TRANSIT PLANNING FOR THE TRANSPORTATION-DISADVANTAGED IN A SMALL TOWN

Arthur Saltzman and Alice E. Kidder,
North Carolina Agricultural and Technical State University; and
Richard Solomon, Consultant, Monson, Massachusetts

High auto ownership rates and low population densities have resulted in large-scale elimination of public transit systems in small towns. This trend exacerbates the mobility problem of the transportation-disadvantaged: the poor, the elderly, the handicapped, and the young. Lumberton, North Carolina, is typical of the transportation situation of towns with a population of less than 25,000. Located along an important Interstate highway, the town has attracted industries that offer jobs within a few miles of the town. Yet, unemployment rates are high among the carless, predominantly Black population of Lumberton. A group of concerned citizens from the transportation-disadvantaged community tried to organize a bus company. The company went bankrupt within 2 months. The Transportation Institute of North Carolina Agricultural and Technical State University performed an economic autopsy and drew up a proposal for an innovative transit program designed to minimize cost and give service specifically to the transportation-disadvantaged. The success of the program depends on the willingness of the City Council to underwrite approximately $30,000 of operating deficit yearly. The authors suggest that in the case of a low-wage area such as Lumberton the major costs are those of overhead, namely management, and the necessary backup system of extra buses and a maintenance crew. The authors propose that towns such as Lumberton join into a transit consortium with nearby communities and make a joint application for funding from the capital grants program of the Urban Mass Transportation Administration.

•THE design of a conventional public transportation system for any small town in the United States is extremely difficult because of twin constraints: a high automobile ownership rate and lack of population density needed to support a conventional bus line. High population density is necessary for conventional transit operations because for most people most trips are more conveniently made by automobile. Even in larger cities, use of transit outside of the downtown core area rarely exceeds 3 to 4 percent of total trips.

The mitigating factor in larger metropolitan areas is, of course, sufficient size to support a minimum conventional bus transit system despite the transit system's low level of trip attraction. Further, even in the largest and densest cities, which have somewhat higher per capita rates of transit use, most transit systems are, at best, marginal operations requiring both capital and operating subsidies.

Recent transit passenger ridership trends show sharp drops in small towns, and there is a concomitant widespread bankruptcy of bus companies serving towns of 50,000 population or less. The U.S. Department of Transportation has documented the elimination of many transit operations and the precarious financial condition of the remaining ones. During the period 1959 to 1970, of the 235 private companies that have gone bankrupt, 89 (38 percent of the total) have been taken over in the public sector, and the remaining 146 have completely gone out of existence (1). These are mainly in smaller cities and towns.

Given the evidence of declining ridership and increased car ownership, one still can make a strong case for a continuing need for public transit in small towns. In all areas, particularly in poorer, rural towns, a significant number of people either do not have access to a car or are incapacitated to an extent that they cannot use a car. The "captive ridership" in urban transit systems—the carless, the elderly, the poor, the handicapped, and the young—is left to arrange informal car-pooling in the smaller, outlying districts (2, 3).

Where jobs are available within commuting distance of a small town but without a transit link between the transportation-disadvantaged and those jobs, the labor force tends to migrate to distant cities rather than remaining in the small town. Programs for retaining the population in rural areas may be frustrated by the high costs of transporting the labor force to remunerative employment.

Given the selective need for public transit, one must ask whether there is any economically sound arrangement that can provide this service in a low-trip-density area where demand for non-automotive transportation is scattered. Funding sources are few and far between. Fare-box receipts cover only a fraction of the total costs of operations. Large public subsidy is unlikely since town budgets are already strained, and city councilmen are generally unwilling to vote funds for a transit operation that serves only one segment of the community, namely the poor and carless. Moreover, in towns where traffic congestion has not yet reached crisis proportions, public transit is low on the list of priorities.

It is for these reasons that the capital grants applications submitted to the Urban Mass Transportation Administration have only very seldom come from towns with populations under 50,000. (Approximately 95 percent of the capital grants awarded by UMTA since the program's inception in 1965 have gone to cities with populations greater than 50,000.) Since nothing in the guidelines precludes smaller towns from applying, one must conclude that (a) smaller towns and cities are only just beginning to recognize the need for continuing public transit, (b) the one-third requirement of local matching funds eliminates many small towns from the competition, or (c) lack of widespread information about the program, coupled with the need for comprehensive and continuing long-term planning, discourages applications.

What happens in the case where local residents of a small town do recognize the need for selective public transit service? Can an economically defensible plan be developed? How much public underwriting of expected continuing deficits is necessary to sustain the system? Are there ways of spreading the overhead costs?

These are precisely the questions posed by a group of concerned citizens in Lumberton, North Carolina, a town of 17,000 devoid of public transit since the demise of a local bus operation that started operation on January 9, 1971, and ceased all service 8 weeks later. This case study illustrates the need for innovative solutions based on close study of local conditions and sound short- and long-range planning.

LUMBERTON, NORTH CAROLINA

Lumberton is the county seat and principal city in Robeson County, one of the largest counties in North Carolina. The city's population of 15,305 in 1960 increased 10.8 percent by 1970, resulting in a population of 16,961.

Located along the major north-south Interstate highway, I-95, Lumberton has managed to attract quite a number of manufacturing firms in recent years. These firms tend to locate a few miles outside the Lumberton city limits. Since the unemployment rates in the rural counties of eastern North Carolina can run as high as 11 percent, these companies have little difficulty in pulling a sizable work force from the surrounding rural areas.

Despite the advent of these important job sources, unemployment in downtown Lumberton still remains high—critically high for many in the Black labor force.

Table 1 indicates that, although the population of Lumberton increased between 1960 and 1970, there was a small decrease of 227 in the number of Blacks who lived within the city limits.

Table 1. Lumberton population data.

		Black		White		Indian	
Year	Total	Number	Percent	Number	Percent	Number	Percent
1960	15,305	4,128	27	10,835	71	342	2
1970	16,961	3,901	23	11,533	68	1,526	9

Table 2. Employment, unemployment, and labor force participation by ethnic group.

