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Abridgment

Coordination and Integration of Special Transportation Services for the Transportation Disadvantaged

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In the region comprising the Michigan counties of Ingham, Eaton, and Clinton, which includes the city of Lansing, a variety of agencies offer transportation services to those whose mobility is limited because of age, income, or physical or mental handicap. This situation offered a unique opportunity for an examination of the operational efficiency and the cost-effectiveness of current transportation services for the transportation disadvantaged. It was possible, through an analysis of the transportation needs of this sector of society, to compare transportation demand with the characteristics of transportation service as it is now supplied. That comparison determined the efficiency with which such special transportation needs were being met and made it possible to identify alternative service patterns that promise greater efficiency.

ESTIMATED GROWTH OF DEMAND

Service agencies in Lansing, Michigan, currently provide approximately 43 000 trips/month to the elderly, the handicapped, and low-income residents within their service areas, which are heavily concentrated in the Lansing urban area. It has been estimated that the potential market for trip making by transportation-disadvantaged groups in the tri-county region is between 100 000 and 120 000 trips/month (this includes all persons whose mobility is limited because of age, income, or physical or mental handicap and who currently have no access to transportation service). These estimates are based on a potential expansion of service in the service areas only and do not consider changes in the characteristics of service provided. The number of trips could thus be increased by almost a factor of 3 if service

were expanded to areas that are not now being served by the special transportation agencies. Of this increase of about 70 000 trips/month, a gain of nearly 15 000 trips/month could be expected in areas outside the public transit service region (1).

Two factors will have a major influence on the future demand for trips by the transportation disadvantaged in the tri-county region. The first factor is the growth in the base population classified as elderly, low-income, or handicapped. Population projections of the state of Michigan in 1974 indicated that the elderly population is expected to grow by about 50 percent in the next 20 years. Similar data available on the handicapped and low-income population classifications show that the proportion of persons within these classifications will remain fairly constant during the next 20 years and therefore the total increase in demand from these segments is expected to be about 30 percent during that period (2). These data indicate that demand on the transportation system will increase substantially in the next 20 years and that the potential exists for ridership at a level of 200 000 trips/month as a result of population growth alone.

The second factor is the type of service offered to the transportation disadvantaged. As a basis for comparison, the demand for trips by the elderly population of East Lansing is between 3 and 4 trips/month/person. In the tri-county region, the demand from this market segment is only about 1 trip/month/person. The significant difference between these demand figures may be at least partially attributed to the difference in service offered to the elderly residents of East Lansing. As part of the East Lansing Older Peoples Program, service is provided by taxi and half the fare is subsidized by the community. This may represent the ultimate

service quality because it provides door-to-door service on demand without ride sharing. If this type of service were provided throughout the region and the demand ratios cited above were extrapolated over the entire region, it is apparent that the ultimate potential market would be between 400 000 and 450 000 trips/month. This increase translates to between 45 000 and 60 000 trips/month outside the area served by public transit.

ANALYSIS OF EXISTING SPECIAL TRANSPORTATION

Most special transportation service is currently provided in the Lansing urban area and in Ingham County; at best, only token service is provided in Clinton and Eaton counties. Service is provided mostly by nonprofit agencies that are heavily supported by government at the federal, state, and local levels (3). Data show that there is heavy reliance on subsidy to cover service costs and that the services offered are limited by the available subsidies.

Service in the Lansing urban area is provided at a significantly lower cost per client than in the outlying areas. This is probably a result of the area of coverage in the Lansing urban area as well as the larger number of clients in this area. Service is generally provided without charge; only two agencies charge users a fee.

The agencies are generally small in terms of their client market, and 60 percent of the agencies serve only 13 percent of the clients. Most agencies have six or fewer vehicles at their disposal and use them extensively. Several agencies indicated that their vehicles have been heavily used, which indicates higher maintenance costs and capital replacement costs in the near future. The total seating capacity of the vehicles owned by the 21 selected agencies is estimated to be about 1450 seats; this estimate may be extrapolated to about 2000 seats available to the transportation disadvantaged in the region. Thus, if operating efficiencies could be effected, the existing vehicle fleet could provide a significant level of service.

Service costs are estimated to range from about \$0.15 to \$0.31/km (\$0.25 to \$0.50/mile). These costs seem significantly lower than those available in data from other areas. Trip lengths average about 13 km (8 miles).

In an examination of the available financial data of the various agencies, it became apparent that important service improvements or cost economies could be realized through coordination of services or integration under a single management structure. Under the present arrangement, there are overlapping and duplication of service areas as well as duplication of allocated management costs and indirect costs among the agencies.

