MICHIGAN DEPARTMENT
OF
STATE HIGHWAYS AND TRANSPORTATION

AN OPERATIONS EVALUATION OF A ZONE DIAL-A-RIDE IN A MID-MICHIGAN COUNTY

MARCH 1978

By

Bureau of Urban and Public Transportation
Bus Transport Division
Bus Development Section

STATE HIGHWAY COMMISSION

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I. INTRODUCTION

Midland County is, in land area, a "typical" sized Michigan County (520 square miles). With respect to population density, however, Midland ranks eighteenth of the 83 Michigan Counties with 123 persons/square mile. Estimated occupied households in 1975 were 22,124, roughly half of which are in the City of Midland. Total 1975 population for the County was roughly 68,000, half of whom reside in an urban setting (Midland City).

The demographics of Midland City heavily bias any statistics generated for the county. For instance, estimated median family income for the city in 1969 was $13,428 while the same measure taken for the county as a whole shows median income to be $11,618. This city median income is the tenth highest of all Michigan cities of consequence in size (i.e., 2,500 inhabitants or more). Average weekly earnings in 1974 for the County as a whole were the highest of all Michigan counties.

The City of Midland, which is the county seat, itself occupies 30 square miles of the county and is located in the east central section, 20 miles west of Saginaw Bay in Michigan's lower peninsula. The major employer of the area, Dow Chemical Corporation, owns 25 percent of land within the city limits. Dow and other ancillary heavy and light manufacturing firms are the lifeblood of Midland County; the economic importance of manufacturing with respect to total employment was the highest of all Michigan counties in 1973 with nearly half of total employment in manufacturing. Midland, unlike its neighbors to the west and southwest, is not heavily agricultural and employment in the county is the "least supported," by the governmental function of all Michigan counties.

The area is served by Tri-City Airport which is ten miles southeast of the city (in Saginaw County). Midland County possesses one college (Northwood Institute) and one hospital, both located in the city. Four other nearby higher learning institutions are located in Isabella County to the west (CMU), in Bay County to the East (Delta College), and in Clare County (Mid Michigan Community College) to the northwest, and in Saginaw County (Saginaw Valley State College) to the east, each about 15 miles from the county line. Midland County has four major school districts, the one in the city consuming three of every four dollars of general fund expenditure (1975 budget - $22,500,000).

Midland City has the services of a single taxi company and an airport-based limousine service (serving a 40-mile radius around the airport). Two intercity bus carriers operate in the county, stopping in the city. Two daily runs by Greyhound connect Saginaw, Flint, and Midland with points north. A daily run each way connect Mt. Pleasant and Alma respectively, with Midland City; Mercury Lines also runs a weekday commuter connection between Mt. Pleasant and Midland. On weekends, Mercury also connects Midland with Mt. Pleasant and Big Rapids. Midland City is served by a zone Dial-A-Ride system; the existence of the city DART system has important ramifications for the constraints under which the County DART must operate. (General Statistics from Michigan Statistical Abstract, 1977)

II. COUNTY DART SYSTEM CHARACTERISTICS

A. Service Area

All of Midland County excepting 30 square miles which is served by the city system, thus roughly 490 square miles. However, the complexity of the system actually decrees that some points of the city are served (See Mode of Operation, Section III).

B. Fleet

One 21-passenger Argosy Bus
One 15-passenger Argosy Bus
Three 9-passenger Travco-Dodge converted vans
One 8-passenger Travco-Dodge converted van equipped with a wheel-chair lift.

C. System Hours

7:00 a.m. to 6:00 p.m. - Monday through Friday
8:00 a.m. to 6:00 p.m. - Saturday
No Sunday service
Total of 65 system hours/week

D. Vehicle Hours

320 (5 vehicles) to 385 (6 vehicles) vehicle hours/week

NOTE: During the period covered by this survey, Midland County system was a five-vehicle system due to an inoperative sixth vehicle.

E. Vehicle Miles

Each vehicle logs roughly 220-250 miles/weekday. All vehicles' odometers are in 60,000 mile range as of this writing.

F. Fare Structure

50¢ - Adult one-way direct fare
25¢ - Either: Special[1] one-way direct fare
Or: Adult one-way transfer charge
10¢ - Special[1] one-way transfer charge
0¢ - Babies carried on bus

[1] Senior citizens (62 years old and older), handicapped, and children under 12 years old accompanying a full-fare person.

G. Employees

7 full-time drivers
2 part-time drivers
2 full-time dispatchers
1 full-time maintenance person
1 full-time manager equivalent (2 employees of RCM share this role)

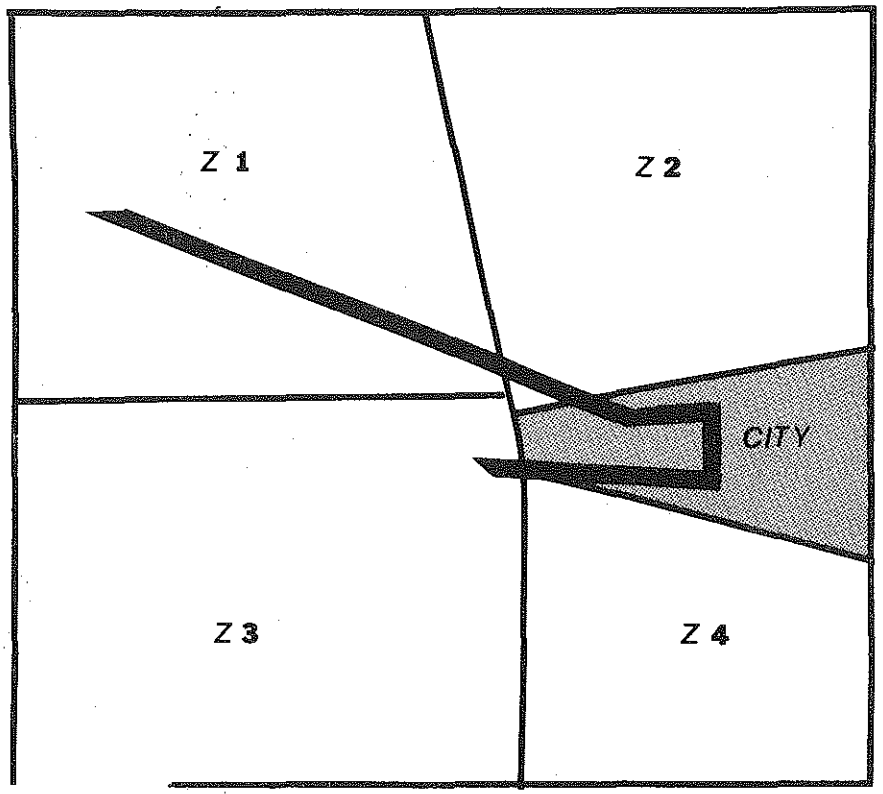
NOTE: Employees of this system technically are employed by a for-profit subcontractor, RCM Transit, and not by Midland County directly.