Ethnic Group	Labor Force[a]	Number Employed[b]	Number Unemployed[c]
Black	1,919	1,535	384
Indian	545	491	54
White	5,428	4,994	434
Total	7,892	7,020	872

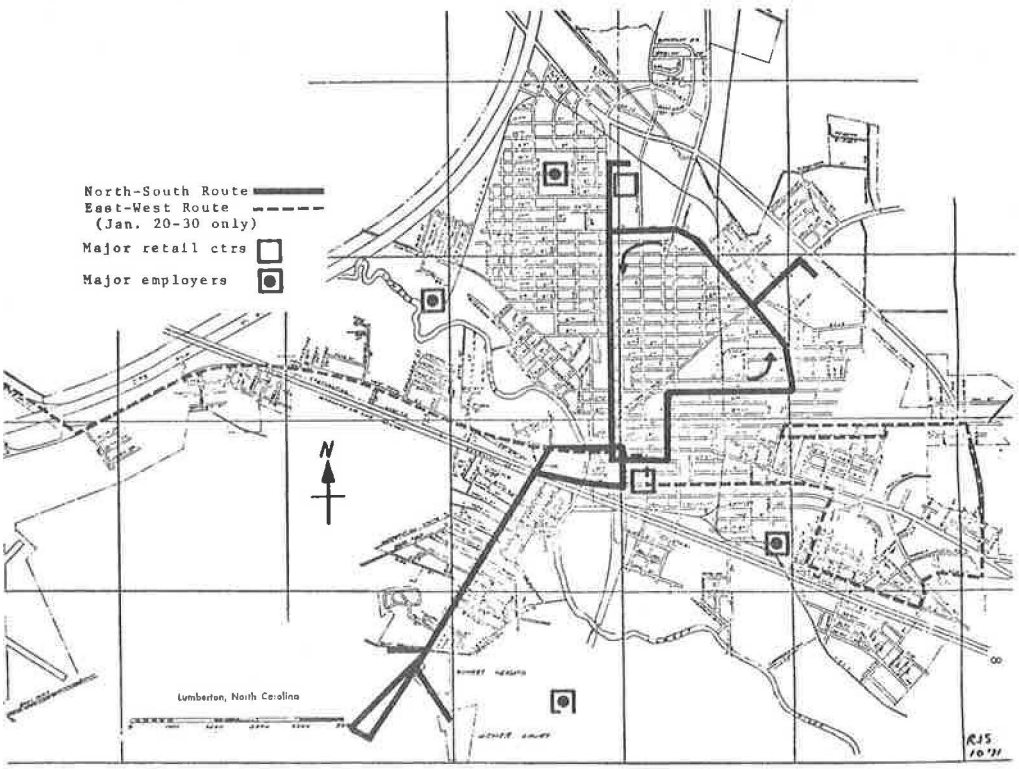
[a]14 years of age and older, based on estimates of overall unemployment rate of 11 percent (North Carolina Employment Security Commission).
[b]Based on data from Lumberton Origin/Destination Traffic Survey, 1965.
[c]Assuming 20 percent unemployment rate among Blacks and 8 percent unemployment rate among Whites and Indians.

Table 3. Number of autos in predominantly Black neighborhoods.

Traffic Zone[a]	Cars	Workers
40	96	147
41	308	497
42	348	464
26	129	244
50	188	183
Total	1,069	1,535

Source: Planning Department, North Carolina State Highway Commission, Lumberton Origin/Destination Traffic Survey, 1966.
[a]These are the zones shown in Figure 2 that contain a predominantly Black population.

Figure 1. Routes operated by Lumberton Transit Authority, Inc., January 9 to March 5, 1971.



The school population of the City of Lumberton was as follows:

Year	Total	Black	Percent Black
1960	4,768	1,095	23
1970	5,500	1,456	26

Table 2 was constructed from various data sources to present an overview of the employment situation in Lumberton. A disproportionately small share of manufacturing employment on the periphery of Lumberton is Black. Whereas Blacks constitute 25 percent of the Lumberton population, they are between 10 and 20 percent of the work forces in the two major firms surveyed. Much of the industrial labor force comes from rural areas in the vicinity of Lumberton, particularly White and Indian labor forces.

The data in Table 3 indicate that in the predominantly Black neighborhoods there was approximately 0.70 auto per worker. This means that 466 persons, or 30 percent of Blacks in the labor force, do not go to work in an automobile that they own. This is based on the assumption that, if there is an auto in a family, then it is used to commute to work by the person or one of the persons who is employed in that family.

These autoless workers currently either are getting to work by some other mode or are in car pools. Based on a visual survey, it was determined that there is an extensive amount of car-pooling taking place in Lumberton.

The Failure of Privately Organized Public Transit in Lumberton

Between January 9, 1971, and March 5, 1971, a private, church-sponsored group incorporated as the Lumberton Transit Authority (LTA) ran a conventional public transit service almost wholly within the city limits of Lumberton. This service was instituted without a preliminary feasibility study. There was a long-felt need, primarily within the Black community, for non-automobile transportation in the town. Because of excessive operating costs, the private company went bankrupt within 2 months, even before maximum ridership could be developed.

Transit service consisted of three to four routes radiating from the town center, as shown in Figure 1. Two buses initially were assigned to the North and South routes (often operated as one contiguous route without transfers). A third bus began operating on the East-West route on January 20 but was terminated on January 30 when one of the regular buses broke down. Fares were 25 cents per ride.

By the end of the first week of operation, almost 300 trips per day were being made on LTA buses. As shown in Table 4, traffic tended to fall Wednesdays and Thursdays, down to 150 to 200 trips per day. Traffic rose toward the end of each week, with Friday and Saturday showing the highest patronage. The peak use occurred at the end of the third full week of operation, a Saturday, when over 350 trips were made. The following week one of the North-South route buses broke down and had to be withdrawn from service; the East-West bus replaced it, with service on the East-West route suspended.

Although the East-West line rarely carried more than a small percentage of the daily total, overall LTA patronage dropped significantly when service was curtailed. This drop is more likely ascribed to the unreliable service caused by the malfunctioning bus on the heavier North-South routes rather than the lack of coverage due to the elimination of the East-West route. Also, the drastic fluctuations of traffic shown on the East-West route probably occurred because its bus was occasionally assigned to one of the North or South routes as a substitute vehicle.

Buses on the North route and the eastern part of the East-West route had difficulty meeting the intended schedules and took more than the originally scheduled times to make their runs.

During the sixth and seventh weeks maintenance difficulties reduced the operations to one vehicle, with service discontinued after 6:00 p.m. Two buses, on the short operating day, were reinstated during the last week and a half of operation, with significant rises in patronage to the former levels.

Table 4. Number of passengers carried per day, Lumberton Transit Authority, Inc., January 9 to March 5, 1971.

