1992

BOWLING GREEN PUBLIC

TRANSPORTATION

STUDY

Prepared by

Department of Public Works
Division of Engineering
City of Bowling Green, Ky.
P.O. Box 430
Bowling Green, Ky. 42102-0430
Ph. 502-843-5628

Prepared for

Mayor and Commission
City of Bowling Green, Ky.

November 11, 1992

EXECUTIVE SUMMARY

A comprehensive study of public transportation needs in Bowling Green has been completed by the City's Engineering Division at the request of the City Commission. The study developed goals and objectives of a transit system; inventoried Census data, previous studies, existing service providers, and operations in similar cities; analyzed the relationships and implications of that data; designed four alternative systems; evaluated the extent to which each alternative met the goals and objectives; reached conclusions, and made recommendations to the Commission.

The study found that most transit trips would be made by persons who have no automobiles available to them, including elderly, handicapped, and economically impacted persons. About one of every seven households in Bowling Green has no auto, according to the 1990 Census, and three out of four of those households are within two miles of City Hall in the central portion of the city. However, the remaining needs are spread throughout the city, and many key destinations, such as shopping malls and industrial parks, are near the edges of the city limits. The City itself has an exceptionally low density, making transit more expensive.

The study looked at four alternatives: 1) a traditional fixed route, fixed schedule system, 2) a demand-responsive (or "Dial a Ride") system providing door-to-door service, 3) a "user end" subsidy of the existing taxi service, and 4) the null alternative of no action. Costs ranged from $112,500 to $230,000 per year in local funds.

Analyses showed that Bowling Green has existing public transportation services, but those services are either too expensive or too restrictive to meet needs of those without automobiles available. Especially lacking are options for low income persons. Park and ride services for Western Kentucky University students, however, are very good.

All cities surveyed operated systems at substantial deficits. While the federal government funds up to half of the operating losses, the local governments are responsible for the remainder. Revenues typically cover only 15 to 25 percent of cost, since the true cost of providing an urban trip is about five dollars and fares are about one dollar.

Recommendations of the study:

Public transportation should be recognized as an unmet need of the City of Bowling Green and included in future needs assessment and financial planning by the City. Information on present services should be made available to the public on a consistent basis.

When long-term financial conditions permit, *the City should establish a user-end (taxi) subsidy system* for a six month trial duration. The service area would be the City of Bowling Green. Fare subsidy up to $2.50 for a trip for a city resident for a trip beginning and ending within the City would be provided. The City would provide a $40,000 local match Based on the results of the demonstration, a determination would be made by the City as to a permanent service area and continuation of the service.

The City should encourage and stress cooperative and coordinated services among local social service agencies through the Southern Kentucky Community Action Agency.

INDEX OF FIGURES

Figure

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT.)

TABLE OF CONTENTS (CONT.)

INDEX OF TABLES

Table

ACKNOWLEDGEMENTS

Preparation of this report would not have been possible without the assistance of a number of individuals and agencies. The following persons are among those who provided assistance: Dr. Ron Milliman, Dr. Jim Davis, and Mr. Horace Johnson, Western Kentucky University; Ms. Marilyn Anderson, Warren County Board of Education; Mr. Norman V. Lewis, Bowling Green; Mr. Charles Coates, Ms. Alice Burks and Ms. Stacy Crain, City of Bowling Green; Mr. John Matheney, City-County Planning Commission; Rev. Elliot Joiner, Bowling Green; Dr. Don Butler and Ms. Helen Allen, Southern Kentucky Community Action Agency; Mr. Steve Miller, Yellow Cab; Ms. Yvonne Guy, Warren County Fiscal Court; Ms. Melinda King, Bowling Green; Ms. Kay Brooks, City of Frankfort, Ky.; Mr. Dwayne Stice, Paducah (Ky.) Area Transit System; Ms. Sue Jeffers, Bluegrass Community Action Agency (Frankfort); Ms. Florence Tandy, Kentucky River Foothills Development Council (Richmond); Ms. Linda Stepenoff, Missouri Highway and Transportation Department; Mr. Tony Eldridge and Mr. Jim Smith, City of Clarksville, Tenn.; Mr. Rick Sparer, LexTran (Lexington, Ky.); Mr. Rick Dunning and Ms. Marita Wellage-Reiley, ATE Management and Service Company, Inc.; Mr. Ned Colcord, Barren River Area Development District; Mr. Jerry Ross, Ms. Vickie Bourne, and Mr. Dallous Reed, Kentucky Cabinet for Transportation; Mr. Bryant Worley, Jackson (Tenn.) Transit Authority; Ms. Mary Hicks, City of Elkhart, Indiana; Mr. Matt Brooks, Indiana Department of Transportation; Mr. Ralph Rascoe, City of Owensboro, Ky.; Ms. Sue Morris, Murray-Calloway (Co., Ky.) Transit System; and Mr. Darren Brugmann, MAPT-ZBUS (City of Zanesville, Ohio).

CHAPTER 1

OVERVIEW OF THE PUBLIC TRANSPORTATION PLANNING PROCESS

The transportation planning process has well-established stages which are followed in any study. An overview of those stages is provided in this introductory chapter.

Goals and Objectives:

The first step in the transportation planning process is the establishment of goals and objectives. In addressing public transportation needs this step requires consideration of important policy decisions early in the process that will affect the design of a system later in the study.

Goals and objectives are not isolated, vague, or airy statements that have no real meaning. Instead, the goals and objectives are part of a value hierarchy. That hierarchy has at its top the values of a community, followed by the broad goals reflecting those values, the specific objectives to meet those goals, the criteria by which the objectives are measured, and finally the standards which set the minimum or maximum limits the community will accept.

The only formal set of goals and objectives related to public transit in the Bowling Green area were from the 1974 study. Participants included an appointed committee which ranked and rated the goals. The most recent set of goals for community planning are those from the Warren County Comprehensive Plan Update, but these do not address specific public transit issues.

Among the issues that formed the community goals for transit are these:

a) *Service Area:* Would the system serve the entire city, parts of the county, be limited to certain parts of the city, or limited to an area with certain major generator exceptions (such as the Greenwood Mall)?

b) *Type of Trips Served:* Would the system focus on work trips for commuters (as recommended by the Comprehensive Plan) or emphasize shopping, medical, and educational trips, which comprise the typical needs in cities under 50,000?

c) *Type of Client Served:* Would the system address general transportation needs of the public or focus on transit-dependent persons (the elderly, the physically challenged, and the economically disadvantaged)?

d) *Western's Needs:* To what extent would the system address transportation needs of students at Western Kentucky University, parking needs around campus, and would it interface with the existing park-and-ride system operated by the university?

e) *Specialized Needs:* Would the system address particular needs of the school systems and various social service institutions? Would needs of children as independent riders be addressed? Would job training and initial job access be a focus of the system, and would day care access be included? Would existing federal funding for transportation for the elderly, the physically challenged, and other specialized programs be integrated with this system?

f) *Private Sector:* How would impacts on the existing private taxi service be evaluated? Would a private operator be appropriate for the system?

g) *Costs and Ownership:* Should the system be owned by the City, the County, or by an independent transportation authority? Should a franchise be granted? Should local general tax revenues be used to offset deficits, or should a separate tax be levied for that purpose?