III. COUNTY SYSTEM OPERATIONS MODE:

As the County DART is coexistent with the City DART, the functioning and operation of the County system is designed around the City's method of operations. The City uses a zonal-based system with transfers at a common meeting place in the city, the Circle Mall area. Similarly, Midland County (excluding the city portion) is divided into, roughly, quadrants and one bus assigned per zone. A line-haul route runs in a fish-hook pattern from Coleman through Sanford (Saginaw Rd.) to Midland, through Midland to Dice Corner (Intersection of Old M30 & M20) and the reverse. Transfers to/from this route to the various zones as well as direct spinal access are the function of the route bus.

Passengers may or may not need to use the route bus to travel between zones or to the City. Please refer to the following examples and Figure 1 for further clarification.

Figure 1



Example 1: A person travelling from Z1 to Z3 might go directly (i.e., transfer from one zone bus to another) or may be transferred to the route to "ride the fishhook" to be transferred to the zone bus. This is naturally dependent on the level of business and on the direction the route is travelling (Z3 to Z1 or Z1 to Z3). The passenger may have to wait until the appropriate rotation if buses in Z1 and Z3 cannot accommodate the trip directly. Please note buses from Z1 and Z3 never travel to the Circle Mall City-County transfer area.

Example 2: A person wishing to travel from Z2 to Z4 will almost never go directly. The appropriate bus will carry them to the City-County transfer point (both Z2 and Z4 buses enter the City as well as the route bus). These transfer meetings, however, are run on 1½ hour headways, so the passenger may or may not be able to be serviced depending on the timeliness of their call. (Meeting times at city transfer area, when the route, and both zone buses are present - 7:45 a.m., 10:15 a.m., 12:45 p.m., and 3:45 p.m. The route and, frequently, one zone bus, will additionally be present at 8:45 a.m., 11:15 a.m., 2:15 p.m., 4:45 p.m., and 5:15 p.m. (opposite rotation for the route).

Example 3: A person going from Z3 to Z4 or reverse normally will be transferred to the zone bus directly. However, a person going from Z1 to Z2 or the reverse nearly always must be transferred to the route. Although not shown in Figure 1, a large lake stretches along the border of Z1 and Z2, which may only be crossed at two points.

NOTE: The route bus in its travel to the transfer point makes restricted stops in the City--the Hospital, the County Courthouse (downtown area), Giantway Plaza, and the "47" Building (Dow). Persons requiring the use of the wheelchair lift are required to "reserve" the bus 24 hours ahead; in practice, the callers for it ignore this rule.

IV. OPERATIONS SURVEY METHOD

All of the substantive information contained in this report was obtained through the use of a modified driver's log sheet. See the following page for a copy of this driver's log. Information from the log was matched with the appropriate dispatch information.

At most times of the two-day study (January 18, and 19), drivers were accompanied by a "record-keeper" surveyor who helped to collect the more detailed than normal information.

V. DATA OBTAINED

Two distinct types of information were collected--personal data as related to the passenger (e.g., sex, age) and system data such as origin point and ride time.

During the two-day period, 278 unique individuals made trips of varying complexity. Data about each segment of multi-transferred individuals' rides was collected; in the following sections, we assume, for purpose of analysis, that regardless of the number of transfers, the individual is counted only once. Midland County, like some other zonal bus systems, "doublecounts" ridership in issuing its ridership statistics. That is, persons in order to be carried to their ultimate destination, may experience single or multiple transfers and thus, may "technically" be counted more than once in ridership statistics. While it cannot be denied that transfers impose a burden on the system, neither can it be maintained that these transferred people are truly additional unique riders. The burden they impose is a function of the design of the system and not directly of the demands for travel of the citizenry.

NOTE: The sample size for various presentations will vary as any missing observation is eliminated for purposes of analysis. All presentations represent two days collection.

A. Rider Personal Data

Sex, Age, and Handicapper Status:

Below is shown a cross-tabulation distribution which describes the sample of riders. One can see several tendencies which are "un-Dial-A-Ride" like. In a typical Dial-A-Ride, senior citizens will normally appear in the rider sample greatly in excess of their presence in the general population. Handicappers, in the Midland County system, appear in much more noticeable fashion than in a typical city or county Dial-A-Ride. However, the relative over-representation of women in the rider sample is typical of all Dial-A-Rides. The sex ratio for seniors taken alone is also typical.

	Male		Female		TOTALS	
General Public	78	28%	135	49%	213	77%
Senior	3	1%	16	6%	19	7%
Handicapped	25	9%	21	7%	46	16%
TOTALS	106	38%	172	62%	278	100%