Week	Day	Date	Combined Routes	South Route	North Route	East-West Route	Total Passengers	Number of Buses
	Sat.	1-9	163				163	1
I	Mon.	1-11	127				127	1
	Tue.	12	141				141	1
	Wed.	13	107				107	1
	Thur.	14	116				116	1
	Fri.	15	130				130	1
	Sat.	16	298				298	1
II	Mon.	1-18		77	63		140	2
	Tue.	19		74	92		166	2
	Wed.	20		104	114	29	247	3
	Thur.	21		80	91	52	223	3
	Fri.	22		386	282	34	702[a]	3
	Sat.		no data					
III	Mon.	1-25		164	66	10	240	3
	Tue.	26		101	88	56	245	3
	Wed.	27		108	66	11	185	3
	Thur.	28		116	113	12	241	3
	Fri.	29		138	92[b]	90[b]	320	3
	Sat.	30		203	136	13	352	3
IV	Mon.	2-1		90	89		179	2
	Tue.	2		146	103		249	2
	Wed.	3		177	108		285	2
	Thur.	4		121	106		227	2
	Fri.	5		155	110		265	2
	Sat.	6	no data					
V	Mon.	2-8		202	29		231	2
	Tue.	9		147	140		287	2
	Wed.	10		121	102		223	2
	Thur.	11		140	94		234	2
	Fri.	12		228	96		324	2
	Sat.	13		254	30		284	2
VI	Mon.	2-15[c]		224	3		227	2
	Tue.	16		202			202	1
	Wed.	17		206			206	1
	Thur.	18		161			161	1
	Fri.	19		171			171	1
	Sat.	20		216			216	1
VII	Mon.	2-22		168			168	1
	Tue.	23		141			141	1
	Wed.	24		131	22		153	2
	Thur.	25		130	53		183	2
	Fri.	26		111	150		261	2
	Sat.	27		189	151		340	2
VIII	Mon.	3-1		100	109		209	2
	Tue.	2		59	169		223	2
	Wed.	3		55	158		213	2
	Thur.	4		154	94		248	2
	Fri.	5		156	167		323	2

Source: Derived from cash receipts per bus of the Lumberton Transit Authority, Inc.

[a]Suspect this is two days' receipts: 702/2 = 351.
[b]The east-west bus was probably substituted for the north-south bus part of this day.
[c]Service cut back to 6 p.m.

Table 5. Estimate of capital requirements.

Buses (4 at $15,000)		$60,000
Fare registers (4 at $400)		1,600
Tires		2,400
Office furniture and fixtures		1,000
Working capital:		
Insurance deposit premium	$1,000	
Rent, deposit and advance	500	
Utility deposits	100	
Cash balance	3,800	5,400
Total		$70,400

Service was terminated on Saturday, March 5, 1971. (That day, interestingly, had one of the highest levels of patronage, despite service cutbacks, of the entire operating period.) The Lumberton Transit Authority, Inc., had been plagued by relatively high costs, unreliable vehicles, and service undercapitalization throughout its history. Lack of ability to meet its operating expenses forced the company to suspend operations.

A study of the patronage of the now-defunct Lumberton Transit Authority reveals that there is definitely a demand for an alternative transportation service other than the private automobile, principally on the North-South axis in Lumberton.

Judging from the gyration of patronage between routes on certain days and discussions with some of the principals in the LTA, operations were plagued by bus breakdowns and other service reliability problems. The company purchased old vehicles and did not have a large enough number to provide needed back-up services. Regular and reliable service can sustain a higher patronage than unreliable operations, and most probably for the latter reason the LTA did not reach its highest demand levels.

Since the principal route (North-South) served primarily the business and retail districts (both downtown and the shopping centers), it must be assumed that most of its patronage was made up of shoppers and some employees in the retail establishments. The bus routes did not provide access to most of the major employers in the Lumberton area (Fig. 1), although the North loop did terminate at the shopping centers at North Elm (the principal regional shopping center) and only 2 short blocks from the Southeastern General Hospital. The short-lived East-West route had one pair of runs per day serving the B.F. Goodrich plant and on its eastern segment passed within 3 blocks of Jones Knitting. Other than that, the routes were primarily oriented toward the downtown, the county seat, and a major retail district.

The financial difficulties that caused ultimate termination of all service indicate that conventional operations (buses running on fixed routes and fixed schedules despite variations in demand) could only be applied to Lumberton in special circumstances.

The Lumberton Transit Authority operation can be usefully considered as a valuable experiment in determining which types of transit would be best for Lumberton and can also be used to aid in determining patronage and operating structure of proposed systems.

The LTA system's biggest pitfall was in trying to operate a fixed-route system in a low-density area with obsolete buses, lack of sufficient cash flow, and top-heavy administrative structure. For the first 4 weeks of operation, its gross passenger revenue was $1,494.18, while its total expenses, including start-up costs, were $16,705. Of total expenses, approximately 25 percent could be considered recurring operating expenses, exclusive of insurance and depreciation. About $4,000 was spent for the used buses, and insurance came to some $4,000 per year. While a larger capital investment would have kept the company solvent, about $4,500 per month in revenue would have been needed to cover operating costs alone, including insurance but exclusive of vehicle depreciation or interest on outstanding debt. It is doubtful that the type of system being run, particularly with the aged and expensive vehicles utilized, could ever have generated enough income to cover operating costs.

LTA, during its 8 weeks of operation, accumulated more than 1,300 bus-hours of service. Not including their non-operating overhead, at $4,500 per month, LTA's per-hour bus operating costs were close to $7.00.

In Fayetteville, the nearest city with a transit system, the transit operators figure that it costs $5.00 an hour to cover operating costs. They operate 25 General Motors TDH-3162's, a 31-passenger bus dating from the early 1960's. Total revenue to cover all overhead and depreciation, as well as a fair profit, would come to about $7.50 per hour; however, their revenue is insufficient to reach that level and they estimate a loss of $4,000 per year on the regular transit service. Profits come from contract operations for the U.S. Army in Fort Bragg and for several small towns nearby. For contracts they charge $8.00 per hour or 50 cents per mile.

At LTA's high overhead rate it would have been cheaper to contract with Fayetteville for service. For $1.00 more per hour, LTA would have been buying a higher level of reliability and skilled management. Fayetteville is a 30-minute drive north of Lumberton along the Interstate. The Fayetteville bus company has invested exten-

sive capital in buying spare parts and maintains a trained mechanic on duty whenever buses are in operation. Such a large investment in overhead could economically be spread over several smaller bus operations in adjacent towns. The private operator has extended his service to one other town, Goldsboro, but as yet has not developed any proposal for serving Lumberton.