The answers to these questions formed the value hierarchy of goals, objectives, criteria, and standards. That hierarchy was then used to evaluate and select a preferred public transportation system for the community.

Inventory:

The second phase of the transportation planning process is inventory. Traditionally, huge sums of money and time has been spent on this phase, with every conceivable item exhaustively catalogued. Not surprisingly, little money or energy remained for analysis of alternative solutions.

The inventory phase, then, must be balanced against the rest of the study. The level of detail need not be greater than the accuracy of the simulation model, and neither the data nor the model need to be more precise than the level of decision being rendered. For example, if the issue is whether to build a freeway with four lanes or six, the decision is not enhanced by an inventory and model that yield an answer of 4.756 lanes!

Past transit studies in Bowling Green have developed extensive public surveys of attitudes regarding public

transit. However, national research indicates little correlation between such surveys and resulting transit ridership. Such surveys may reflect only a response a citizen feels is "expected" or one made without actual experience.

Accordingly, the inventory phase for the current study focused on the character and capacity of existing services, such as taxis, the shuttle service at Western Kentucky University, and agency services of the Southern Kentucky Community Action Agency. Census data from 1990 was the source of socio-economic data. Planning Commission maps reflected major destinations of tripmakers.

Analysis:

Census data. Maps. Service requests from citizens and agencies. National rates. Surveys.

All the data accumulated from the inventory phase of a study is worthless if it cannot be used to explain the relationships between certain actions, characteristics, and experiences. Until past and present conditions can be simulated in an abstract form, future conditions or changes cannot be accurately predicted. Therefore, data must be analyzed to establish certain relationships. Such relationships are called "empirical," since they result from the study of certain data, not from the establishment of principles or concepts.

Transportation planners relate available data through well-established empirical relationships, calibrating (or "fine-tuning") those relationships for a particular area. Sometimes relationships can be transferred directly from one city to another, but usually certain local conditions will prevail. Accordingly, careful analysis is necessary.

Planners usually produce a simple linear equation to predict the number of trips beginning or ending in an area, based on population or employment characteristics. However, explaining which trips go where is far more complicated, requiring sophisticated computer models and shortest path algorithms.

The analysis phase results in the tools needed to predict with sufficient accuracy the performance of alternative systems, and design of such systems is the next step in the planning process.

Design of Alternative Plans:

Once the inventory of existing systems and needs has been accomplished, and an analysis of the capacity and demand in the transportation system is complete, options for

addressing the existing and future demand by changing the capacity of the system (or perhaps even managing the demand) can be determined.

Alternative transportation systems allow planners, policy makers, and citizens the opportunity to see at a macro --or large scale-- level the effect of changes to the system. Installing a six route bus system on the existing highway system can demonstrate how many drivers would switch to the bus if routes ran once an hour or once every 30 minutes, if more than one transfer was needed, if downtown parking increased by 50 percent, or if congestion on the highway system created peak hour delays for automobile drivers. Computer simulation of the system permits many different choices to be considered, performing the millions of mathematical calculations in seconds.

Empirical relationships between certain actions and reactions can often be transplanted from one community to another. For instance, relationships between household income and automobile ownership are the same in Atlanta and Louisville. Moreover, experiences in other cities can be used to predict the effects of policy decisions: a 50 percent increase in the cost of a transit ride will result in a predictable decrease in ridership.

The design of alternative systems should focus on broad policy decisions: how much area to serve, how frequently to provide service, what capacity per route, and similar issues. Debates over narrower issues, such as which street a route should take, are best left to the project level of planning. The emphasis should be to provide a wide range of general choices with clear and measurable results.

Once distinct choices of systems are designed, the evaluation of those systems is made in light of the established goals and objectives, utilizing the data from the inventory stage and the tools developed in the analysis stage.

Evaluation:

Plans must be compared, both with each other and with the goals and objectives established at the beginning of the transit study. While one plan may on the surface appear to be the popular or logical choice, a careful, quantitative analysis may reveal problems not initially observed. For example, the preferred alternative may have a higher cost per mile or cost per trip that is masked by other elements of the plan.

The quantitative analysis is made in association with the specific criteria and standards associated with the goals and objectives. If, for example, a goal is equity and

an associated objective reduction of system costs, then a possible criteria might be cost per operating mile and a standard be a maximum of $2.00 per operating mile. Thus, plans could be compared in terms of the costs per operating mile; plans which exceed the standard could be eliminated or revised to meet it.

While this analysis is helpful, it does not address the question of what to do when one plan meets Goal A the best and another meets Goal B best. Which, then, is more important, Goal A or Goal B? While comparative weights may be set for goals at the beginning of the study, the impact of alternative plans on various unweighted goals can also be instructive. How the choice of one goal over another affects the actual outcome of the evaluation process -- the choice of one plan over another -- may help decision-makers determine the relative importance of each goal better than attempting in an abstract setting to compare the importance of one goal against another.

The result of the evaluation stage is the selection of an alternative plan to be recommended to the community.

Recommendations:

Based on the results of the evaluation of alternatives in view of meeting goals and objectives, a set of recommendations is established and forwarded to decision-makers.

IMPORTANT TERMS

A few technical terms are essential in understanding the body of this report:

Capacity - the number of passengers which can ride in a vehicle at one time

Demand-Responsive - a transit system that provides door-to-door service based on where demand for service exists, without regard to particular routes

Fixed Route - a transit system whose vehicles traverse an assigned set of streets by route without varying from those routes to meet individual needs

FTA - Federal Transit Administration, formerly the Urban Mass Transportation Administration

Headway - the time between available transit vehicles arriving at a given location, in minutes

Paratransit - a transit system that provides demand-responsive service to a target population or to the general population

Route - the streets by direction a scheduled vehicle takes during a given time period

Route-deviation - a system in which a vehicle varies its normal route to serve a particular need

Schedule - the time a vehicle is committed to serve a given area

Simulation - a computer representation of a real world event using mathematical relationships and selected assumptions

UMTA - Urban Mass Transportation Administration, now the Federal Transit Administration, the federal agency responsible for funding and technical assistance to public transit systems

TYPES OF TRANSIT SYSTEMS

Five different types of public transit systems were considered in this study:

Fixed Route, Fixed Schedule Systems:

Fixed route, fixed schedule systems represent the traditional city bus systems with which people are most familiar. Such a system last operated in Bowling Green during the early 1950s. While these system flourished up to and through World War II, ridership plummeted soon after the war. Nonetheless, such systems continue to be the dominant form of transit service in cities under 50,000, and of course serve as the foundation for all public transit in larger communities.

