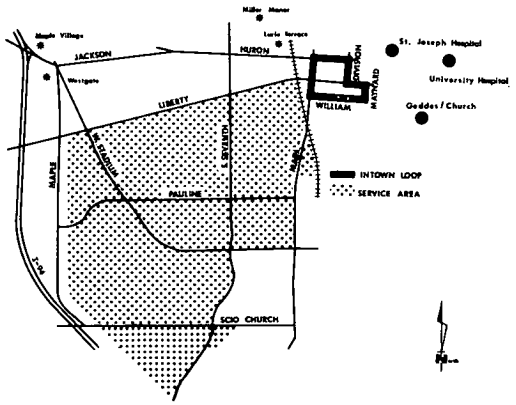
DIAL-A-RIDE PROJECT IN ANN ARBOR: DESCRIPTION AND OPERATION

Thomas Urbanik, II
Dial-A-Ride Project Coordinator, Ann Arbor Department of Traffic Engineering and Transportation

The purpose of the Ann Arbor dial-a-ride project is to test the market response and economic viability of door-to-door, dynamically routed and scheduled public transportation in a Michigan community. The project is sponsored by the Michigan Department of Commerce, Bureau of Transportation, and the Ann Arbor Transportation Authority (AATA). The Transportation Research and Planning Office of the Ford Motor Company is technical consultant.

This report describes the project and gives a summary of the operation from September 20, 1971, to February 29, 1972. The information was assembled by the consultant and project staff.

Figure 1. Service area.



SERVICE

The residential service area (Fig. 1) contains approximately 3,300 households. Within this service area, customers may request doorstep service by telephoning the dispatch center. The primary downtown destination points to be served have been organized into a loop. Passengers may request pickup or delivery at any point along the loop. At the 2 extremes of the loop, key points have been established where there are free direct telephones to the dispatch center. The loop is merely a convenient way to provide a many-to-few mode of operation. Vehicles can enter the loop at any point and, in actuality, rarely complete a trip around it.

In addition, service is provided to the University of Michigan, St. Joseph's Hospital, and University Hospital. At the dispatcher's option, callers are provided point-to-point service within the residential service area.

The service hours are from 6:30 a. m. to 6:00 p. m., Monday through Friday, and from 8:00 a. m. to 6:00 p. m. on Saturday. There are a maximum of 3 vehicles in service; the number is set according to the demand.

The fare structure is 60 cents cash (exact fare) for a 1-way trip. Tickets may also be purchased in strips of 10 for $5. A $15 unlimited-use pass is available for a calendar month. Any number of members of a family may travel between the same 2 points on 1 pass. A special unlimited-use pass that is good only between 9:00 a.m. and 3:00 p.m., Monday through Friday, and all day Saturday is available for $10.

VEHICLES

The entire dial-a-ride fleet consists of existing vehicles from the AATA fleet except for a Ford Courier (10-passenger van with roof conversion to provide a stand-up interior) on loan from Ford's Transportation Planning and Research Office. The other 2 vehicles making up the basic 3-vehicle fleet are 1969 Ford club wagons (school bus package) that were refurbished and repainted for dial-

a-ride service. As many as 3 GMC 3301, 28-passenger vehicles have been used as backup vehicles for breakdowns or accidents.

COMMUNICATIONS

The dial-a-ride system shares the existing AATA radio channel and transmitter. All equipment is from existing inventory. The radio frequency is 44,520 MHz (low band) and suffers skip from distant stations during summer months. The telephone communication consists of 3 public lines (group hunt) and 2 direct lines servicing the 2 free telephones previously mentioned. These lines are in addition to 3 existing for the regular AATA service.

CUSTOMER SERVICE

The dispatcher answers all incoming telephone calls and records the following information: time of call, pickup address or point, and delivery address or point. The dispatcher then gives the customer an estimate of the pickup time. For walk-in customers, the driver radios the information given above to the dispatcher so that a complete record is made of each vehicle tour.

At all times, there is only 1 dispatcher on duty. During peak times, the head dispatcher for the line-bus operation answers the phone and places the customer on hold for servicing by the dial-a-ride dispatcher.