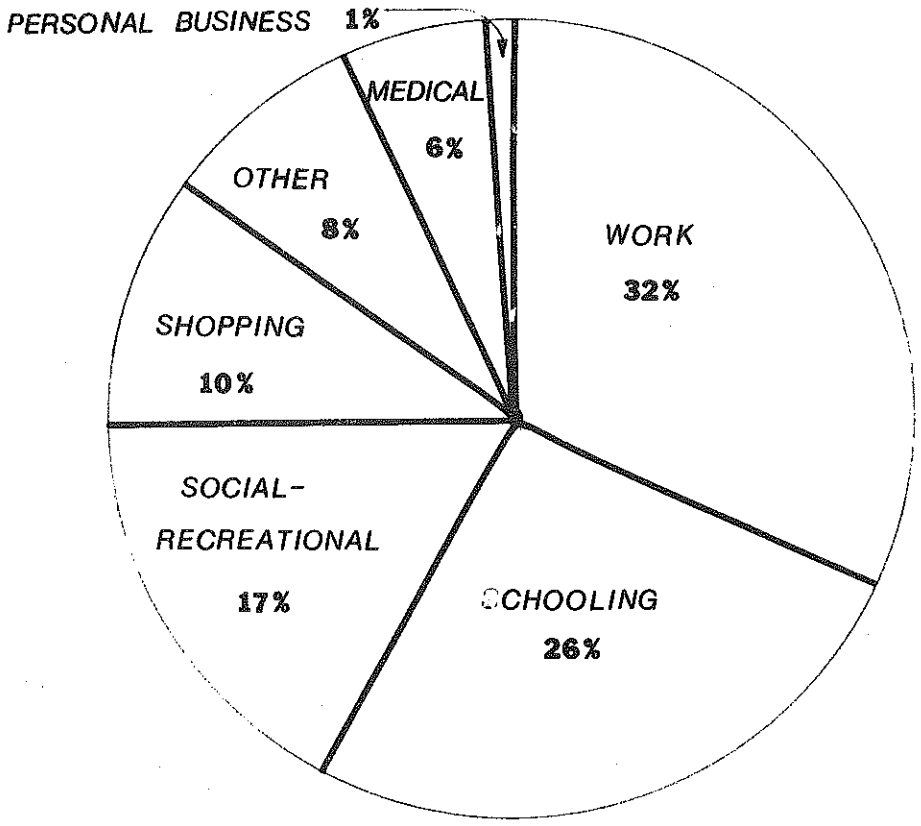
Trip Purposes:

Below are shown the categories of trip purpose (where possible, responses initially indicated as "other" were reclassified.). Please note trip purposes which generally indicate regular system use (i.e., work plus school trips) are over 50 percent of all surveyed rides. Had we surveyed unique individual "riders" rather than "rides," this percentage to all would have dropped.

Indicated Trip Purpose

Type	Number	% to All
Work	89	32
School	71	26
Social-Recreational	45	17
Shopping	28	10
Other	25	8
Medical	16	6
Personal Business	4	1
	278	100%

Also see graph below:



PX	ORIGIN			DESTINATION			FARE										PURPOSE							SEX		····Office Use····			
	LOCATION	TIME	ODOM	LOCATION	TIME	ODOM	50¢	25¢T	25¢	10¢T	T→City	T→Co	Ci→Co	Z→Z	FREES	"S" or "H"?	WORK	SCHOOL	SHOPG	MEDICL	PR BUS	SOC-RC	OTHER	MALE	FEMALE	ΣT	ΣM	OZ	DZ

BUS #

DATE / /78

Driver

Mileage END :

START :

Rider

SHEET NUM

When the trip purpose distribution is examined in conjunction with the time of day[2], several patterns emerge. That is:

Work Trips - (over 30 percent of sample) distribute themselves throughout[3] each hour of the day; over half of all work trips fall into the expected 7-9 a.m. and 4-6 p.m. time range.

School Trips - (Roughly 25 percent of sample) one-fifth of all school trips fall into the 7-8 a.m. time class; another one-fifth fall into the 3-4 p.m. time slots. Other schooling trips distribute themselves fairly consistently over the other service hours of the day.[3]

Social-Recreational Trips - Two-thirds of these trips occur between 11 a.m. and 3 p.m.; this pattern is quite typical.

Shopping Trips - Two-thirds of these trips occur between 2 p.m. and 6 p.m.; again the pattern is predictable. Considering, however, the major bus meeting place is a high volume shopping area, one might expect a higher overall trip-making rate for shoppers.

B. System Data

1. Distribution of Survey Rides: Following the convention discussed in the earlier section, and counting each trip as one trip regardless of the number of intra-county system transfers, both survey days yield roughly an equal number of rides; also morning and afternoon surveys gathered are also roughly equivalent in weight. Below is this distribution.

Surveyed Rides on System

Day 1 (Wednesday, January 18)		154	(55%)
Morning	68		
Afternoon	86		
Day 2 (Thursday, January 19)		125	(45%)
Morning	61		
Afternoon	64		
TOTAL		278	(100%)

2 Pickup time was used as "time of day".

3 The presence of significant numbers of the handicapped may "tilt" the distribution towards non-typical working and schooling hours, ie. trips to and from sheltered workshops, special education trips, etc.

2. Origins and Destinations: The origin-destination matrix drawn from a two-day sample of bus rides attempts to describe a "snapshot of conditions" which prevail normally at that season. If the "experimental" or sample period is a "normal" period (i.e., no acts of God, holidays, massive mechanical breakdowns or the like) then the "snapshot" can be believed. There is every reason to believe these two days were typical of winter Wednesdays and Thursdays. The types of calls served, general level of demand, and both staff and management assent to this point.

The patterns of trip-making reveal a great deal of the constraints under which the day-to-day system must operate. Below is shown the most frequent types of trip patterns for Midland County Dial-A-Ride. A formal origin-destination flow chart is shown on the following pages. The city obviously is the focus of many, but certainly not all, trips. The single most frequent trip pattern accounts for less than 10 percent of all trips.