SYSTEM OPTIONS AND EVALUATION CRITERIA

The various transportation service options available in the tri-county region for people of limited mobility have been developed in relation to two broad areas of concern—service characteristics and institutional structures. The alternatives available in the category of service characteristics are given below:

Item	System Option	Item	System Option
Routing	Fixed route	Coverage	Regional
	Route diversion		Greater Lansing area
	Demand responsive		Activity centers
	Subscription service		Corridor
Vehicles	Standard buses	Scheduling	Specific areawide
	Mixed fleet		Peak period
	Modified vehicles		Weekday
	Special vehicles		Daily
			Periodic

The alternatives available in the category of institutional structures are as follows:

Item	System Option
Organization	Regional central agency
	Greater Lansing central agency
	Supplemental agencies
	Activity area
Funding	Government
	Donation
	Purchase of service
	Subsidy
	Fare box
Integration	Coordination
	Central management
	Central operation
	Subsystem management
	Subsystem operation

Obviously, a large number of alternatives are available in the region. However, if the existing system is imposed on these system options, only a few workable alternatives result. This is particularly true if the geographic pattern of demand identified in the earlier survey data is considered.

Evaluation criteria to be considered in a comparison of service alternatives are given below:

Category	Criteria
Performance and cost	Vehicle type and features
	Vehicle seating capacity
	Average trip speed
	Subsystem potential (seat kilometers per vehicle hour)
	Subsystem productivity (trips per vehicle hour)
	Average trip length
	Subsystem output (trip kilometers per vehicle hour)
	Subsystem utilization (trip kilometers divided by seat kilometers per vehicle hour)
	Operating cost
Institutional structure	Percentage of demand served
	Coverage (service area)
	Funding sources
	Funding levels
	Transferability of interagency funding
	Management economics
	Maintenance economics
Service measures	Level of service (service time divided by automobile trip time)
	Percentage of demand served (by subgroup and subarea)
	Service frequency
	Fare

The following series of options, which form a hierarchy of alternatives ranging from the existing system to the ultimate regional system, were identified:

Alternative	Description
1	Maintain existing supply of special transportation service in the region
2	Integrate and coordinate operation of special transportation service of existing agencies
3	Integrate and coordinate operation of special transportation service of existing agencies to effect a minimal level of regional coverage on a periodic schedule
4	Expand service of Lansing Capitol Area Transportation Authority (CATA) in the urban area and integrate and coordinate operation of special transportation service of existing agencies in the urban area
5	Integrate and coordinate county system and subsystems of urban area
6	Expand service of Lansing CATA to several outlying areas and integrate and coordinate operation of existing transportation service
7	Establish fully integrated and coordinated special transportation system at the regional level

These service options have been generated with the objective of satisfying higher levels of demand with each incremental commitment of resources in the progression from the existing system to an ultimate regional system of special transportation service. In other words, a greater commitment of resources should result in greater satisfaction of demand. Figure 1 shows the nature of coverage for the seven alternatives.

COST-EFFECTIVENESS ANALYSIS OF ALTERNATIVES

The implied goal of this study was to examine the efficiencies that would result from coordinating and integrating existing special transportation services in the Lansing region. For this purpose, two measures of efficiency—the percentage of potential demand that may be satisfied by an alternative and the cost of service for an individual trip—were used. The cost-effectiveness analysis considered each of these factors in the evaluation of each alternative.

The degree to which each alternative satisfies regional and specific areawide demand is given in Table 1 (4). The daily demand satisfaction in trips and a percentage of the ultimate regional demand of 9600 trips/d are given for each alternative. The table also gives the total cost per trip and the number of buses and vans required for provision of service under each of the seven service alternatives.

RECOMMENDED SERVICE PLAN

The highlights of the recommended plan for providing service to meet the transportation needs of elderly,

handicapped, and low-income persons in the tri-county region (5) are summarized below:

1. A central coordinating agency (CCA) would be established to coordinate the special transportation services in the region. The CCA would act as a broker to arrange for and provide transportation services for the elderly, handicapped, and low-income population by the most cost-effective and efficient means.
2. The social service or government agencies that currently operate or purchase transportation services for their clients would be encouraged to participate in the coordinated system. This participation would be based on certain guidelines proposed in the study, such as high trip costs and low vehicle productivity and the difficulty of obtaining funds for capital equipment and maintenance.
3. In the contiguous and heavily populated areas, there would be intensive use of taxicabs for incidental and individual trips.
4. The fleet of small buses used by social service agencies and the public transportation agency in the area would not be expanded until the end of the demonstration period.
5. Transportation cards that entitle the holder to reduced taxi fare would be used.

The plan for the county areas includes the following points:

1. Each county would have the option of initiating a minimum level of service in the out-county area by using three small buses operated on a demand-responsive basis.
2. The funding for the county system would be channeled through the CCA.
3. The plan could be scaled downward or upward based on the resources available to an area.