DISPATCHING SYSTEM

The central concept in dispatching the Ann Arbor dial-a-ride system is the vehicle tour. The tour beings when the dispatcher radios a driver and gives the driver a sequenced list of pickups in the service area.

During times of heavy demand, the dispatcher may transmit an unordered list.

When he arrives at the downtown loop, the driver calls the dispatcher. (The point of entering the loop is usually determined by the driver unless he is previously instructed by the dispatcher.) The driver circulates on the downtown loop (or executes the hospital and university leg), simultaneously dropping off inbound passengers and picking up outbound passengers according to the list of stops transmitted by the dispatcher. The driver radios the dispatcher when he leaves the loop.

All outbound distributions are performed in sequence so that an outbound subtour is completed at the farthest point in the service area from downtown. No passengers are picked up until all passengers are dropped off. The driver radios the dispatcher after all passengers are dropped off. If there is insufficient demand to dispatch another tour, the driver is instructed to park either in the service area or downtown depending on anticipated demand.

RIDERSHIP

During the 24-week period from Wednesday, September 22, 1971, through Saturday, March 4, 1972, 23,541 passenger trips were provided. Total weekly ridership has exceeded 1,200 trips 5 times during this period; the average for the last 11 weeks was 1,176. Weekday ridership has leveled off at approximately 214 trips per day, and Saturday ridership has declined to 108 trips from a preholiday average of 148. (Standard deviation of week total is 53 trips; standard devia-

tion of mean weekday average is 18 trips.)

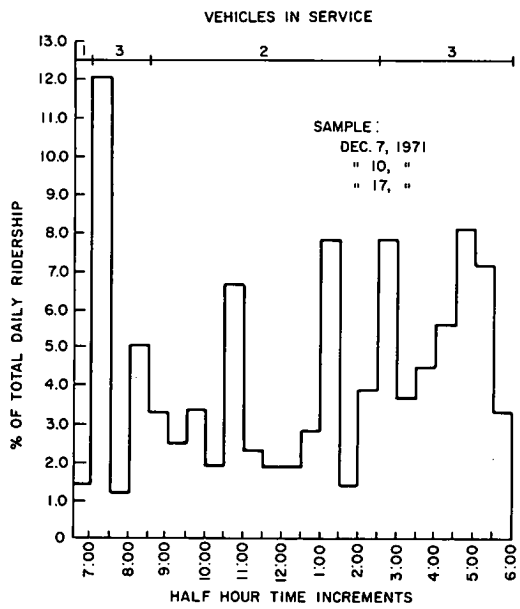
Day of week trends have been established as follows (days do not include Thanksgiving, Christmas, and New Year's Day):

Day	Percent
Monday	17.3
Tuesday	17.8
Wednesday	17.5
Thursday	17.5
Friday	19.0
Saturday	10.9

Figure 2 shows the hourly demand pattern experienced on 3 typical days in December. The times are when service was requested and not when passengers were picked up; therefore, some smoothing of peaks in actual service is experienced. The dominant morning peak reflects travel to work and to Slauson Junior High School. The 10:30 to 11:00 a.m., 1:00 to 1:30 p.m., and 4:30 to 5:00 p.m. peaks result from Slauson School shift changes. Rationale for the assignment of 2 vehicles from 8:30 a.m. to 2:30 p.m. is clear from the data shown in this figure.

Table 1 gives the daily ridership total since the project began. Through December 18, 1971, 822 households have used the dial-a-ride service at least once, accounting for a "penetration" of approximately 25 percent. Throughout that period, new households were trying the service at the rate of approximately 63 per week (11 per day average). Although household use has not been tabulated subsequent to December 18, it is almost certain that by February 29, 1972, more than 1,000 households, or fully one-third of those eligible, have used dial-a-ride service at least once. However, most of these households are infrequent users.

Figure 2. Hourly demand.



TRIP GENERATORS

Approximately 93 percent of all dial-a-ride trips are to or from points on the downtown loop, the hospitals, or the university area. The remaining 7 percent are intraservice area trips such as from one address to another. The relative popularity of the several destination points available to dial-a-ride users is approximately as follows:

Point	Percent
Downtown loop	67
Slauson Junior High School	17
Hospitals	12
East University stops	4

REVENUE

Table 2 gives a summary of revenue and ridership for the 5 pass periods since the beginning of the project. Also given are average pass fare, as derived from pass ridership and pass revenue, and average fare for all users. The pass charge was $10 per month through January; it was increased to $15 per month in February.