Fixed route, fixed schedule systems offer a high level of predictability, a characteristic important for work trips, where maintaining a schedule is critical. Such systems are most effective in high-density corridors or between two or three large generators. Long trips are served effectively, especially if transfers are well-planned. For trips more than three to four miles in length, fixed route is the better choice. Peak hours are in the mornings and late afternoons, reflecting the commuting pattern.

The service area for fixed route, fixed schedule systems is 1000 feet either side of the route. Some systems allow small deviations along the route to meet passenger needs.

Management of such systems is comparably easy, since the system performs the same way each day. Patronage may take months to develop, since trip needs must fit the route pattern. Obviously, coverage areas must be limited to the critical parts of a city. The walk distances required for transit make it less preferable for the elderly and certain of the physically challenged.

New requirements of the Americans With Disabilities Act have increased the cost of fixed route systems, since the act requires equal access and level of service for physically challenged persons.

Cities with fixed route systems find changing to a demand-responsive one politically difficult, even when economics suggest the change. Thus, selection of this alternative leaves little room for change in the future, whereas a demand-responsive system can evolve into a fixed route system.

Fixed route systems typically require at least 500 passengers per day in areas under 25 square miles to be effective. Fixed route is more cost efficient than other systems when the rate of demand is 80 or more passengers per square mile per hour. Between 10 and 80 passengers per square mile per hour, one has to examine a number of factors to determine the more cost-efficient system.

Operating costs for fixed route systems in second class cities in Kentucky average about $40,000 per route. Revenue is normally about 15 to 30 cents on the dollar expended.

Based on studies of a number of cities, Bowling Green may expect about 275 riders per day and about 2 riders per square mile per hour, assuming a 12 square mile service area, 12 hours per day, using four buses. (A service area population of 25,000 is assumed, with average density of just over 2,000 persons per square mile). However, consideration of actual trip patterns must be made before determining the viability of a fixed route system.

Demand-Responsive Systems:

After World War II public transit ridership in the United States plummeted in the face of better, cheaper, and faster cars traveling on wider and smoother roads. Suburbs sprang up at the edges of cities, and the commuter rush hour was born. Meanwhile, transit systems faced what appeared to be a slow but inevitable decline.

In the last 1960's transit planners focused on a new concept -- demand responsive transportation. Fixed routes and fixed schedules were dropped, and transit vehicles reacted strictly to demand. Users called the transit

service, often 24 hours in advance, to reserve a trip. The transit vehicle came to the door like a taxi, then proceeded to pick up and drop off other passengers while enroute. Eventually, the rider would reach his or her destination, again at the "door."

Unlike a taxi, the rider had to share the vehicle with others. Rather than a direct trip, a route was chosen in view of the travel needs of a group of riders. However, the door-to-door service was more convenient and feasible for many riders.

Fares were typically higher than traditional systems, though lower than taxis. Operating costs could be better controlled by increasing the ridership per operating mile. Commuters typically dislike the system due to the lack of an exact schedule; elderly and challenged persons prefer it for the door-to-door convenience.

Many variations of the demand-responsive concept were developed, including zones, many-to-few routing systems, and generalized routes with deviations. Only the latter, called "route deviation," has gained any popularity. This system uses a general route with certain key stops that are always served on a rough time schedule, but deviations for passenger needs is routine. The system retains the dependability of fixed route/schedule systems and the flexibility of demand-responsive systems, with a route becoming a type of zone. The requirements of the 1990 Americans With Disabilities Act has forced many transit systems to look at route deviation as an option.

While demand-responsive systems come in all shapes and sizes, a typical system in a six square mile service area of 18,000 people, such as the central portion of Bowling Green, would use six vehicles and serve about 400 persons per day.

User-End Subsidy System:

Not all transit systems provide buses or other high capacity vehicles to move riders. Some areas, particularly those with low densities, use existing taxi services. This method, called user-end subsidy, allows full use of private enterprise in providing service (with taxis in this case) but helps riders pay part of the fare. This allows cities to keep a taxi service viable without the competition of a government-subsidized bus system, which may result in a private taxi service becoming unviable. Where only one or two taxi companies serve an area, such competition may be considered unfair and undesirable for the community.

User-end subsidies may be for the elderly and physically challenged only or for the general public. In either case riders usually have to obtain a certified pass to obtain the

subsidy. The taxi company credits the passenger with the amount of subsidy (usually $1.50 to $3.00) and turns in the invoice later to the transit management authority.

In Elkhart, Indiana, a city of 44,000, all public transit is by subsidized taxi. The very popular service is used most often by elderly or physically challenged persons, but it is available to all citizens of the city. Over $300,000 was spend last year in subsidizing fares, with half coming from the federal government.

In areas of very low density, two or less trip demands per square mile per hour, taxi service is preferable to fixed route or demand-responsive service. Shared ride arrangements may also be more cost-effective than providing a large capacity vehicle.

In cities under 50,000 the true cost of a typical bus trip, nearly five dollars, is close to the average short taxi ride. Obviously, a low density of demand can quickly tip the economic scales toward taxi services.

Finally, user-end subsidies relieve local governments of the problems of owning and maintaining buses or vans. While the high level of federal subsidy for capital equipment may be appealing, studies show that federal funds actually cover only 58 percent of all capital costs for the typical system. Maintenance costs for a small, specialized fleet may also be high, as might insurance, administration, and dispatching. When a local taxi service already provides such services, some communities opt to utilize existing capacities in the taxi system with user-end subsidies rather than start new systems.

Brokerage System:

When communities inventory existing providers of public transportation services, the total sum of travel opportunities may be surprising. Few citizens are aware of the range of transportation services available from various federal, state, and local agencies, as well as from non-profit organizations. Sometimes the need in public transportation is not for more vehicles and staff but rather for coordination and matching of needs with capacity in the system.

Coordinating the demand and capacity is the function of a transportation broker. A brokerage system is really a clearinghouse for transportation. Ideally, the broker negotiates among competing providers on behalf of a client. More often, the broker seeks out a willing provider for a client's specific need. Coordination is vital where several agencies all have vehicles and services available;

duplication and overlay produce wasteful and unnecessary expenditures.

Social service agencies are often strapped financially and in terms of staff hours when trying to provide transportation. Volunteer transportation programs, many utilizing retired persons, offer an important resource for a community. Insurance and liability issues must be addressed, but this local source of drivers is often untapped. Volunteers can be found through organizations such as the Retired Senior Volunteer Program (RSVP), a part of the national volunteer agency ACTION. RSVP is part of the federally legislated grant program established by the Domestic Volunteer Services Act of 1973.

Locally, two existing programs meet the criteria of transportation brokers. The regional carpool/vanpool matching program, federally funded and administered through the Barren River Area Development District, addresses home to work trips. Social service trips are increasingly coordinated through the Southern Kentucky Community Action Agency, which recently hired a full time transportation coordinator using a local United Way grant.

Section 18 funding emphasizes coordination of services among local social service agencies receiving federal funding, as well as among other transportation service providers such as taxi companies.