Table 2 (4) compares the performance of the present system with that of the proposed system. Clearly, the proposed system is the more efficient of the two; total annual costs are about equal. Trip cost under the proposed system is lower than that under the present system but higher than average taxi cost per trip, which indicates that, based on this analysis, taxi service is perhaps the least costly system.

SUMMARY AND CONCLUSIONS

The study conducted in the Lansing area demonstrated that the level of transportation service provided for the transportation disadvantaged is quite low in comparison with the service offered to the general public through the existing transit system. It further showed that the provision of special transportation service by independently operated agencies resulted in duplication of management requirements and service vehicles, the overlapping of service areas, and service inefficiencies. The development and analysis of alternative means for providing service indicated that a simple coordination of the operations of these independent agencies would significantly reduce service costs and increase both vehicle utilization and the level of demand satisfaction.

The tri-county region is currently in the process of implementing the plan for a minimal level of coordinated service in the Lansing urban area and the rural areas of Clinton, Eaton, and Ingham counties.

It is anticipated that the results of this planning study will be applicable to many communities throughout the state of Michigan that are faced with similar service re-

Figure 1. Approximate regional coverage of seven service alternatives.

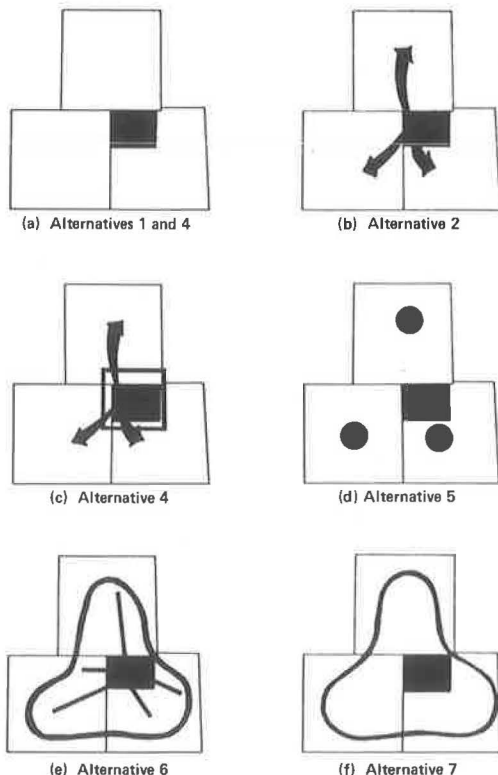


Table 1. Demand, cost, and service data for seven service alternatives.

Item	Alternative ^a						
	1	2	3	4	5	6	7
Trips per day ^b	833	1600	916	2300	2100	1900	2560
Satisfied demand, \$							
Lansing urban area	14	27	10	38	30	32	27
Clinton County	0	0	8	— ^c	8	— ^c	27
Eaton County	0	0	8	— ^c	8	— ^c	27
Ingham County	0	0	8	— ^c	8	— ^c	27
Region	9	17	10	24	22	20	27
Cost of service, \$000	1000	835	939	1382	1459	1148	1699
Capital cost, \$000	338	208	338	607	455	451	533
Cost per trip, \$	3.87	1.67	3.28	1.93	1.83	1.99	2.13
Vehicles							
Buses	42	42	42	51	42	51	42
Vans	26	26	26	26	35	26	41
Service area							
Lansing urban area	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clinton County	No	No	Yes	No	Yes	No	Yes
Eaton County	No	No	Yes	No	Yes	No	Yes
Ingham County	No	No	Yes	No	Yes	No	Yes
Region	No	No	Yes	No	Yes	No	Yes

Note: Demand data are average daily figures.

^a Least costly alternative is used.

^b Regional average daily trips based on 6-d week.

^c Some level of satisfaction, but no estimate is possible.

Table 2. Comparison of performance measures for present and proposed systems.

Item	Present System	Proposed System	
		Existing Agencies Only	Including Taxi Service ^a
Average number of clients per day	207	231	431
Average number of trips per day	439	462	862
Total operating hours per day	24	22	
Vehicles operating	17	12	
Vehicle hours of operation per day ^b	84	68	
Seating capacity	220	160	
Trips per hour	18.3	21.0	
Trips per vehicle hour	5.2	6.8	
Cost per day, \$	844	680	1480
Cost per hour, \$	35	31	
Cost per trip, \$	1.92	1.47	1.72
Operating cost per vehicle hour, \$	10.05	10	
Operating cost per year for scheduling center, \$		66 000	66 000
Total operating cost per year, \$	219 230	242 800	450 800
Total capital cost per year, \$	74 000	52 000	52 000
Total cost per year, \$	293 230	294 800	502 800
Total cost per trip, \$	2.57	2.45	2.45

^a Additional 400 trips/d.

^b Accumulated hours for all agencies.

quirements and limited financial resources for implementing special transportation services for the transportation disadvantaged.

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