Minimizing the Public Cost of Transit to Low-Income Neighborhoods: Innovations in Public Transit for Lumberton

The Transportation Institute of North Carolina Agricultural and Technical State University was invited by local sources to study the problems of transit planning in Lumberton and devise an innovative solution that would have only limited requirements for public support. The study group consisted of an interdisciplinary team of faculty and selected external consultants. This team included a management specialist, an economist, and two urban transit specialists.

The "Lumberton Transit Feasibility Study" (4) suggested a system consisting of a 2-bus operation over substantially what was formerly called the North-South route, offering 30-minute headways from 7:00 a.m. until 9:00 p.m. Monday through Thursday and continuing until 10:00 p.m. on Friday and Saturday. The fare would be 25 cents on this route. The operating costs of the proposed service were based on a 60-minute round-trip running time and a 10-mile round-trip route. In addition, a one-bus dial-a-ride operation was proposed that would operate over what was formerly called the East-West route offering a 120-minute headway from 7:30 a.m. to 3:30 p.m. and from 4:30 p.m. until 8:30 p.m. Monday through Thursday and extending until 10:30 p.m. Friday and Saturday. This would not be a conventional fixed-route operation because there would not be a sufficient volume of demand to justify a conventional system along this route.

The dial-a-bus route would allow the bus to deviate from its route at the request of the passengers to allow for doorstep service. Any customer living within ¼ mile of this route could request doorstep service by telephoning the dispatcher from his home or by giving the driver his request as he boards the bus. Before starting each run, the driver would be given the phoned requests. These requests must be phoned in before the driver starts his run unless a 2-way radio system is utilized. The high quality and convenience of the service being offered on this route dictated the 50-cent fare that was recommended.

The vehicle used for this route would run a premium-special home-to-work service between 6:30 and 7:30 a.m. and 3:30 and 4:30 p.m. (Premium-special is the name given to a home-to-work subscription service that operated under a federal demonstration grant program in Peoria, Illinois.) This would be subscription service for workers at the major employers in Lumberton. The routing for this service would be determined by the subscribers' locations, although initially service would be offered only to residents of a small area in a specific part of the city. This so-called premium-special service could as it catches on be expanded through use of the fourth vehicle. Persons wanting to use this service would sign up in advance for 1 month's or 1 week's service for a prepaid 50 cents per ride.

The projected cost and expected revenue of this recommended system are as follows:

System: Three 18- to 23-passenger air-conditioned buses and one spare
Routes, schedules: North-South route to be conventional fixed route service with 30-minute headways; East-West route to be dial-a-ride service with 120-minute headways
Estimated yearly operating costs:

Drivers' wages (12,954 hours at $2.07)[a]	$26,814
Fuel and maintenance (129,540 miles at 5.88 cents)	7,617
Dispatchers (4,080 hours at $2.07)[a]	8,446

[a] Basic rate of $1.80 per hour plus 15 percent for vacations, sick leave, FICA, unemployment insurance, etc.

Utility man (part-time)	1,300	
Tire replacements	4,500	
Utilities	1,300	
Subtotal		$49,977
Operating rents		1,200
Insurance and safety		4,500
Traffic and advertising		500
Manager ($12,000 + 15 percent fringe benefits)	13,800	
Accounting and legal fees	500	
Office forms and supplies	100	
Subtotal		$14,400
Total operating expenses		$70,577
Passenger revenues		$45,900
Net operating surplus (or deficit)		(24,677)

The total yearly operations and maintenance costs of $49,977 are for a projected 12,954 bus hours of service. The resulting $3.86 per hour operating costs are extremely low compared to most transit operations. This is primarily due to the relatively low wages being paid the driver. Adding the administrative expenses to the operations and maintenance costs drives the costs up to $70,577 ÷ 12,954 = $5.45 per hour.

Passenger revenues are estimated at $45,900 for the first year's operation. To allow the new bus service to break even in its second or subsequent years of operation (not including its capital recovery costs) would require an additional $24,677 in passenger revenue, which means a 54 percent growth in ridership. This growth is feasible, but only starting the system into operation will determine whether it will be realized.

Capital Recovery Cost

Table 5 lists the estimated capital requirements for setting up such a service. The capital recovery costs are not generally considered as part of the operator's expenses by transit operators. They are presented here so that the true cost of providing the services can be computed. Capital recovery costs of the 18- to 23-passenger buses and fare boxes are based on a 6-year period at 8 percent interest:

(4 buses at $15,000) + (3 fare registers at $400)
($60,000 × 0.21632) + ($1,200 × 0.21632)
($12,979) + ($260) = $13,239

Thus, the yearly deficit will be $24,677 + $13,239 = $37,916 if capital recovery costs are included.

Conventional Fixed-Route System

For purposes of comparison, an analysis of the expected equipment costs, operating costs, and revenues from operating a conventional fixed route system like the one attempted by LTA was prepared:

System: Three operating 18- to 23-passenger air-conditioned buses and one spare.

Routes, schedules: North-South route and East-West route to be conventional fixed-route service with 30-minute headways on the North-South route and 90-minute headways on the East-West route because of time saved by elimination of the dial-a-bus feature.

Estimated yearly operating costs: The costs of operating this system would be virtually identical to the cost of the system that includes the dial-a-bus feature on the East-West route except for the elimination of the necessity of having a dispatcher available at all hours of operation. If a part-time dispatcher is hired it would result in a savings of approximately $4,000. Thus, the total operating expense for this system would be $70,577 - $4,000 = $66,577.

Figure 2. Lumberton traffic analysis zones (Source: North Carolina State Highway Commission).