Point-Deviation System:

The passage of the 1991 Americans With Disabilities Act imposed significant new accessibility requirements on transit operators. Many operators responded by adding a demand-responsive system for elderly and handicapped persons on top of the fixed route system they already operated. (Dial a Ride systems with handicapped-assessable equipment met the requirements of the act without significant changes). Obviously, the additional service requirements added to the financial problems many of these systems already faced. Some systems began looking for a alternative approach.

Since the most important requirement of the ADA legislation was accessibility, transit operators first looked to route-deviation, a method by which a bus deviated from its fixed route a short distance to pick up or discharge a passenger. This addressed those passengers near the route but did not fully meet the ADA intentions.

Operators then took a page from the Dial a Ride book, expanding the door-to-door service to all within a route's service area, in effect creating a zone of service. As each route received a designated zone the entire service area was

in effect divided into zones. The system then took on the characteristics of a zone-based Dial a Ride system that had a central transfer point.

This alone did not satisfy the operator's problems. Riders were used to a route, and several locations in each zone were so popular that buses seemed to stop there nearly every time anyway. Moreover, the deviation from the route meant that users had to call in for each trip rather than going to a bus stop and waiting for the bus to arrive on schedule. For long-term users of a fixed route, this was an inconvenient and unpopular choice.

Finally, some operators reached a compromise, using the zone of service and offering door-stop, demand-responsive service, but still making a certain number of stops at permanent points --shopping centers, hospitals, etc.--on a regular schedule. This system, called point-deviation, tried to combine the dependability feature of fixed route, fixed schedule with the accessibility offered by demand-responsive service. The method not only meets the ADA requirements but also allows a reduction in operating costs for fixed route systems. In Hamilton, Ohio, for example, a nine route system was reduced to six zones using point deviation.

CHAPTER 2

HISTORY OF PUBLIC TRANSPORTATION PLANNING IN BOWLING GREEN

Bowling Green, Kentucky is a city of 40,641 persons (1990 Census) in Warren County (population 76,673). A city of the second-class by state legislation, Bowling Green is the only major population center within the county and the largest city in southcentral Kentucky. (See Figures 1 and 2). Western Kentucky University, with over 15,000 registered students, is near the center of the city.

In terms of land area Bowling Green is one of the largest cities in the region, having 28.6 square miles of incorporated area. As a result population density by square mile is relatively low, less than 1,500, compared to the 3,000 persons per square mile in most similar sized cities.

History of Public Transportation in Bowling Green

In 1889 the first mule-drawn cars were introduced in the city by the Park City Railway Company. (Downtown streets had been paved in a macadam base two decades earlier). The mules gave way to electric cars six years later. Following foreclosure in 1898, the company gave way to the Bowling Green Railway Company, which expanded the system to a total of six miles by 1911.

In 1915 the company was purchased by the Southern Traction Company, which quickly encountered financial difficulties. Despite a drop in fares in 1918 ridership continued to stagnate. Finally, a 1921 accident resulted in litigation and a damage award that forced the company out of business.

For 24 years no transit company entered the Bowling Green market. In 1945 the Bowling Green Transit Company was founded, using motor buses for transport. The post-War years were not good ones for transit companies, however. Nation-wide, city bus companies saw patronage plunge as returning veterans rushed to start new houses in outlying areas nicknamed "suburbs." Vehicle registration soared, spurred on by cheap, plentiful gasoline. In 1956, the year Congress established the Interstate Highway System, the Bowling Green Transit Company closed its doors.