Most "Popular" Trip Patterns

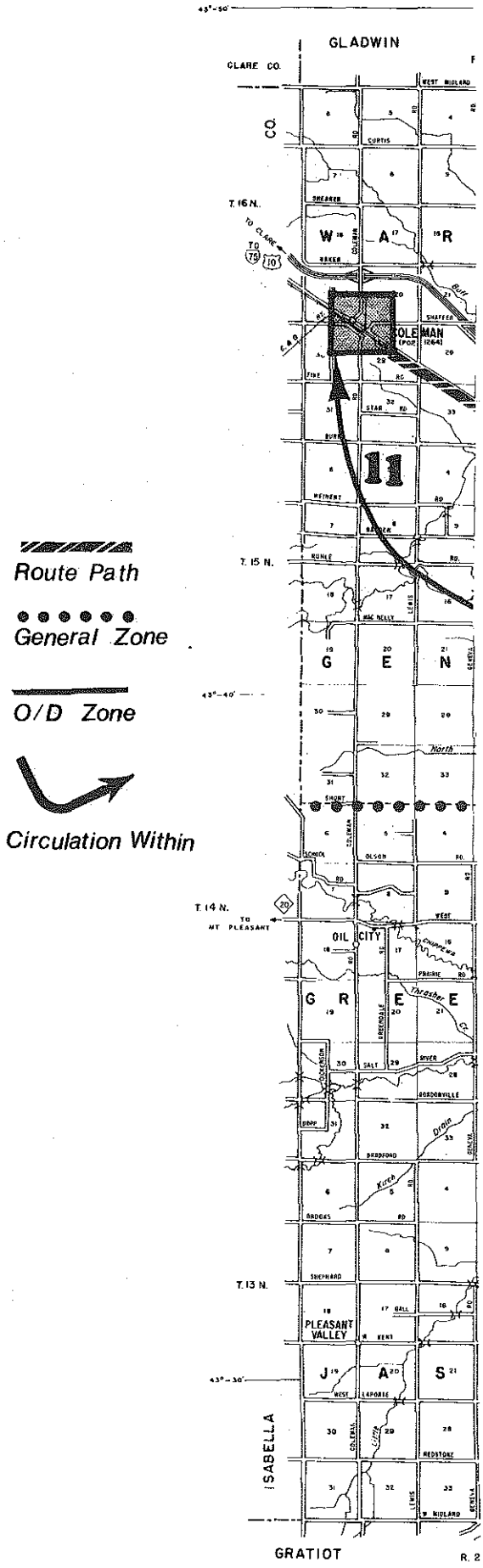
Pattern			No.	Percent
Dice Corners	to	City	16	5% of all trips
Coleman	to	City	14	5% of all trips
*City	to	City	13	4% of all trips
Bullock Creek/ Midland Twn.	to	City	13	4% of all trips
Sanford Area	to	City	11	3% of all trips
City	to	Coleman	11	3% of all trips
City	to	Bullock Creek/ Midland Twn.	11	3% of all trips

Seven patterns account for 27 percent of all trips.

*(NOTE: Circulation within the city boundaries can occur easily, given the designated city stops of county buses going to/leaving the transfer point. These persons may be city or county denizens. All remaining trip patterns are shown in the appendix.)

Inspecting the matrix as a whole, one finds the City involved as an origin point in 32 percent of all cases, as a destination point in 43 percent of all cases. Naturally, in a system designed as this one is, one would expect the City to be important. Circulation for the two days within each county zone demarkation is as follows:

Zone 1	-	54	rides	
Zone 2	-	12	rides	
Zone 3	-	20	rides	
Zone 4	-	9	rides	
		46	rides	- 16% of all

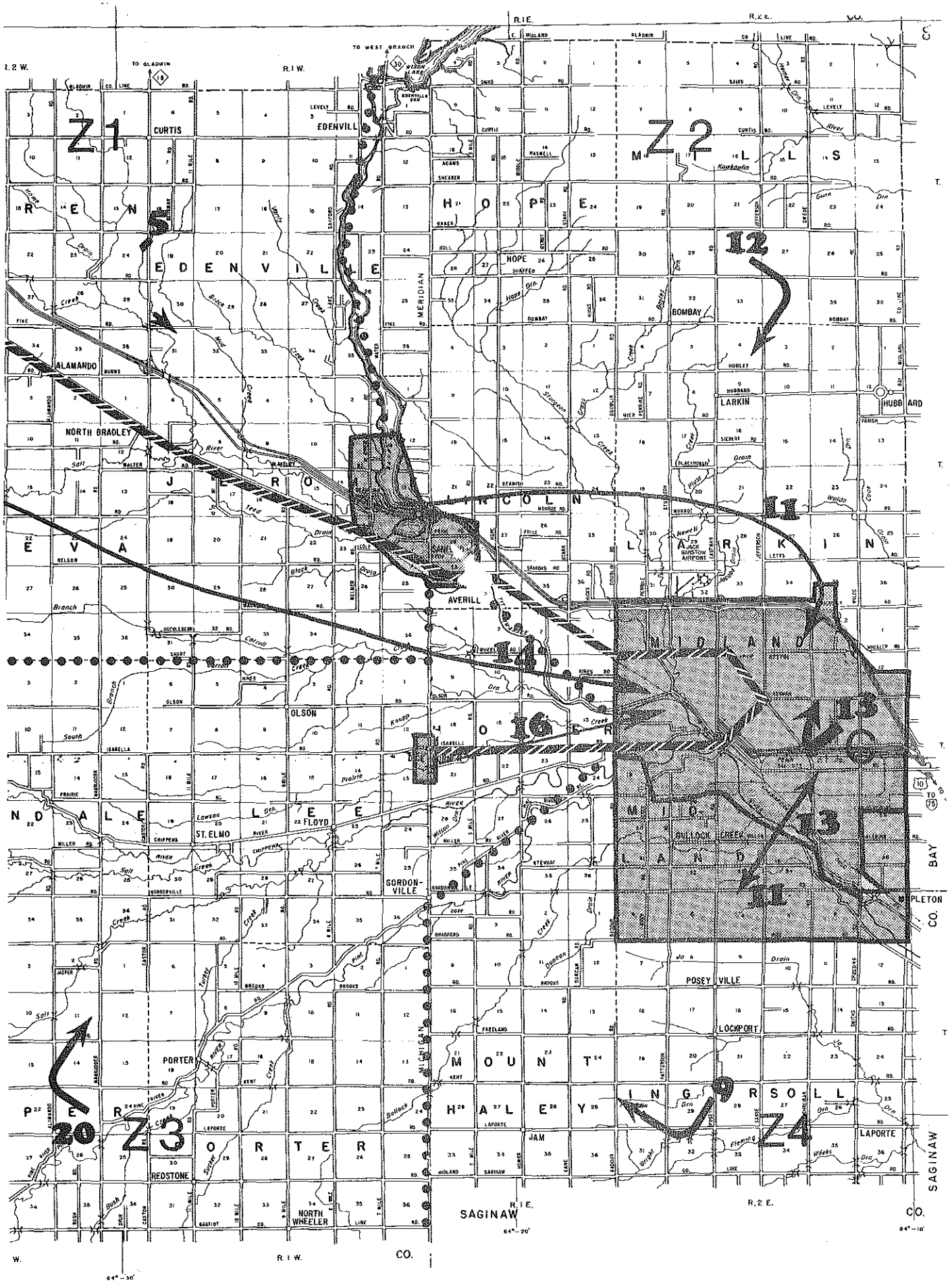


Route Path

General Zone

O/D Zone

Circulation Within



Origins & Destinations

We have now accounted for nearly one-half of all rides using 11 different patterns. Thus, overall, we can characterize this Dial-A-Ride's travel patterns as "many origins to one or to many destinations;" this is true despite the relative importance of the City.