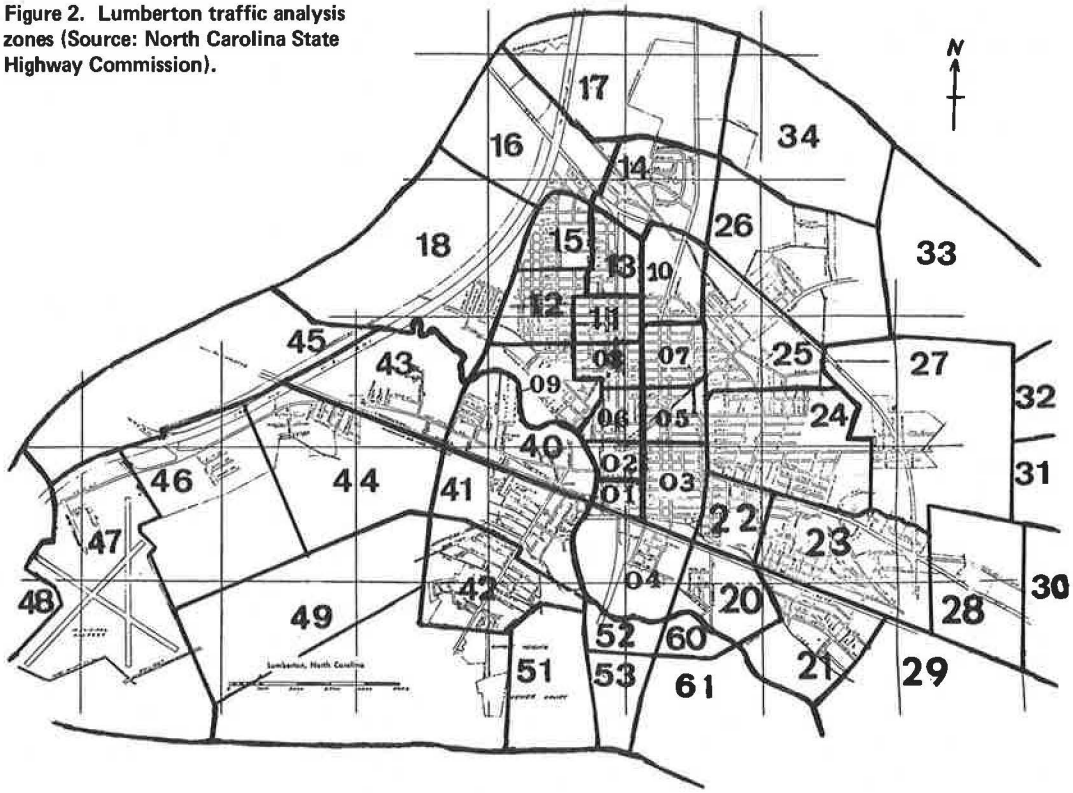
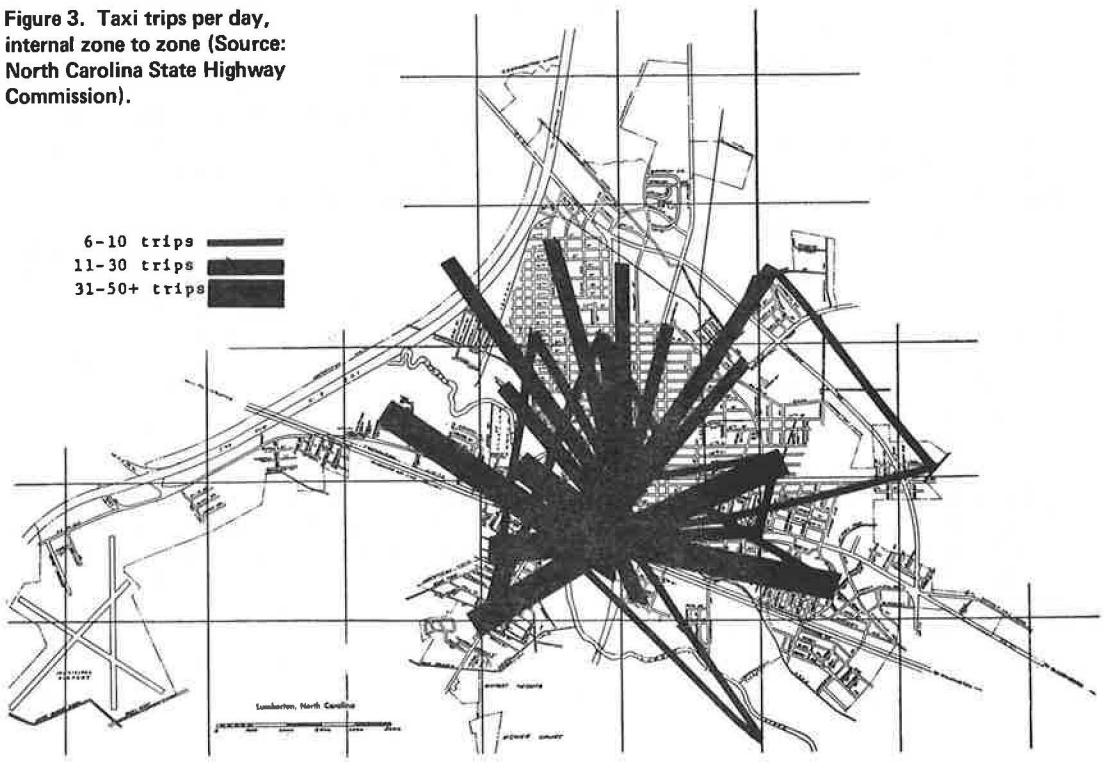


Figure 3. Taxi trips per day, internal zone to zone (Source: North Carolina State Highway Commission).



Passenger fares for the East-West system would increase 25 percent because of the better headways, but the fares would be reduced 50 percent from 50 to 25 cents. Thus, as detailed in the section on passenger revenue, estimated revenue for this route would decrease from $47,900 to $40,162.

Therefore, the net operating deficit for a conventional fixed-route system would be $40,162 - $66,577 = $26,415. This deficit is $1,738 larger than the one predicted for the recommended system.

DEMAND FOR PUBLIC TRANSPORTATION IN LUMBERTON

Public transportation is usually used by persons who have either no automobile or no access to one. In some congested areas, auto owners and users have been diverted to mass transit, usually transit that runs on exclusive rights-of-way to bypass the congestion. However, this is an unlikely candidate for Lumberton since there is both ample parking and street space in the more congested sections of the city.

Normally, some 40 percent of public transit trips are made during the two peak travel periods of the day—to and from work. The remainder of transit trips, for work, recreation, or personal business purposes, are spread over the remainder of the day, with very few trips being made at night and on Sundays. This characteristic of transit is termed the "peaking phenomenon"; it makes such services extremely difficult to operate economically. Because of severe peaks in demand, most of an operation's capital and labor are only used a few short hours per day. Few transit lines lose money in the rush hours; it is the rest of the day that drains an operation of any profit. Where density is sufficient, transit service is quite economical in the peak hours.

It is unlikely that Lumberton is any different in characteristics of total travel than the average small city; most firms start work at the same time in the morning and end their shifts at the same time in the afternoon. Traffic congestion does not appear high enough to encourage employers to stagger their working hours, although a small amount of staggering would probably eliminate whatever auto congestion there is near the major factories. If a conventional mass transit bus system were planned for Lumberton, with the usual grid system of routes, it is certain that the system would be inordinately expensive to run and would generate little more revenue than that produced by the four-route system tried by the LTA in 1971.