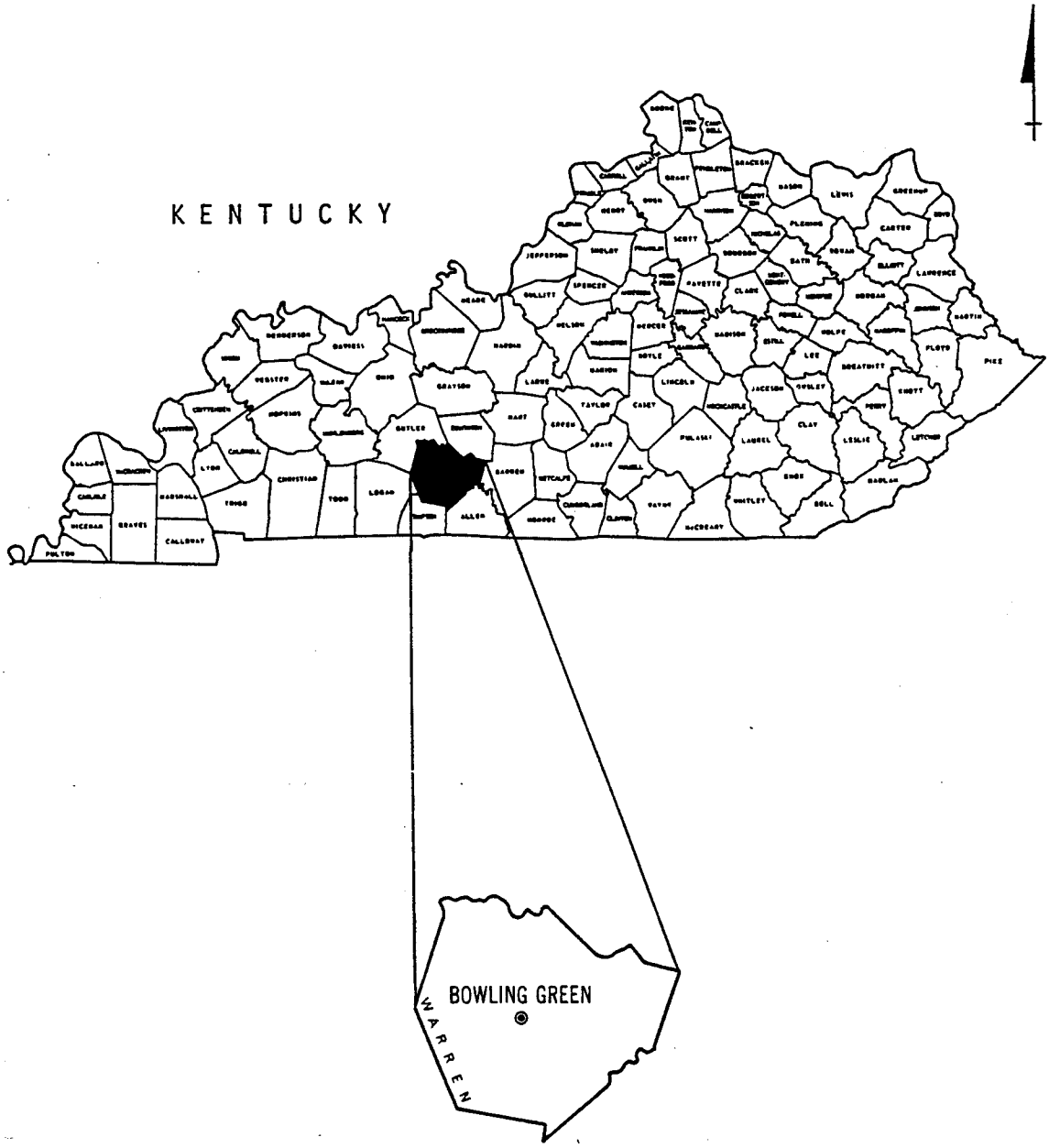

Figure 1

LOCATION MAP

Figure 2

STUDY AREA

Except for a single vehicle "trolley-like" system that apparently operated briefly in the early 1970's, no other transit system served Bowling Green after 1956. Thus, development occurred without consideration to transit routes. Social service agencies and public housing projects were located with little consideration to locating on corridors that could be connected by transit. Indeed, 63 of the last 74 years have seen development occur in the absence of a transit system. While the first part of that growth occurred immediately adjacent to existing development, recent decades have seen new residential, commercial, and even industrial growth occur miles away from the city's core, extending well beyond the reach of storm sewers and even sanitary sewer systems. The result has been an urban area with very low density, seriously impacting utilities, urban services, public safety coverage by fire and police, and street maintenance costs.

With the adoption of the 1990 Warren County Comprehensive Plan the community has begun broad policy initiates to corral development back to areas which can be effectively served by the urban infrastructure. The effects of those policies will not be fully realized for decades, however.

Previous Public Transit Studies

The first modern study of public transit in Bowling Green was made in 1971 by Dr. Jim Davis for the Model Neighborhood Executive Board. Relying on a random telephone survey city-wide, the survey successfully completed 1,091 interviews. The results showed that 85.4 percent of respondents had a vehicle, a number very close to the 85.6 percent found in the 1990 Census. Another 2.7 percent relied on friends, while 4.8 percent used a taxi. Walking was the option for 6.8 percent. Motorcycles and other options comprised the final 0.3 percent.

The study demonstrates the dramatic shift in shopping patterns in the last 20 years. In 1971 the percentage of persons identifying the downtown area as their primary shopping location was 38.1 percent. Today, that percentage would be far lower.

When asked about use of a bus system, 76.7 percent of respondents said they would use the system, and 97.3 percent in the target Model Cities area responded positively to a bus system. Such surveys generally overestimate true ridership, since individuals are responding to a hypothetical system with no information on wait times, headways, costs, or any other level of service. Moreover, use of public transportation is perceived as the "right" thing to say, regardless of one's true intents. More

instructive is the response to fares: less than seven percent agreed to a fare of 50 cents in 1971.

The Davis study recommended a demand-responsive system of six buses, emphasizing express routes to industrial areas and service to the downtown area and Western Kentucky University. Night and weekend service was also proposed.

The 1972 Bowling Green Urban Area Transportation Study by Barr Dunlap and Associates for the Kentucky Department of Transportation referenced the Davis study as an example of the need for a limited system but concluded:

> Generally speaking, the travel projections (to 1995) analyzed in the Urban Transportation Study do not indicate any extensive future potential for "mass transit." With a continuation of rather dispersed land use in commercial and industrial development as well as in housing, concentrated travel corridors are not defined and therefore do not contribute to an economically feasible transit system.

The study did suggest further study on the specific needs located by Davis.

In 1974 the City commissioned Schimpeler-Corradino Associates (SCA) of Louisville to study parking and transit needs. The SCA study was the first to propose specific routes, headways, and costs, although it did not incorporate any travel simulation models. Instead it relied on 840 responses to a survey of a seven square mile study area in the central portion of the city (Figure 3). Again, a large majority, 76.7 percent, said they would use a hypothetical system.

The SCA study took the trips as projected by the survey, reduced them to reflect more realistic numbers, and then assigned them to routes based on spatial distribution of trip origins. System revenues and costs were then developed. The SCA study was the first one to develop goals and objectives for public transit and evaluate alternative plans based on those goals and objectives.

In 1989 Ms. Stacy Crain, a Western graduate student and intern at the city's Department of Community Development, prepared in cooperation with the city's Engineering Division the first computer-based travel simulation of a public transit system. The study used the same level of ridership as the SCA study, about 1,500 per day, distributing origins based on estimated household income levels, and assigned them to six routes. The operating deficiency was estimated at $281,000, in addition to capital costs.