When the origin-destination matrix is divided into AM rides and PM rides, the morning period's important patterns are, roughly speaking, the reverse of the afternoon's. No data is presented; the small size of the sample severely limits any further inferences on our part.

3. Travel Distance, Fare Distribution[4] and Riding Time: Total accountable miles travelled by riders[4] during the two day survey were 1,605 miles. The average rider then rode 9¼ miles. As the general sample is not strongly weighted by any particular type of travel, it may be useful[4] to construct a confidence interval. The majority of passengers[4] (74 percent) rode from 4 miles to 17 miles.

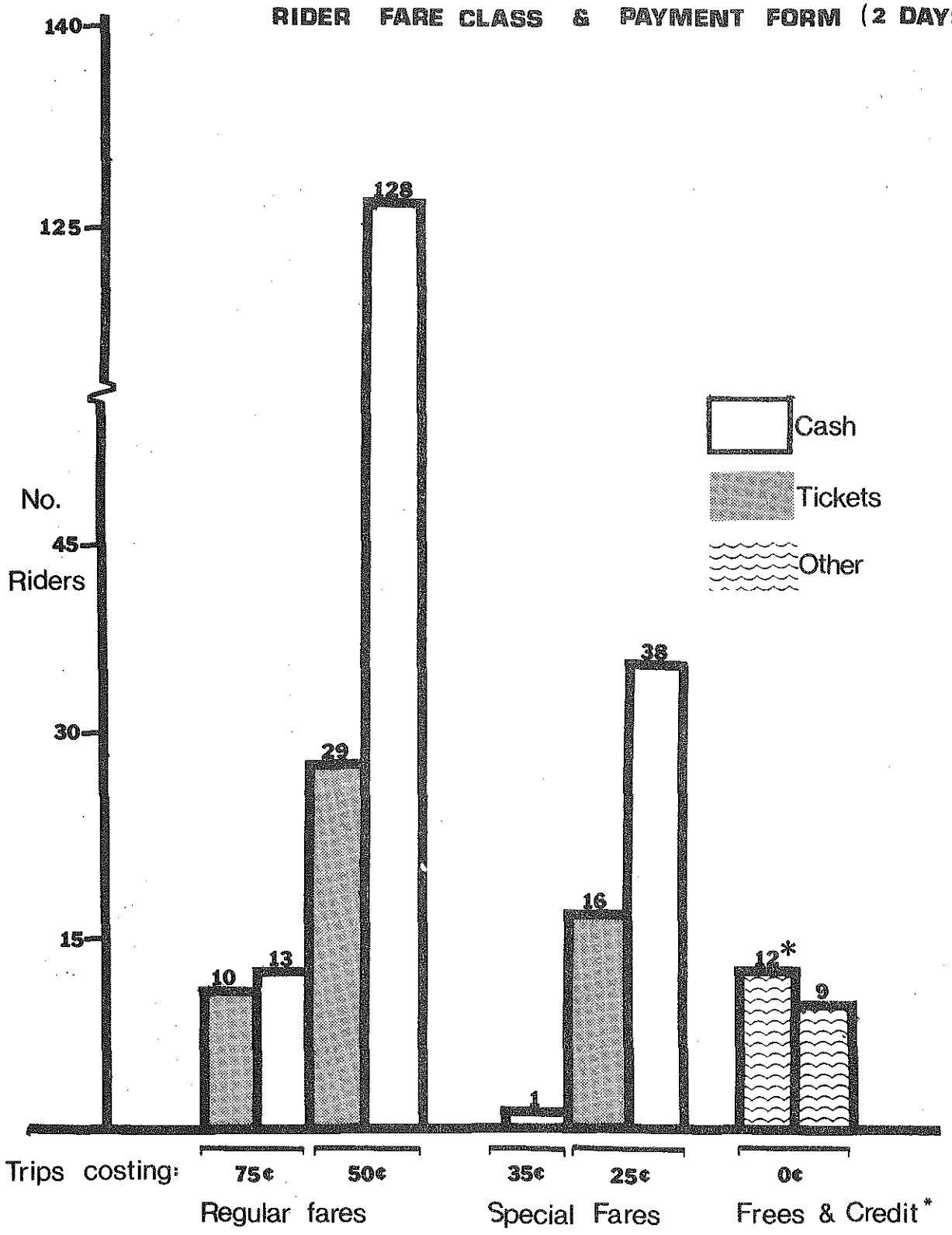
The distribution of miles travelled is as follows:

	# of Rides	% to All
0.1 - 2 miles	12	7
2.1 - 4 miles	2	12
4.1 - 6 miles	13	8
6.1 - 8 miles	21	12
8.1 - 10 miles	28	16
10.1 - 12 miles	14	8
12.1 - 14 miles	13	7
14.1 - 16 miles	20	12
16.1 - 20 miles	4	2
20.1 - 30 miles	24	13
30.1 - 40 miles	4	2
	174	100%

The fare structure of Midland County is one reflecting both transfers and special status the rider might hold (See Section 11 for special status definitions). The use of discount full and half-fare tickets is important to Midland County Dial-A-Ride; persons needing change in order to pay for a ride must purchase tickets from drivers as the drivers may not make change.

On the following page is a graph which reflects both the fare distribution and the form of fare payment.