Even though the December ridership was lower than that for November, the revenue was higher. This is because more passes were sold, but were used less, and because more rides were paid for with cash. Revenues for January and December were about the same, but January ridership was higher, making a lower average fare. The February revenue was $300 higher than that for January, but the ridership was almost the same.

The revenue increase resulted from the higher pass cost. Although pass sales reached a peak of 92 in January, the pass revenue peaked at $1,110 during February. The increased pass cost appears to have caused some users to switch from pass to ticket or cash fares. The increased pass cost raised the average fare from a low of 40.4 cents during the first pass period to 49.4 cents during February. The increase was due in part to fewer rides per pass. During the first period there were 38.9 rides per pass, but there were only 34.4 during the February pass period.

SERVICE TIMES

Detailed time studies have been conducted on 4 separate occasions; results are given in Table 3. Ridership for the

Table 1. Daily ridership.

Week Beginning	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	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	1,123
11-8	199	222	219	207	221	162	1,230
11-15	204	191	173	186	228	163	1,145
11-22	200	193	200	–[a]	147	131	871
11-29	199	205	202	192	238	164	1,200
12-6	213	208	208	199	209	155	1,192
12-13	205	238	201	193	242	118	1,197
12-20	216	185	170	128	97	–[a]	796
12-27	129	128	137	136	91	–[a]	621
1-3	191	195	194	192	201	102	1,075
1-10	198	202	185	214	234	107	1,140
1-17	238	232	207	233	250	89	1,249
1-24	184	214	226	242	234	129	1,229
1-31	226	194	188	220	212	119	1,159
2-7	234	209	237	223	227	95	1,225
2-14	203	229	209	199	209	113	1,162
2-21	174	225	208	228	223	111	1,169
2-28	205	213	207	219	227	107	1,178

[a]Holiday.

study dates was as follows:

Date	Number
10-15 and 10-19	277
12-10	209
2-18	209

Table 2. Monthly revenue and ridership.

Type of Fare	Month	Revenue (dollars)	Riders		Avg Fare (cents)
			Number	Percent	
Pass	September-October	480	1,867	52.1	25.7
	November	813	2,664	55.8	30.5
	December	882	2,399	52.2	36.8
	January	920	2,781	56.5	33.1
	February	1,110	2,546	51.5	43.6
	Total	4,205	12,257	53.8	34.3
Cash	September-October	835	1,392	38.9	
	November	1,033	1,722	36.1	
	December	1,098	1,830	39.7	
	January	1,040	1,734	35.3	
	February	1,046	1,744	35.5	
	Total	5,052	8,422	37.0	
Ticket[a]	September-October	131	262	7.3	
	November	154	308	6.5	
	December	148	297	6.4	
	January	162	323	6.6	
	February	268	536	10.9	
	Total	863	1,726	7.6	
Other[b]	September-October		59	1.6	
	November		79	1.6	
	December		76	1.6	
	January		81	1.6	
	February		81	1.6	
	Total		376	1.6	
Total	September-October	1,446	3,580		40.4
	November	2,000	4,773		41.9
	December	2,128	4,602		46.2
	January	2,122	4,919		43.1
	February	2,424	4,907		49.4
	Total	10,120	22,781[c]		44.4

[a]Used by customers. Through observation period, 83 percent of tickets sold were actually redeemed; therefore, revenue from ticket sales was higher than amount shown.
[b]Not accounted for in other fare types. Number was tabulated precisely during first month and that same percentage was used for other months.
[c]Does not agree with total of 23,541 because 4 days (March 1 through 4) are not included.

In general, service, as measured by service times, improved between December 10, 1971, and February 18, 1972. Most notable improvements were the reductions in average times and variances of inbound waiting, inbound riding, and total inbound travel. The inbound service improved to both the downtown loop and the hospital-university area. There has been some deterioration in service times for outbound travel from downtown, but outbound service times from the hospital-university area have improved.