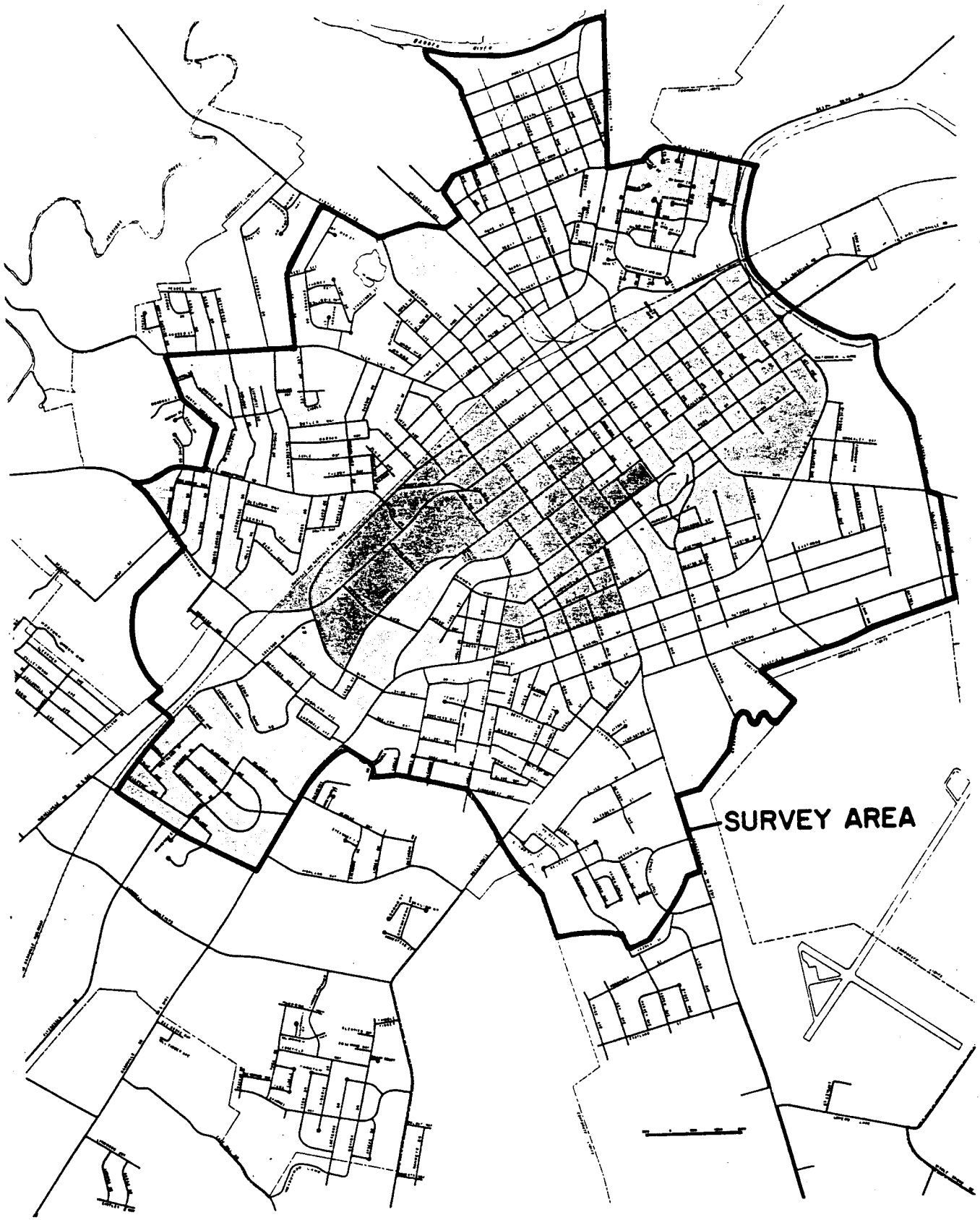

Figure 3

POPULATION PER ACRE

1974 Study Area

Finally, in 1990 a rehabilitation support group, Helping Others Progress Effectively (H.O.P.E.), conducted a survey of needs of handicapped persons. Ms. Melinda King, chairman of the group's transportation committee compiled survey results and made an application on behalf of the organization for a handicapped accessible van. The grant was not received, and the organization is no longer pursuing the application. Survey forms were widely distributed in strategic locations. Forty one written and telephone responses were tabulated, with medical and shopping trips being the dominate need. Trip frequency was most often 2-4 times per week.

The 1992 Public Transportation Study

In February of 1992 the City Commission, upon hearing the requests of concerned citizens, voted to direct the City's engineering division to apply for planning funds for study of public transportation funds. The application was not successful, and in May the Commission authorized the engineering division to conduct its own study. This report is the cumulating of that work.

CHAPTER 3

GOALS AND OBJECTIVES

The 1974 study established a set of goals and objectives through a citizen's committee called the Transit Advisory Committee. Those goals in order of most important to least important (as determined by the committee) were as follows:

Employee transit as a tool to solve urban problems and improve the urban environment

Adequately serve the transit dependent

Maximize total system efficiency

Provide a viable alternate to the automobile

Minimize costs

Maximize comfort and convenience to transit patrons

Maximize transit ridership in the community

Promulgate a good public image for transit

Provide transit services to the entire community

No objectives were provided with the goals, and no criteria and standards were established. The committee itself had four of its thirteen members from the Chamber of Commerce Committee on Transportation, which may indicate a problem with the composition of the committee.

A set of goals, objectives, criteria, and standards developed as part of the Louisville Urban Area Transportation Study Update was reviewed. This set was developed by a citizens' advisory committee using a value hierarchy method and reviewed by both technical and policy committees. The entire process was monitored by the Federal Highway Administration and the Urban Mass Transportation Administration.

Because no citizens' advisory committee was available, modifications were limited. The Louisville set and the

Bowling Green set were combined by staff and modified to incorporate legal changes (the Americans With Disabilities Act) and local concerns expressed during the 1992 study (such as needs of social service agencies). The resultant set is included in Appendix I. This set was used in the evaluation of alternative plans later in the process.

CHAPTER 4

INVENTORY

The inventory phase was driven by the budget and time restrictions on the study. Accordingly, efforts focused on prior studies and updating of records. Information on public attitudes toward transit were obtained from the previous studies. Two separate, large sample size surveys were conducted previously, and no repeat of these surveys were attempted.

Most socio-economic data come from the 1990 Census. Additionally, specific transportation needs were discussed with representatives of virtually all area social service and educational agencies through meetings with two multiagency organizations representing consortiums of those groups. Those meetings allowed agency representatives to discuss specific types of needs, particularly those relating to children and families. Transportation was considered a critical problem for most agencies; several observed that many counseling sessions were missed by individuals or families due to lack of transportation.

A major portion of the inventory phase concentrated on studies of and site visits to other transit systems in the region. Site visits were made to Lexington, Clarksville (Tn.), Paducah, Owensboro. Hamilton (Ohio), and Zanesville (Ohio). Other reviews relied on extensive telephone conversations and agency reports. The studies of other cities gave an effective comparison of costs, revenue, system attributes and capacity, and related information.

A possible deficiency of this study was the lack of public participation in the process. While the previous interviews were helpful, the results may not be stable over time in all respects. Some form of public input will be needed after publication of this report. however, the report itself will be a basis for discussion by interested parties on the attributes of public transit and will provide a statistical inventory of transportation needs as determined by the 1990 Census. Public participation was encouraged, though, by six monthly newsletters distributed to an extended mailing list of agencies and individuals. An audiocassette version was also prepared and distributed to a representative of the visually challenged community. The newsletter was effective in obtaining additional information in the inventory phase.

EXISTING DEMAND

Data from the 1990 Census was still being released when this study was made. However, sufficient information was available for analysis.

Two levels of study were established. The 1974 study area was used as the base area, and the entire city limits were used as a secondary boundary. A comparison of population data within the 1974 area showed little change from 1970 to 1970 in terms of the distribution by age, density, etc.

Automobile Ownership

The most critical category for purposes of this study was automobile ownership by household. The areawide statistics are as follows:

Vehicles Available (% of households)	Countywide	City
None	9.7	14.4
One	31.5	38.1
Two or more	58.8	47.5

Data by tract for auto ownership were not available; however, advance information for ten tracts was purchased by the City. This information is given in Table I.

Elderly Persons

The number of persons in Warren County 65 or over and not in institutions according to the 1990 Census was 8,018. Within the city limits were 4,826. Of those within the City, 23.5 percent had a mobility or self-care limitation.

The number of elderly persons within the 1974 study area boundary was 3,260 in 1990.

Female Heads of House With Children

The number of females with children who headed households within the 1974 study area was 795 in 1990. Another 128 households were headed by single parent males with children. About half of the citywide females in this classification resided within the study area boundary.

TABLE I
City of Bowling Green, Ky.
Transit Trips in Ten Census Tracts

Census	None	One	Two	Three plus	Total HH	Autos/HH
101	390	427	229	64	1,110	0.97
102	488	562	260	107	1,417	0.99
103	344	598	361	105	1,408	1.16
104	5	95	67	12	179	1.48
105	182	353	291	149	975	1.42
106	88	801	679	260	1,828	1.61
107	184	693	910	361	2,148	1.67
108	90	486	914	428	1,918	1.88
109	100	541	706	227	1,574	1.67
110	209	844	696	282	2,031	1.52
Totals	2,080	5,400	5,113	1,995	14,588	

Citywide, 58.5 percent of female heads of households with children under six are in the labor force.

Additionally, 1,417 persons citywide were in households where both parents worked and children were under six years old.