4 A broken odometer on the route bus and some data not recorded on some zone buses reduce our actual sample size for the two day period to 174 rides.



* (12 Handicapped persons' rides will be billed to the County)

4. Riding Time and Distance: Because riders, on the average, travel relatively long distances on Midland County Dial-A-Ride, one might assume also relatively long riding times. Other factors, of course, also influence riding time--general time-related demand, the weather, the type of roadways, etc.

Below is shown the sample ride time distribution for the survey period.

Ride Time Distribution - Two Days
(Mean ride time - 23 minutes)

	No.	% to All
0 - 5 minutes	8	4
6 - 10 minutes	32	15
11 - 15 minutes	45	21
16 - 20 minutes	27	13
21 - 25 minutes	26	12
26 - 30 minutes	25	12
31 - 35 minutes	18	8
36 - 40 minutes	10	5
41 - 45 minutes	5	2
46 - 50 minutes	5	2
51 - 55 minutes	6	3
56 - 60 minutes	1	1
Over 1 Hour	4	2
	212	100%

Roughly 90 percent of riders' trips fall in the range of 2 - 40 minutes; half of these riders' trips took no longer than 16 minutes. The average ride took 23 minutes.

It does appear that ride distance may greatly influence riding times. Also, at least one vehicle (and often three) must periodically enter the City where many signals, stop signs and the like will reduce their average speed. Below is a cross-tabulation distribution showing class of ride times versus classes of ride distances. The rather fast average speed that must be maintained to produce such small ride times (given distances), while very efficient, may prove hazardous.[5]

[5] Surveyors all commented on the speed maintained by the bus drivers in the out-county area. This is our overall impression, but it should be noted that the tight time constraints make presence at the central transfer point a hurried affair. The far-flung location of passengers must create additional heavy pressure on the drivers.

Ride Time Cross-Tabulated With Ride Distance
(135 Cases With Complete Data)

Ride Miles Class	0-4 Mi	4-8 Mi	8-12 Mi	12-16 Mi	16-20 Mi	20-30 Mi	Total	
1-5 Mins.	9	7	2				(13%)	18
5-10 Mins.	1	19	5	1			(19%)	26
10-15 Mins.	1	5	11	8	4		(21%)	29
15-20 Mins.	2	1	3	5	1		(9%)	12
25-30 Mins.		1	5	7	1	4	(13%)	8
30-45 Mins.		2	8	4	3	11	(21%)	28
45-60 Mins.						4	(4%)	4
TOTAL	13 (10%)	35 (27%)	34 (25%)	25 (18%)	9 (6%)	19 (14%)	135 (100%)	

5. Demand & Productivity: On the following page is shown average daily demand by hour of day and average hourly productivity (passengers/vehicle hour) for the two survey days. These compare favorably with operation statistics submitted monthly.

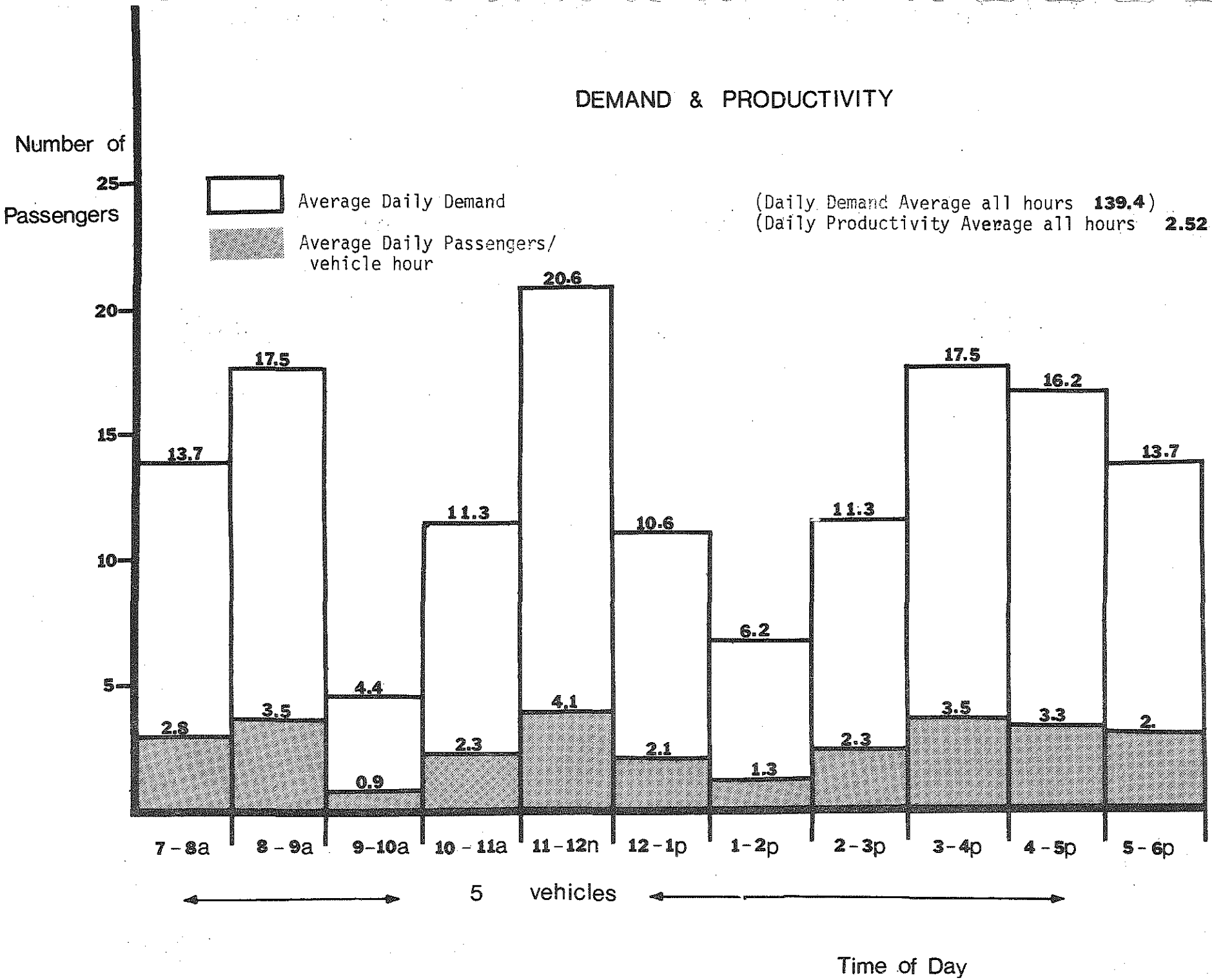
Peak demand occurred on the system from 11 am to 12 noon and secondarily, from 8 am - 9 am and 3 pm - 5 pm. Demand is calculated using pickup time as proxy for time of day. Because the system is quite top-heavy with standing orders and time calls, the usually more desirable call-time would be meaningless here. (See also Section 6.)

