total Project Duration

Week Beginning (Monday Date)	Mean Weekday Productivity
9-20	2.0 Estimate
9-27	2.74
10-4	3.90
10-11	4.63
10-18	5.55
10-25	4.39
11-1	5.98
11-8	6.56
11-15	5.89
11-22	6.09
11-29	6.95
12-6	7.21
12-13	7.44
12-20	6.28
12-27	5.52
1-3	6.82
1-10	7.51
1-17	8.25
1-24	8.10
1-31	7.44
2-7	8.17
2-14	7.56
2-21	7.59
2-28	7.82
3-6	7.27
3-13	8.00
3-20	7.72
3-27	6.34
4-3	7.01
4-10	6.92
4-17	6.74
4-24	6.47
5-1	6.97
5-8	6.27
5-15	6.67
5-22	6.11
5-29	5.94
6-5	7.04
6-12	5.59
6-19	5.08
6-26	5.32
7-3	4.57
7-10	5.15
7-17	6.48
7-24	4.76

APPENDIX H
(continued)

Week Beginning (Monday Date)	Mean Weekday Productivity
7-31	5.18
8-7	5.80
8-14	4.58
9-21	5.63
8-28	4.63
9-4	6.41
9-11	7.25

APPENDIX I

REFERENCE DOCUMENTS

Ann Arbor-Ypsilanti Urban Area Transportation Study. Preliminary Report - Volume I, prepared by the Planning Division, State of Michigan Department of Highways. December 1, 1966.

Guide for Change. City Planning Department, Ann Arbor, Michigan. Originally published May, 1969; updated and revised April, 1971. (This document serves as an instrument for preliminary review and discussion of the concepts and proposals scheduled for incorporation into the finally approved city plan.).

A Survey of Bus Passengers. By Dr. Lewis Mandell, May, 1970. (This survey provides baseline data on the demographic profile of line bus riders at that time.)

Ann Arbor Dial-A-Ride Program: Proposed Summer Experiment. Prepared by Transportation Research and Planning Office, Ford Motor Company, June 27, 1970. (This was the very first proposal for implementation of a pilot Dial-A-Ride project, to be conducted in Ann Arbor's Model Neighborhood area. The Ann Arbor Transportation Authority, City Officials, and Model Neighborhood Governing Board were unable to come to agreement and the proposal was never implemented.)

A Status Report to the Ann Arbor Transportation Authority. Transmitted by Transportation Research and Planning Office, Ford Motor Company, May 3, 1971. (Summarizes work done between January 28, 1970 and April 30, 1971, by Transportation Research and Planning Office on behalf of the Ann Arbor Transportation Authority.)

Application for Financial Assistance. Submitted to the State of Michigan, Department of Commerce, Bureau of Transportation. Submitted to the Ann Arbor Transportation Authority, May 1, 1971. (This is the formal proposal which resulted in the project being funded and undertaken.)

Public Transportation Grant Contract Between the Ann Arbor Transportation Authority and State of Michigan. August 6, 1971. (Final contract guiding execution of project, including detailed budget.)

General Work Program: Ann Arbor, Michigan Dial-A-Ride System. August 11, 1972. (Discusses in detail the objectives, scope of work, service description, system design, and system evaluation procedures for Phase I of the pilot program.)

Ann Arbor Dial-A-Ride: Phase II Work Program. May 3, 1972. (Describes changes to be implemented in Phase II of the pilot program, based upon Phase I experience and anticipated summer ridership decline.)

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Dial-A-Ride Operations. By Tom Urbanik, Department of Traffic Engineering and Transportation, Ann Arbor, Michigan. June, 1972. (This paper was presented at the Third Annual Conference on Demand Responsive Transportation Systems, held in Ann Arbor on June 12, 13, and 14, 1972. The paper summarizes Phase I results for the pilot project.)

Defending the Legality of the Ann Arbor Dial-A-Ride System. By Jerold Lax, City Attorney, presented at the Third Annual Conference on Demand Responsive Transportation Systems, June, 1972. (This paper details the legal actions taken by the local taxicab industry to prevent Dial-A-Ride from operating, and the resulting successful defense of the Dial-A-Ride system by the City Attorney. So far as is known, this court action is the only actual data available on the legal defense of Dial-A-Ride.)

Eleven Interim Reports covering all aspects of the pilot project were prepared during the year by the consultant and circulated to those associated with the program. These reports were never formally published. Their total content is incorporated in the Final Project Report.

Proposal for an Expanded Community-Wide Public Transportation System. Prepared for the Ann Arbor City Council and the Citizens of Ann Arbor, by the Ann Arbor Transportation Authority. January 18, 1973. (This document is, in one sense, the "outcome" of the one year pilot project. A comprehensive proposal for a community wide system combing neighborhood Dial-A-Ride service and express trunk lines connecting major activity centers is presented.)

Public Response to an Innovative Public Transit System (tentative title). By Michael J. Berla, Ph.D. Thesis in preparation for submission to University of Michigan Urban and Regional Planning Program: A study of the motivations for use and support of the Ann Arbor Dial-A-Ride pilot project among the public in the city's Fourth Ward.

In addition to the above listed reference documents, the Authority's consultant prepared a series of interim reports on various subjects as the project proceeded. In some cases, the data reported was not final, and updated information has been used here in the final report - hence, there are some disagreements in information reported earlier and that reported in the body of this text. A listing of the interim reports follows:

	Subject	Date
1.	December Pass Renewals	December 15, 1971
2.	Intensive Monitoring Periods #1 & #2 (Waiting & riding times, productivity)	December 15, 1971
3.	13 Week Ridership (September 22 thru December 18 inclusive)	January 25, 1972

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	Subject	Date
4.	Tabulation of (January) on Board Survey Results	February 2, 1972
5.	13 Week Productivity Analysis	February 11, 1972
6.	11 Week Ridership and Revenue Analysis (December 20, 1971 thru March 4, 1972)	March 10, 1972
7.	Intensive Monitoring Periods #1, #2, #3 (waiting and riding times)	March 20, 1972
8.	Telephone Survey Results (frequency of use)	April 17, 1972
9.	Initial (home interview) Survey Data	April 2, 1972
10.	Ridership, Revenue, Origin/Destination Patterns, Waiting/Riding Times, Dwell Times, and Analysis of "free day" - (period March 6 - June 3, 1972)	June 21, 1972
11.	On-board Survey Tabulations (January survey and June survey compared)	August 15, 1972

In all cases, material presented in these interim reports is included in the final report. Photocopies of interim reports are available from the consultant, Ford Motor Company, Transportation Research & Planning Office, at cost of reproduction.