Handicapped (Challenged) Persons

The 1990 Census lists about 2,094 persons in Warren County between 16 years and 65 year old not in institutions who have mobility or self-care limitations, and about 1,980 more who were 65 or over. The 1980 Census reported 1,733 persons in the county having a public transportation disability, 991 of which were 65 or over.

The 1990 Census identified about 1,230 persons within the city between 16 and 64 who have mobility or self-care limitations (and not in institutions), and about 1,173 more 65 or over.

Persons Below Poverty Level

In 1990 a total of 8,759 persons within the city limits were below the poverty limit, about 23.9 percent. These included 2,658 children under 18 years of age. (About 964 of those children were below five years of age). Additionally, 979 persons 65 years or older were within the city.

Overall, 1,745 families (18.1 percent) within the city were below the poverty level.

Means of Transportation to Work

Citywide, 89.3 percent of workers drive a vehicle to work. Most of the remainder carpool. Less than one percent of workers report using any form of public transportation (taxi, van, etc.).

Vehicles per Household

County-wide, in 1991 Warren County had 1.96 vehicles registered per household. The ratio in the five Census tracts in the core of the 1974 study area was considerably lower, 0.97 to 1.42.

EXISTING PUBLIC TRANSPORTATION

Three local agencies, public and private, provide public transportation in Bowling Green.

The Southern Kentucky Community Action Agency provides specialized transportation for elderly and handicapped persons using UMTA Section 16(b)(2) funds, and childrens' services through Headstart. Director Don Butler has explained his agency's services in a February 3, 1992 letter to City Manager Charles Coates; (see Appendix II). About 60 persons per day (150 total trips per day) are served. Since that letter the agency has added a full-time transportation coordinator. Of the eighteen vans operated by the agency nine are headquartered in Bowling Green. Additional social services are coordinated with Lifeskills, Inc., which has another 18 vans, two of which are located in Bowling Green.

Yellow Cab, operated by Steve Miller, provides about 425 rides per day. The new fare is $1.60 plus $0.20 for each fifth of a mile. A 2.4 mile trip, the average taken, is $4.00. Mr. Miller has 21 vehicles in his fleet, and operates about 12 per day. One of those vehicles is a van. Medicaid trips are available at 100 percent funding, as is a local program for intoxicated persons. About 60 percent of the taxi trips occur between 6:00 a.m. and 6:00 p.m., and the majority originate with the 1974 study area boundaries. A shuttle service on Thursdays operates from the Bowling Green Towers (a Section 8 elderly care facility at 12th and College) to the Greenwood Mall; the two dollar service is used by 3-10 persons per trip.

Western Kentucky University operates two 47-passenger buses between parking lots near Campbell Lane and Nashville Road to the university campus. About 3,500 students per week (700 per day) make use of this service. Service during the school year is 7:30 a.m. to 5:00 p.m. weekdays on 30 minute headways.

Additionally, free brokerage services for carpooling and vanpooling are available through the Barren River Area Development District Ridesharing Coordinator.

Finally, intercity bus service is available along I-65 through Greyhound, and group charter service is available through the Southern Kentucky Bus Lines, Inc. Both the county and city school systems provide school bus transportation for students.

No commercial air, rail, or water services are available in the county. Only about 64 miles of sidewalk exist within the city for pedestrian travel.

Computation of Existing Capacity

The eleven vans operated by the Southern Kentucky Community Action Agency have a combined capacity of 16x11 or 176 riders for each trip made. However, these vehicles are often committed for several hours at a time to groups which may have considerably fewer riders.

Twelve taxi cabs can handle up to 470 passengers in a 12 hour period, provided trips are of 2-3 mile length.

The Western shuttle is assumed to be operating at close to capacity for the peak conditions.

VEHICLE REGISTRATION

In 1991 vehicle registration in Warren County was 56,492. No breakdown by city was available. Handicapped tags were at 119, but about one thousand permits for dashboard display had been issued.

At Western Kentucky University 5,573 student vehicles are registered at the Public Safety Department, as well as 1,660 facility vehicles and 82 handicapped permit vehicles. (Western had 15,800 students in the fall of 1992, of which 4,800 lived on campus). Considerable parking occurs on City streets near campus. Based on location of parking, an estimated 3,200 of the 4,800 students on campus have automobiles.

INVENTORY OF EXISTING SYSTEMS IN COMPARABLE CITIES

In preparation for this study bus systems in several comparable cities were reviewed. Here are capsule summaries of those systems:

Paducah, Kentucky:

While the city population of Paducah is about 27,000, the urban area population is 42,000. Streets are in a grid pattern, and the downtown is relatively strong. A regional shopping mall is 15 minutes by bus from downtown. Densities are generally comparable to Bowling Green, although the

presence of the Ohio River means development is fan-shaped and quite compact in the central city area.

Paducah operates four buses on eight routes. Half the routes are short, 25 minute runs, while the rest are longer, 50 minute runs. As a result each route has headways of one and one half hours, though a three-point transfer system assists in limiting ride times. Fares are 75 cents each, with discount structures. Ridership is about 410 per day, discounts included, and revenue is about $53,000 per year at the farebox. Considerable charter service is involved, and a trolley operates during convention periods. Heavy duty transit buses with 31 seats are used; the cost of these was $180,000 each. The local taxi service is used to meet requirements of the Americans With Disabilities Act provisions. Saturday service is available.

In 1989 the cost per passenger on Paducah's system was $2.73, with $0.43 per passenger in revenue received, a reflection of the heavy discount system. Paducah's system is considered one of the best-managed transit authorities in the region, supplementing fare revenue with aggressive advertising revenue. Last year local funding of the system was about $91,000, with another $14,000 in non-revenue support. The present system has operated since 1981, although transit service has been available in Paducah for decades.

Elkhart, Indiana:

A city of 44,000 with an area size of 16.7 square miles (compared to 28.6 for Bowling Green's 41,000 persons), Elkhart has one of the most extensive user-end (taxi) subsidy systems in the Midwest. In six years the program has grown from 15,000 passengers per year to 102,000. Service is 24 hours a day, 365 days per year. Citizens receive a book of 40 rides (the monthly limit), and each ticket is worth half the cost of a taxi ride up to $3.00. A second rider has no charge. The cost for a third passenger is 40 cents, 20 cents for a child. Courtesy waits (for laundry pickup or similar errand) are three minutes. Handicapped vehicles are purchased by the system, but other vehicles remain private. The cost per mile ($2.53) is high compared to other Indiana transit systems, but the service and cost effectiveness of the system is much better. Taxi fares are almost identical to Bowling Green's. The same service operates in the nearby cities of Plymouth and

Goshen. These cities had no transit systems when the taxi subsidy programs began.

Cape Girardeau, Missouri:

Cape Girardeau has many similarities to Bowling Green. A city of 34,360 with a large state university (Southeast Missouri State), it encompasses 20.5 square miles. The density of 1,676 persons per square mile is very similar to Bowling Green. It is bounded by the Mississippi River on its east side and by I-55 on its west side.