For a small town like Lumberton there is no magic formula to aid in determining the potential demand for a transit service in advance of operating the service. The prior existence of a service, which Lumberton fortunately can benefit from, is one of the best indexes of success or failure of proposed services. Furthermore, there is some reason to suspect that the riders generated by the LTA did not fall into the normal journey-to-work category of public transit in small cities, with the consequent uneconomic patterns of highly peaked use.

One reason for this suspicion is the very low use of the East-West route, which did serve potential work sites. (Note that the North-South route generated almost its full potential by the end of the first week.) And, as indicated previously, traffic rose on typical shopping days and fell during midweek. Some patronage of the bus routes must have been work trips, but such trips were likely a smaller percentage of the total than normally found. Work trips made on LTA's buses could only have been oriented toward downtown, the hospital, and the shopping centers.

The level of automobile ownership and use and data on non-auto trips such as car-pooling and taxi use are other indications of potential transit use. It is generally recognized that car-pooling is very high among low-wage employees in Lumberton, although no hard data have been developed in this respect. Taxi use, fortunately, was surveyed in 1965 as part of the North Carolina State Highway Department's Origin/Destination Traffic Survey (2). The zones for the traffic survey are shown in Figure 2, and the taxi "desire lines" or number of taxi trips each day between zones are shown in Figure 3, which was developed from the highway department's data.

Not surprisingly, the downtown area is shown as either the origin or destination of most of the taxi trips in Lumberton. The heaviest use is approximately along the routes

Table 6. Population and automobile ownership by zone.

Zone	Persons 5 Years Or Over	Automobiles	No. of Automobiles per Household	No. Employed per Household	No. Employed per Auto	No. Persons Over 5 per Auto
01	12	6	1.00	1.00	1.00	2.0
03	322	120	1.00	1.27	1.27	2.7
04	266	82	0.86	1.06	1.23	3.2
05	367	148	1.09	0.86	0.78	2.5
06	367	228	1.50	1.21	0.80	1.2
07	464	203	1.23	1.07	0.88	2.2
08	451	237	1.52	0.81	0.53	1.9
09	449	256	1.41	1.20	0.85	1.8
10	160	70	1.37	1.75	1.27	2.3
11	430	228	1.35	1.19	0.82	1.9
12	602	350	1.72	1.34	0.78	1.7
13	95	51	1.34	1.00	0.75	1.9
14	155	81	1.50	1.63	1.09	1.9
15	417	216	1.88	1.43	0.76	1.9
16	73	37	1.68	0.68	0.40	1.9
17	20	4	1.00	1.00	1.00	5.0
18	421	145	1.16	1.21	1.04	2.9
20	84	12	0.67	1.00	1.50	7.0
21	384	117	0.90	1.20	1.33	3.4
22	947	256	0.86	1.09	1.27	3.7
23	1,625	466	0.92	0.96	1.04	3.5
24	1,954	752	1.24	1.37	1.11	2.6
25	689	214	1.09	1.52	1.39	3.2
26	658	129	0.82	1.17	1.42	5.1
27	371	156	1.33	1.44	1.08	2.4
28	315	89	1.07	1.25	1.34	3.5
29	133	51	1.34	1.50	1.12	2.6
30	172	77	1.51	1.74	1.16	2.4
31	78	12	1.00	2.50	2.50	6.5
32	76	19	1.00	1.00	1.00	4.0
33	296	65	1.00	1.78	1.78	4.5
34	16	8	1.00	1.00	1.00	2.0
40	339	96	1.00	1.53	1.53	3.5
41	980	308	0.85	1.37	1.61	3.1
42	1,262	348	0.92	1.22	1.33	3.6
43	228	36	0.55	1.36	2.50	6.3
44	554	174	1.27	1.77	1.40	3.2
46	297	89	1.00	1.34	1.34	3.3
47	169	54	1.17	1.00	0.85	3.1
49	104	13	0.50	0.65	1.30	8.0
50	717	188	1.00	1.30	1.30	3.8
51	57	17	1.70	1.70	1.00	3.3
52	175	40	1.14	1.29	1.13	4.3
53	118	38	1.15	1.73	1.30	3.1
61	123	43	1.16	1.00	0.86	2.9

Source: North Carolina Highway Commission 5 percent sample traffic survey.

that LTA buses used, although with far less daily patronage in the North-South axis than the buses generated. This is easily explained by the difference in the fare: $1 for the taxi versus 25 cents for the LTA bus. Along the East-West routes, on the other hand, taxi use surpassed the average LTA bus patronage for that route. The 2-hour headway on the East-West route could not have been sufficiently attractive to sustain the same level of patronage as the North-South routes, even though the population characteristics and level of auto ownership are about the same (auto ownership is a bit lower) for both areas of the city. (It should be noted that a 1-hour headway on the East-West route was originally planned by using the fourth bus, which was inoperative. Even a 1-hour headway would not be sufficient to attract patronage, and reliability of service would hardly have improved since there still would not have been a spare vehicle.)

Automobile ownership rates by zone and occupancy rates were obtained from origin-destination survey data and are given in Table 6. Figure 4 shows those zones with the highest and lowest number of persons (over 5 years old) per auto. Two out of 6 zones with 5 or more persons per auto are located on the LTA bus routes; the other 4 zones were too far on the edge of the city to be easily served by conventional bus transit. There was general correlation between the highest income areas and zones with low auto occupancy rates. For the rest of the city, only the pockets noted show a particularly severe deficiency in auto availability that might affect mobility. These pockets should be taken into account when planning any future public transportation services, recognizing that the degree of poverty in these areas that shows up in low automobile ownership also indicates a lessened demand for journey-to-work trips and probably a higher demand for social service mobility.

Another indicator of demand, location of major employment centers, clearly shows the difficulty of improving general mobility in Lumberton for the non-auto-owner by running a conventional transit system. Almost all of the major employers, except two factories and the retail centers, are located beyond the city limits, spread out primarily along Interstate 95 (south) and State Highway 72 and US-74. These are shown in Figure 5; firms employing more than 100 persons are listed in Table 7. Telephone interviews with several of the major firms revealed a willingness on their part to cooperate in improving transportation for their lower income employees, but it was pointed out that more than half of their employees do not live in Lumberton or nearby, and the region's fairly high unemployment rate has, of course, not constrained the availability of labor.