(Discussion)

The graph itself illustrates the most important efficiency problem of this system. If a system is organized on the basis of equal access of all geographical areas of a county and the system is also predicated on serving demand-response calls within a reasonable time, then these two influences eliminate much of the possibility of cutting vehicle hours in any systematic fashion to improve productivity. As the origin-destination data indicates, there are no overwhelmingly systematic geographical loci of demand. Thus, the status quo alternatives are not pleasing - degraded service in terms of riding and waiting time is the tradeoff factor for higher productivity.

Below is shown the average daily levels of demand and productivity by zone of service for the two days.

	Demand	Productivity by Zone
Zone 1 (Northwest Quadrant)	25.6	2.32
Zone 2 (Northeast Quadrant)	15.0	1.36
Zone 3 (Southwest Quadrant)	38.0	3.45
Zone 4 (Southeast Quadrant)	29.0	2.63
Route	32.5	2.95


DEMAND & PRODUCTIVITY
Number of Passengers
Average Daily Demand
Average Daily Passengers/ vehicle hour
(Daily Demand Average all hours 139.4)
(Daily Productivity Average all hours 2.52)
25
20
15
10
5
13.7
17.5
4.4
11.3
20.6
10.6
6.2
11.3
17.5
16.2
13.7
2.8
3.5
0.9
2.3
4.1
2.1
1.3
2.3
3.5
3.3
2.
7 - 8a
8 - 9a
9-10a
10 - 11a
11 - 12n
12 - 1p
1 - 2p
2 - 3p
3 - 4p
4 - 5p
5 - 6p
5 vehicles
Time of Day

Under normal conditions, ridetime will lengthen during system peaks; unfortunately, no crystal clear picture emerges for Midland County DART. This is probably the influence of the variation in ride distance, but this inference cannot be statistically supported due to small sample size.

6. Waiting Times: Waiting time information was extrapolated from dispatch records (cards) and matched to the survey observation data after the fact. A distribution of waiting time for pickups was then constructed. These waiting times are divided into two distinct groups - true demand-response callers and standing order-time callers.

These two groups must be treated differently as each imposes different sorts of tasks for the system. A demand-response caller books his or her trip a relatively short time ahead of desired pickup time (an interval perhaps one hour to twenty minutes ahead). A standing order is a one-time call which "reserves" a ride at the same time of the day for one or more days per week; similarly, a time call allows the system more time to accomodate it. Time callers may book their trips two days, one day, or perhaps, three hours early. It is commonly accepted Dial-A-Ride "wisdom" that the predictable demands are more readily and easily serviced. They also should exhibit more accuracy of pickup time than those of less predictable demand-response.

The distribution of types of calls for service which Midland County DART accommodated for the two day period is shown below. Please note the large percentage of predictable demands.

Type of Call For Service	Number	Percent to All Calls
Standing Orders	153	46%
Demand Response[6]	100	30%
Time Calls	48	14%
Walk-ons[6]	24	7%
Cancels	11	3%
Total	336	100%

Ignoring "walk-ons" and "cancels", we then find the ratio of predictable demands to the unpredictable to be a bit greater than 2:1.

[6] Three of which were "no-shows" later; walk-ons, of course, don't call at all.

Below is shown the waiting time for all calls and demand-response calls by time of day. (NOTE: To calculate this waiting time, we compared actual pickup time to the estimate given to the caller at the time the order is placed.

"WAIT TIME" BY TIME PERIOD

All Callers* By Time Periods (2 Days)

Pickup Deviation Time**	7-9 A.M.	9-11 A.M.	11-1 P.M.	1-3 P.M.	3-5 P.M.	5-6 P.M.	Totals
0 to 3 minutes	18 (*6*)	14 (*2*)	24 (*11*)	16 (*9*)	30 (*13*)	10 (*5*)	112 (*74*)
3+ to 6 minutes	27 (*18*)	8 (*3*)	11 (*4*)	13 (*1*)	13 (*6*)	2 (*1*)	74 (*33*)
6+ to 9 minutes	6 (*2*)	3 (*2*)	6 (*4*)		3 (*3*)		18 (*11*)
9+ to 12 minutes	7 (*3*)	3 (*0*)	14 (*8*)		10 (*4*)		34 (*15*)
12+ to 15 minutes	7 (*5*)		2 (*0*)	2 (*1*)	3 (*3*)		14 (*9*)
15+ to 25 minutes	2 (*3*)	3 (*0*)	7 (*1*)	6 (*2*)	3 (*2*)	3 (*0*)	24 (*8*)
25+ to 35 minutes	3 (*1*)	6 (*1*)	2 (*2*)				11 (*4*)
Over 35 minutes		3 (*0*)				3 (*0*)	6 (*0*)
Total	72 (*38*)	40 (*8*)	66 (*30*)	35 (*13*)	62 (*31*)	18 (*6*)	293 (*201*)

* "Predictable" demands shown in (italics.) They are 69% of all calls which were booked.
** NOTE: Pickup Deviation Time assumes a value of -0- if Pickup is on-time; otherwise deviation (both early and late) assume positive values. See also following page.

Several characteristics can be noted from the "wait time" distribution.

(A) Standing orders and time calls are nearly 70 percent of all calls for which a ride is subsequently given. This, in turn, implies roughly seven of every ten rides is somewhat "plannable". Thus, we would expect a fair amount of accuracy in dispatcher's ETA's for these rides.