Cape Girardeau had no transit service prior to 1981, when it began a subsidized taxi program. Users pay one dollar to ride anywhere in the city, and the city (together with the federal government) pays a dollar and a half. The $2.50 total fare provides round-the-clock service within the city limits. Ridership is about 91,000 per year. The city has not always received the full 50 percent federal share, so it has to make up the difference. (The state provides no operating subsidy). Typically, the program costs the city about $75,000 per year. The percentage of elderly in Cape Girardeau is slightly higher than in Bowling Green. Elderly and handicapped persons dominate ridership.

The contract for this service is negotiated annually. No capital costs are involved, and the city's administrative costs are within the finance department. Each applicant receives a monthly book for eight trips; the cost for elderly and handicapped is $8.00 per book, while the cost for others is $16.00 per book. The average length of trip is 2.5 miles.

Owensboro, Ky.:

As a city over 50,000 population, Owensboro is in a different funding category than Bowling Green; however, its budget for the seven route system it operates provides a helpful cost comparison. With the Ohio River to the north and a flood plain to the south, Owensboro covers only 12.1 square mile for its 53,000 people, a density of 4,380 persons per square mile. Two small colleges, Kentucky Wesleyan and Brescia, are in Owensboro.

Owensboro uses heavy-duty, 31 passenger buses; four of which are on 30 minute headways. Two routes run every hour, and the seventh route is a trolley. Daily ridership at a

standard $1.00 full fare (with many discounts) is a high 800 per day. However, the system generates only $103,000 per year in revenue against a FY 92/93 budget of $734,000, a ratio of 0.25 return on the dollar. The City of Owensboro contributes $305,000 a year to the transit system.

Clarksville, Tenn.:

With a 1986 population of 60,730, and a 1990 urban area population nearing 80,000, Clarksville falls into a different federal funding category than Bowling Green. However, its density of 1,326 persons per square mile is very similar. Its regional shopping mall, like Bowling Green's, is miles from downtown, and the presence of I-24 has pulled development outward. It also has a regional university. In addition to a larger population base, Clarksville also has a large military base. Interestingly, the Clarksville transit system receives some federal funds through Kentucky, since the system serves a part of Christian County.

The system operates six routes for 14 hours a day four days a week, 16 hours on Friday, and 12 hours on Saturday. Average daily ridership is 1,200. The annual cost as audited for FY 90-91 was $1,043,000, with the City of Clarksville contributing $294,600. The system cost $39.80 an hour to operate and generated $6.32 in fare revenue per hour. Counting $17,600 in ad revenue and $6,400 in other revenue the ratio of revenue to cost was 0.182. (Depreciation of $106,200 is incorporated into those figures).

The 31 seat heavy duty transit vehicles cost $4.71 an hour to operate. Each bus travels about 200 miles a day, and the system uses 275 gallons of fuel per day. The system receives $469,200 per year in grant funds from state and federal sources. One hour headways are used, and the city has constructed a modern transfer center in the downtown area. A total of 16 parttime and 6 full time drivers, 2 mechanics, 2 supervisors, and 3 dispatchers are involved. In addition the system has added a coordinator for handicapped accessibility service; presently three specialized vehicles serve 700 trips per month on a demand-responsive basis.

Richmond/Berea/Winchester, Ky.:

Operated by the Kentucky River Foothills Development Council (KRFDC), this user-end (taxi) subsidy program serves a four county area through a Community Action Agency. Richmond has a 1990 population of 21,155, while Berea has 9,196 and Winchester has 15,799. Both a regional university (Eastern Kentucky University) and a smaller college (Berea College) are with the service area. Since four separate taxi services are involved, the agency actually places the call for the client 24 hours in advance. Subsidy varies according to funds available, but about two dollars is paid toward each trip. About 70,000 rides per year are now being provided through 17 regional taxi cabs. Local funds are provided by the agency, not by local governments.

Frankfort, Ky.:

Two different systems, a city fixed route service and a regional demand-responsive operation, provide transit in the Frankfort vicinity.

The regional service operates in 11 counties through the Bluegrass Community Action Agency. About 270,000 rides per year are provided at a typical rate of fifty cents per mile per person on a demand-responsive basis. The system has 34 vans and receives $130,000 in Section 18 funds out of a $970,000 budget. Most of the remaining is farebox revenue, although Medicaid and other services are included. The regional service does not operate within the city limits of Frankfort.

The City's bus system is a fixed route, three route system which serves 70,000 passengers per year. However, revenue is only about $28,000 per year against expenses of $217,000 per year (in FY88). Headways are 45 minutes with a 50 cent fare structure (25 cents for senior citizens). Service times are 6:45 a.m. to 4:45 p.m. five days a week, 9 a.m. to 3:00 p.m. on Saturdays. A separate demand-responsive system for handicapped persons operates at a cost of one dollar. The City of Frankfort provides $50,000 per year, the same as the Section 18 matching amount. Density for Frankfort is about 2,100 persons per square mile; both Kentucky State University and state government offices are located within Frankfort.

Murray-Calloway Co., Ky.:

The Murray-Calloway (County) Transit Authority operates a demand-responsive service for the City of Murray (population 14,439) as well as Calloway County. Annual ridership last year was 26,712 passengers. The fare is $2.00 per trip ($20 books are available at 25 percent discount), and courtesy stops are 25 cents each. Operating hours are 7:00 a.m. to 4:30 p.m. weekdays. The system uses three 16 passenger minibuses and one van. Four parttime drivers, one parttime clerical/dispatch person and a fulltime manager/dispatcher provide the service. Both the city and county provide $12,000 per year plus in-kind services. The system receives about $75,000 per year in Section 18 funding, with revenue at about $40,000. Total budget is $150,000, nearer $200,000 when in-kind services are included.

The cost within the city is $2.00, with trips within five miles of the city an additional $2.00. Trips from 5 to 10 miles outside the city is another $2.00 (or $6.00 total) and trips more than 10 miles from the city are $10.00.

Elderly, handicapped, and low income individuals make up most of the ridership. Very limited ridership is generated by Murray State University, according to the system manager. The minibuses serve three permanent pickup locations once an hour (downtown and two shopping centers), making it in effect a point deviation system.

Zanesville, Ohio:

This fixed route system has six routes on one hour headways serving a city of 27,920 persons in 9.7 square miles. Daily ridership is about 623 per day. Regular fare is $0.70, students pay $0.50 and senior citizens/handicapped pay $0.35.

The total annual budget for the system is $627,729, with about 22 percent being administration. Building maintenance is two percent, and vehicle maintenance is 17 percent. The remainder, 59 percent, is operational costs. The City of Zanesville contributes $127,777 per year, the Village of South Zanesville gives $2,082, and the County of Muskingum pays $29,289 for services outside the city limits. The State of Ohio contributes $208,270, and the Section 18 federal funding is $157,465. Farebox revenues last year were