PASSENGER REVENUE ESTIMATES

As has been mentioned earlier, there is no magic formula for determining the potential demand in advance of operating the service. However, to make financial projections, it is necessary to have some estimates that will be used to determine the potential revenue that will be generated.

Projection A, given in Table 8, represents the estimate of the expected revenue passengers per month for the first year's operation of the recommended system. It was derived from a consideration of the items previously discussed, with an emphasis on the past experience of LTA and projections of the growth that could be expected with the higher quality of service that will be provided by the recommended system.

For comparison, a more conservative estimate of expected passengers is given in Table 9 for Projection B. However, Projection A is used in all financial projections and represents expectations for the first year's operations. It is expected that a successful first year of operation would lead to increased ridership in the second and subsequent years of operation, but no accurate estimates of this increase are practical. It is not expected, however, that this passenger increase would be sufficient to cover the operating costs of the system unless there is an unusually favorable community response to the system. This will be elaborated on in another section of this paper.

In another section of this report the cost of operating a conventional fixed route system is estimated. Table 10 gives a projection of the revenues that would be generated by this system.

Figure 4. Automobile availability, persons over 5 years old (Source: Table 3).

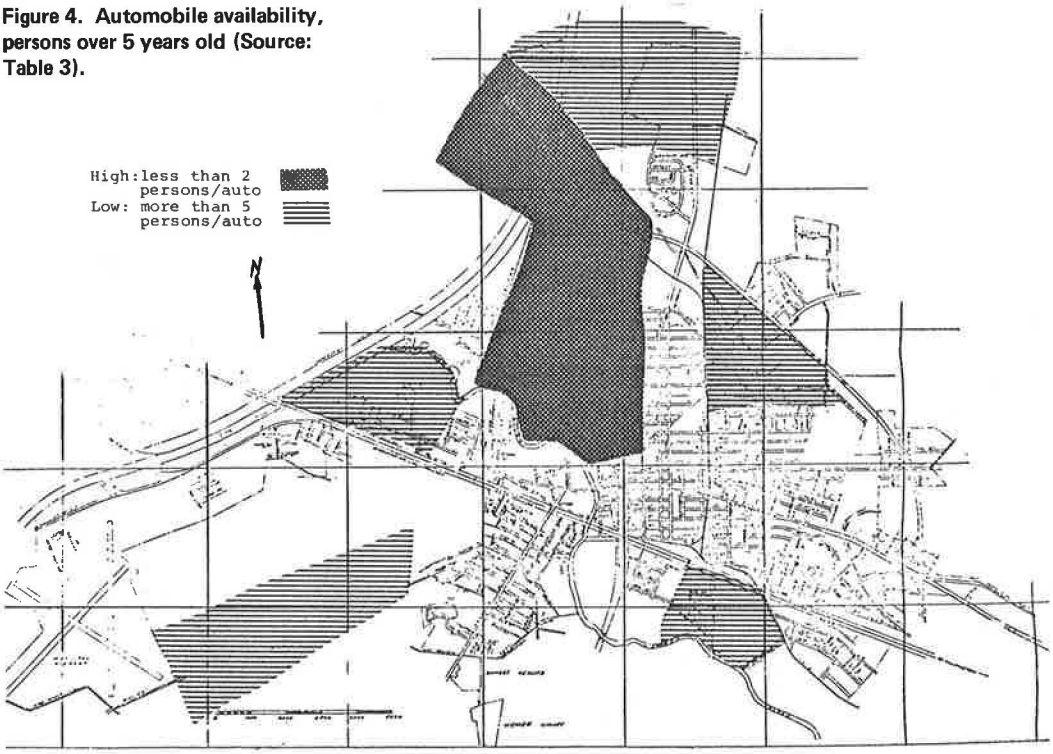


Figure 5. Industries with over 100 employees (see Table 7).

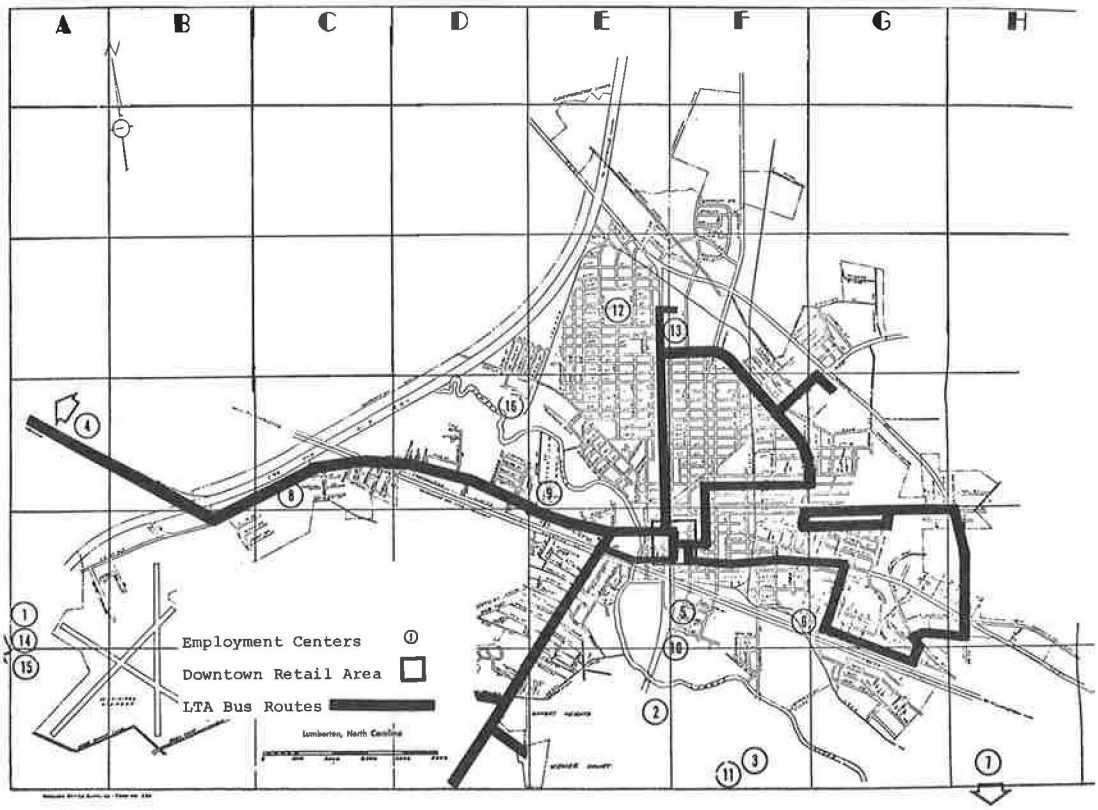


Table 7. Lumberton industries with employment of 100 or more.