Six of every ten rides of a predictable nature are picked up within a reasonable deviation time (i.e. ±6 minutes). However, it is also true that almost five of every ten demand-response rides are picked up within the same time interval.

(B) The intervals which contain peak demand hours also contain the highest percentages of standing orders. Because Midland County DART has to turn down some requests for service (i.e. constraints of the directionality of the route, long headways to enable presence at the City transfer point, etc.), this tendency may represent "insurance" for the user.

(C) 38 percent of all riders are picked up with no "wait time" at all; 80 percent of all rides are picked up within 15 minutes of the time quoted by the dispatcher. Again, this represents a fairly high quality of service.

(D) In terms of whether "on-time", "late", or "early" for pickup, it makes no difference whether the request for service is demand-responsive or "predictable"; the distributions are nearly identical.

(E) There is, however, an understandable tendency to be "late" during the peak periods of demand.

7. Other Considerations:

(A) The Importance of Transfers: Three of every four rides given during the survey period did not involve a transfer of the rider from one County bus to another; this includes route riders, persons travelling within one zone, interzonal direct travel, and those going to the Circle transfer area directly. Roughly three persons in twenty indicated to the dispatcher, however, the need to transfer to a City bus (or that they would be coming from a City bus). How many others, in effect, did utilize the City system we do not know.

(B) The Importance of Midland City: As we have seen, the city of Midland is important to the functioning of the County system. Of all passengers using the system, almost seventy percent either came from or went to the city environs. As mentioned above, a little over 15 percent of them also used the City system.

This fact should not be surprising, given the design of the County system is predicated upon such movement. However, as noted previously, long distances and, hence, headways, the constraint of the meet times with the City system, and the dispersed patterns of demand imposes a severe "efficiency handicap" on current operations.

APPENDIX I

APPENDIX I - ADDITIONAL ORIGIN - DESTINATION PATTERNS NOT PREVIOUSLY SHOWN

ORIGIN	(Z)		DESTINATION	(Z)	NO.	%
Jerome Twn.	(1)	To	City	(c)	10	3%
City	(c)	To	Larkin Twn.	(2)	9	3%
City	(c)	To	Sanford Area	(2)		
Lee Twn.	(3)	To	City	(c)		
City	(c)	To	Lee Twn.	(3)	8	2%
Floyd Village	(3)	To	City	(c)		
Larkin Twn.	(2)	To	City	(c)		
City	(c)	To	Hope/Lincoln Twn.	(2)	6	2%
Bull. Crk./Midl. Twn.	(4)	To	Mt. Haley Twn.	(4)		
Hope-Lincoln Twn.	(2)	To	Lee Twn.	(3)	5	1%
Dice Corners	(3/4)	To	Greendale Twn.	(3)		
Greendale Twn.	(3)	To	Dice Corners	(3/4)		
Mills Twn.	(2)	To	City	(c)		
Ingersoll Twn.	(4)	To	City	(c)		
City	(c)	To	Olson Village	(3)	4	1%
City	(c)	To	Dice Corners	(3/4)		
City	(c)	To	Mt. Haley Twn.	(4)		
Sanford Area	(1/2)	To	Dice Corners	(3/4)		
Hope-Lincoln Twn.	(2)	To	Sanford Area	(1/2)		
Hope-Lincoln Twn.	(2)	To	Jerome (Exc. Sanford Area)	(1)		
Jerome Twn. (Except Sanford Area)	(1)	To	Hope-Lincoln Twn.	(2)		
Mt. Haley Twn.	(4)	To	City	(c)		

Sanford Area	(1/2)	To	Hope-Lincoln Twn.	(2)		
City	(c)	To	Hope Village	(2)		
City	(c)	To	Floyd Village	(3)		
City	(c)	To	Ingersoll Twn.	(4)		
City	(c)	To	Lockport/Poseyville Villages	(4)		
Bull. Creek/Midl. Twn.	(4)	To	Lee Twn.	(3)	2	<1%
Bull. Creek/Midl. Twn.	(4)	To	Bull Creek/Midland Twns.	(4)		
Porter Twn.	(3)	To	Dice Corners	(3/4)		
Floyd Village	(3)	To	Greendale Twn.	(3)		
Sanford Area	(½)	To	Porter Twn.	(3)		
Larkin Twn.	(2)	To	Larkin Twn.	(2)		
City	(c)	To	Mills Twn.	(2)		
City	(c)	To	Greendale Twn.	(3)		
Lockport/Poseyville Vill.	(4)	To	Dice Corners	(3/4)		
Lockport/Poseyville Vill.	(4)	To	City	(c)		
Ingersoll Twn.	(4)	To	Sanford Area	(1/2)		
Floyd Village	(3)	To	Oolson Village	(3)		
Floyd Village	(3)	To	Bullock Cr./Midland Twn.	(4)		
Dice Corners	(3/4)	To	Coleman	(1)	1	<1%
Dice Corners	(3/4)	To	Hope-Lincoln Twn.	(2)		
Lee Twn.	(3)	To	Lee Twn.	(3)		
Oil City Village	(3)	To	Floyd Vill.	(3)		
Greendale Twn.	(3)	To	Greendale Twn.	(3)		
Sanford Area	(1/2)	To	Lee Twn.	(3)		
Hope-Lincoln Twn.	(2)	To	Edenville Twn.	(1)		
Hope-Lincoln Twn	(2)	To	Hope Lincoln Twn.	(2)		
Hope-Lincoln Twn.	(2)	To	Hope Vill.	(2)		
Coleman	(1)	To	Warren Twn. (Exc. Coleman)	(1)		
Coleman	(1)	To	Coleman	(1)		
Coleman	(1)	To	Geneva (Exc. N. Bradley)	(1)		
Coleman	(1)	To	Dice Corner	(3/4)		
Warren Twn. (Exc. Coleman)	(1)	To	Coleman	(1)		
Warren Twn. (Exc. Coleman)	(1)	To	City	(c)		
Edenville Twn.	(1)	To	City	(c)		
Hope-Lincoln Twn.	(2)	To	City	(c)		
Olson Village	(3)	To	City	(c)		
Porter Twn.	(3)	To	City	(c)		