PRODUCTIVITY

The productivity of equipment and labor used in a dial-a-ride system is the most important determinant of cost per ride for a given set of prevailing local conditions. Productivity depends on overall demand levels, demand density (passengers requesting service in a given area), service area density and network, and characteristics of the dispatching system.

Typical system productivity for February ridership levels was as follows:

Item	Amount
Vehicle-hours/day	27.2
Labor-hours/day	
Driver, regular	27.7
Driver, overtime	1.5
Dispatcher	12.0
Total	41.2
Average passenger trips served	214
Passengers per vehicle-hour	7.85
Passengers per driver-hour	7.40
Passengers per dispatcher-hour	17.8
Passengers per labor-hour	5.20

During the period from 4:30 to 6:00 p. m. on high demand days, average productivity often reaches 10 to 11 per hour. Although the question of ultimate system capacity remains unanswered, there is no doubt that a potential for growth exists during many of the midday hours. The problem is one of maintaining service times. During busy hours, stops are closer together, and consequently a given vehicle may serve more calls per hour than during periods of slack demand. Productivity could be increased during slack hours only by forcing longer waiting and riding times for the users during that period. Therefore, an increase in off-peak demand appears to be a highly desirable goal to build productivity levels.

The degree of ride sharing achieved in the Ann Arbor dial-a-ride system has resulted in an average of 5.25 passengers/vehicle-tour. A detailed analysis of tour times has allowed the development of a simple linear relation for tour times, which is statistically significant (R^2 = 0.805 for inbound tours and 0.710 for outbound tours) at the 1 percent confidence level and is accurate within ±12 min in more than two-thirds of the cases studied.

$$T = 25.36 \text{ min} + (3.17 \text{ min} \times N_I) + (2.15 \text{ min} \times N_O)$$

where

T = tour,
N_I = number of inbound stops, and
N_O = number of outbound stops.

The tour times calculated by this equation will be valid for the present demand density. However, the objective of increasing demand and thus reducing distance between stops will force a recalibration of the coefficients.

SURVEY OF CUSTOMER REACTION

Two separate surveys have been conducted to measure customer reaction to dial-a-ride service. The first was a 3-

Table 3. Time study results.

Direction	Date	Observations	Wait Time		Ride Time		Total	
			Minutes	S. D.	Minutes	S. D.	Minutes	S. D.
To downtown	10-15 and 10-19	80	8.0	6.2	11.2	4.0	19.2	6.8
	12-10	51	11.5	8.3	14.9	5.1	26.4	8.7
	2-18	45	9.9	7.9	11.7	4.0	21.5	8.4
From downtown[a]	10-15 and 10-19	101	5.0	6.1	11.7	4.3	16.7	7.2
	12-10	45	10.1	10.2	13.0	4.9	23.1	12.2
	2-18	42	11.8	8.3	15.2	8.4	27.1	10.8
To hospital-university	10-15 and 10-19[b]							
	12-10	14	16.1	10.0	18.4	8.1	34.5	9.1
	2-18	23	9.1	7.4	15.0	4.6	24.1	8.5
From hospital-university[a]	10-15 and 10-19[b]							
	12-10	8	9.8	7.2	21.1	9.8	30.9	9.4
	2-18	15	10.1	9.8	17.0	6.7	27.1	11.9

Note: Service times are not weighted by multiple calls for the same trip. Each datum is an observation of waiting, riding, and total travel time for a specific pickup and delivery address, independent of multiple riders; i.e., service times for 2 persons traveling together are recorded once, not twice.

[a]October waiting times are not properly shown because direct phones were not in and many persons did not call ahead. "Walk-ons" and "hail stops" were recorded as 0 wait times.
[b]Service not operating.

day on-board survey in which 298 valid returns were obtained. The second was a telephone survey of households who used dial-a-ride service only once or twice during the first 3 months to determine what improvement might induce these occasional users to use the service more frequently. In addition to these surveys, others have been conducted by Berla and are reported in the next paper in this Special Report.