Firm	Location	Product	Number of Employees
1. Acme Electric Corp.	I-95 South	Transformers	220
2. Alamac Knitting Mills	S. Chestnut Ext.	Knitting and dyeing	801
3. Cannon Foods, Inc.	S. Chippewa	Canning	100[a]
4. B. F. Goodrich Footwear	Highway 72	Tennis shoes	1,810
5. Henderson Manufacturing Co.	S. Walnut	Fatigues	160
6. Jones Knitting Corp.	Dresden Avenue	Knitted garments	365
7. Kendall Company	US-74 East	Infants' wear	140
8. Lumbee Corp.	2100 W. Fifth St.	Robes and dusters	176
9. Osterneck Industries	McQueen St.	Polyethylene bags	123
10. Pembroke Manufacturing Co.	S. Walnut	Ladies' sportswear	190
11. Pepsi-Cola Bottling	S. Chippewa	Beverages	125
12. Southeastern General Hospital	27th Street		
13. Shopping Centers			
Briggs Park	North Elm		
North Elm	North Elm		
14. TexFi	I-95 South	Textiles	785
15. Temptation	I-95 South	Stockings	235
16. Balcord	Velcord Drive	Textiles	250

[a]Seasonal.

Table 8. Revenue projection A for recommended system.

Route	Passengers[a]	Days[b]	Fare (cents)	Revenue (dollars)
North-South	400	306	25	30,600
East-West	100	306	50	15,300
Annual revenue				45,900

[a]Projected average weekday passengers.
[b]6 days per week x 51 weeks per year (holidays excluded) = 306 days of operation per year.

Table 9. Revenue projection B for recommended system.

Route	Passengers	Days	Fare (cents)	Revenue (dollars)
North-South	300	306	25	22,950
East-West	75	306	50	11,475
Annual revenue				34,425

Table 10. Revenue projection A for conventional system.

Route	Passengers	Days	Fare (cents)	Revenue (dollars)
North-South	400	306	25	30,600
East-West	125	306	25	9,563
Annual revenue				40,162

Fares

The recommended fare for the North-South route is 25 cents per ride, and the fare for the East-West dial-a-bus service is 50 cents. Higher fares should not be considered if the transportation system is to be regarded as a service as opposed to a profit-making venture. Fare increases would tend to drive passengers from the system to alternative modes. The overall effect of increased fares will be to slightly increase total revenue. For example, a 5-cent increase in the 25-cent fare (20 percent) would probably divert less than 20 percent of the passengers to alternative modes. Thus, the total revenue would be greater with a 30-cent fare than with a 25-cent fare. This higher fare is not recommended, however, because a high level of patronage should be one of the goals of the new transportation system.

SOURCES OF FINANCING

Depending on the type of ownership of the transit operation, there are a varied number of sources of financial support for mass transit. Privately owned transit systems will finance their capital improvements and operating costs primarily from fare-box revenues.

Lumberton may aid the private operator by obtaining a federal grant for up to two-thirds of the cost for capital improvements such as rolling stock and terminal facilities and then giving the equipment to the operator. Because capital grants are available only to legally authorized public bodies, private transit operators may participate in federally aided projects only through a public agency. The remainder of the money would be provided from local sources. These could include local businessmen or the City of Lumberton.

The Urban Mass Transportation Act of 1964 initiated a federal grant program that is administered through the Urban Mass Transportation Administration (UMTA) of the U.S. Department of Transportation. This program has provided grants of various types to aid cities in their public transportation problems. Projects eligible for capital grants include acquisition, construction, reconstruction, or improvement of facilities and equipment for use in mass transportation in urban areas. Repairs, maintenance, and other operating costs and ordinary governmental or non-project operating costs are not eligible as part of the grant.

A grant may be made for not more than two-thirds of that part of the cost of the project that UMTA determines cannot reasonably be financed from revenues, provided that all comprehensive and transportation planning has been completed. UMTA must be assured by the applicant that the local one-third share of net project cost is or will be available prior to the completion of the project.

Lumberton will require approximately $70,000 of capital to initiate operations. The minimum time necessary to process an application for a capital grant is from 3 to 6 months. It was therefore suggested that an application be made as soon as possible to cut down on the delay before the federal funding is received.

Financing of Operating Costs

It was expected that the bus transit system would not be able to pay for all its operating costs out of its fare-box revenues. Some other source of operating funds must be found to supplement the passenger revenues. A request for an operating subsidy should be made to the city officials. This request must have the proper support from the citizens of Lumberton, or the city officials are not likely to want to take this subsidy from the general tax funds.

Other local sources of operating funds may be available through poverty agencies or church groups, but these may not be appropriate sources for operating subsidies that may be required annually.

If the City of Lumberton wants to assume the responsibility for providing an operating subsidy for its transit system, then it was recommended that it buy transit services from the private operator. The city would pay the transit operator the difference between his costs and the passenger revenues that accrue from the operations.

LESSONS FROM THE LUMBERTON CASE STUDY

Despite thorough investigation of ridership possibilities, innovative transit operations to serve employers and shopping destinations, and cost-saving programs, the City of Lumberton will have to contribute in the vicinity of $30,000 per year to the fare-box receipts in order to maintain an adequate selective public transit program. It remains to be seen whether many small towns are willing to assume such a financial responsibility.

These considerations lead one back to a reanalysis of why the local transit operation appears so expensive. Two reasons stand out: Management costs are high, and maintenance of vehicles is necessary at all times. Further costs are inherent in the need to have standby vehicles always available. It is interesting to note in the Lumberton case that labor costs, which normally constitute a high percentage of the total costs of operation, are quite low in view of the overall abundance of a labor supply.

Public transit in small towns such as Lumberton would be much more economically feasible, therefore, if the costs of overhead could be spread among several towns within a 50-mile radius of each other. It was noted in the case study that such spreading of overhead among several operations has already occurred under private initiative in Fayetteville.

Since capital grants from UMTA are available only to public agencies or private operators subcontracting from public agencies, it would appear sensible for several towns in the area to submit a joint proposal for selective public transit to serve the transportation-disadvantaged. A proposal could be channeled through the regional planning agency (the regional council of governments).

To date, no such joint proposal has been submitted. Lumberton and the rural towns surrounding Fayetteville provide an opportunity to test the feasibility of this design.

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