General information obtained in the surveys is given in Table 4. Because of the great concern over irregular riders, all surveys contained questions designed to urge service area residents to "sound off" about dial-a-ride service. In general, it has been rather difficult to elicit any negative remarks about the service. People who have never used the service or who have stopped using it were asked, What aspect of dial-a-ride service has not been attractive or satisfactory to you? Users were asked, What improvement in dial-a-ride service would encourage you to use it more frequently? The number of respondents and their responses are are given in Tables 5 and 6.

The responses indicate that waiting time is the most critical variable from a user's point of view. A greater variety of available destinations seems to be the

Table 4. Characteristics of users and their travel.

Item	Percent
Trip purpose	
Work	35
Shop or personal business	33
School	23
Other	9
Former mode	
Automobile	50
Walk	19
City bus	13
Induced travel[a]	5
Other	13
Ride once a week or less	55
Ride one-way only	50
Automobiles/household	
None	8
One	47
Two or more	45
Licensed drivers	56
Men	69
Women	31
Age	
Under 18	39
25 to 34	21
Over 65	1

[a]Trips that were not made before and would not have been made had dial-a-ride service not been available.

Table 5. Number of survey respondents.

Survey	Respondents				
		Percent		To Service Questions	
	Number	Users	Nonusers	Number	Percent
On-board	298	100		255	86
Telephone	102	52	48	36	35
Home interview					
Users	204			111	55
Nonusers	463			99	21

Table 6. Percentage of respondents and responses regarding service improvement.

Response	On-Board Survey	Telephone Survey	Home Interview Survey	
			Users	Nonusers
Shorter wait times; more accurate wait-time prediction	38.0	19.5	0	0
More available destinations	22.2	25.0	62.2	49.5
Lower fare; ability to make change	23.2	11.1	18.0	12.1
Shorter ride time	10.9	11.1	0	0
Extended service hours	0	8.3	9.9	11.1
More inconvenient than automobile	0	11.1	9.0	14.1
Other	5.7	13.9	0.9	13.2

single improvement that would induce nonusers to try dial-a-ride or to encourage occasional users to travel more frequently. Lower fares are simply not a realistic option at this point (from an Ann Arbor Transportation Authority policy point of view). Experience with extended service hours on Friday evening has shown that ridership response is not adequate to cover costs, at present budget levels.

Table 7 gives the results of a telephone survey that was conducted to determine why persons who tried dial-a-ride only once or twice did not ride again. This survey showed that only 3.9 percent of the respondents had had a bad service experience; conversely, more than half of them used dial-a-ride again, and 8.8 percent have become regular users. The problem identified by this survey is that most families view dial-a-ride as a back-up or secondary mode of transportation that is used only when the automobile is not available. No evidence indicates that poor service is responsible for the relative infrequent use most families make of dial-a-ride. This type of attitude toward public transportation is impossible to address at the operating level and must be approached as a long-range policy and educational issue by the Ann Arbor Transportation Authority.

Table 7. Responses regarding user's experience with service.

Response	Respondents (percent)
Totally dissatisfied and will not use again	3.9
Neutral or supportive but automobile satisfies travel needs and cannot perceive of any possible future need for service	18.6
Only moderately dissatisfied or supportive and might use again under extreme circumstances, i.e., if automobile is disabled	15.7
Dissatisfied with service but use on irregular basis	0.0
Satisfied with service and use on irregular basis	52.0
Satisfied and use regularly	8.8
No response	1.0

As part of the research conducted by Berla, 886 citizens in the city's fourth ward (which is included in the dial-a-ride service area) were asked to express their attitudes toward public transport. The following responses were made to the question, Do you agree or disagree that Ann Arbor really does not need a public transit system?

Response	Percent
Disagree strongly	75
Disagree somewhat	13
Disagree somewhat and agree somewhat	5
Agree somewhat	2
Agree strongly	3
Do not know or no answer	1

They were then asked how transit service could best be improved in Ann Arbor and responded as follows:

Response	Percent
Improve bus lines	8
City-wide dial-a-ride only	25
Combined dial-a-ride and line service	61
No bus service	1
Other, such as rapid transit	3
Do not know	2

There appears to be substantial support for public transport in general and for dial-a-ride in particular. The Ann Arbor Transportation Authority can be encouraged by this result and should develop policies that will turn this general support into ridership on the system.