

# New Fixed-Route Bus Service in a Small Urban Area

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Johnson City, Tennessee, which had a population of 39,310 in 1980, initiated a new fixed-route, fixed-schedule bus service in October 1979. This transit service provided an opportunity to quantify the impacts of a traditional transit system on a small community. The findings of a study covering the first 9 months of operation are presented. The study attempted to identify the short-term impacts on travel patterns, retail business, operation of social service agencies, and so on. It was found that the transit service had low ridership and that most of the users were either the very young, who used the service primarily for school trips, or the old, who used it primarily for shopping trips. The service appeared to have had a positive impact on retail business, especially in the downtown area, although it was not possible to quantify the amount of impact. Other types of impacts and some dilemmas encountered are discussed, and a few guidelines for the planning and design of similar services in small communities are presented.

Traditional fixed-route, fixed-schedule transit service in small and medium-sized urban areas has been a controversial issue in the United States in recent years. Some believe that there is not enough demand for such a service and that the costs far exceed the benefits. Others believe that such a service fulfills important community goals and generates substantial indirect benefits. In any case, many medium-sized communities have continued to provide fixed-route transit service in spite of substantial financial difficulties. However, not many smaller communities with less than 50,000 population in the urbanized area are operating fixed-route transit systems. These small communities rely primarily on taxis and social service agencies to accommodate the needs of persons who do not have access to a private automobile. It is rare for a community of that size to have initiated a new fixed-route system during the 1970s. Johnson City, Tennessee, which had a population of 39,310 in 1980, represented such a rare case when it began operating a new fixed-route transit system on October 12, 1979. This was the first fixed-route bus system to be initiated in the state of Tennessee since World War II.

## HISTORY AND DESCRIPTION OF THE TRANSIT SYSTEM

Johnson City used to have a bus system operated by a private company. In 1965 the private company relinquished its responsibility for operating the service and the system was taken over by the local utility district. Because of a continuing decline in ridership, the utility district stopped operation in 1968. The only service available then was along a route connecting the central business district (CBD) and the Veterans Administration (VA) hospital. The city operated two 28-passenger, gasoline-powered school buses along this route. This service, commonly referred to as the VA bus, was discontinued when the new service began.

During the 1973 to 1979 period substantial work was done by the city in planning and preparing funding applications to UMTA, which provided 80 percent of the cost of purchasing the buses for the new service. The primary goals of the new service were to provide mobility to transportation-disadvantaged persons and to influence the future urban form by encouraging more business and other activities in the CBD.

The Johnson City Transit (JCT) system purchased 12 minibuses manufactured by Chance Manufacturers of Kansas and operated eight buses at one time on eight route legs between 6:00 a.m. and 6:00 p.m. Monday

through Saturday. The routes provided approximately 60 percent coverage of the city's land area. The round trip on each route leg radiating from the downtown took 30 min. The system operates on a timed-transfer basis, and every 30 min all eight buses meet at a central place in downtown, which allows passengers to transfer between buses with little waiting.

The bus service was received favorably by users. When asked to evaluate service characteristics such as dependability and transfer conditions, most of the bus riders rated all characteristics as excellent or good.

## IMPACT ANALYSIS AND OBJECTIVES

The JCT service offered an opportunity to identify various direct and indirect impacts of a new transit service. A series of before and after surveys was conducted and analyzed for this purpose during the initial 9 months of operation. Presented in this paper are the study findings regarding short-range impacts on travel patterns, retail business, and so on, and also some points are discussed that should be considered by other small cities interested in initiating similar transit service.

## TRANSPORTATION USERS AND SUPPLIERS

A transit service is naturally expected to have some impact on travelers and transportation service providers. The impacts of the JCT system from this point of view are examined under four different categories: transit users, transit supplier (JCT), other public transportation suppliers, and automobile users.

### Transit Users and Their Travel

Daily ridership data on each route were maintained by the JCT system. This source of data was augmented by two on-board surveys designed and performed specifically for this study—one on a weekday and the other on a Saturday. The weekday survey covered the entire service period, and interviewers were assigned to every bus. Because of the uncrowded condition on the buses, it was possible to contact every rider and, if necessary, assist the rider in filling out the survey questionnaire. The sample size was more than 95 percent. For the Saturday survey, only half the buses were provided with interviewers, but still the sample size was fairly large, nearly 50 percent.

### Ridership Level

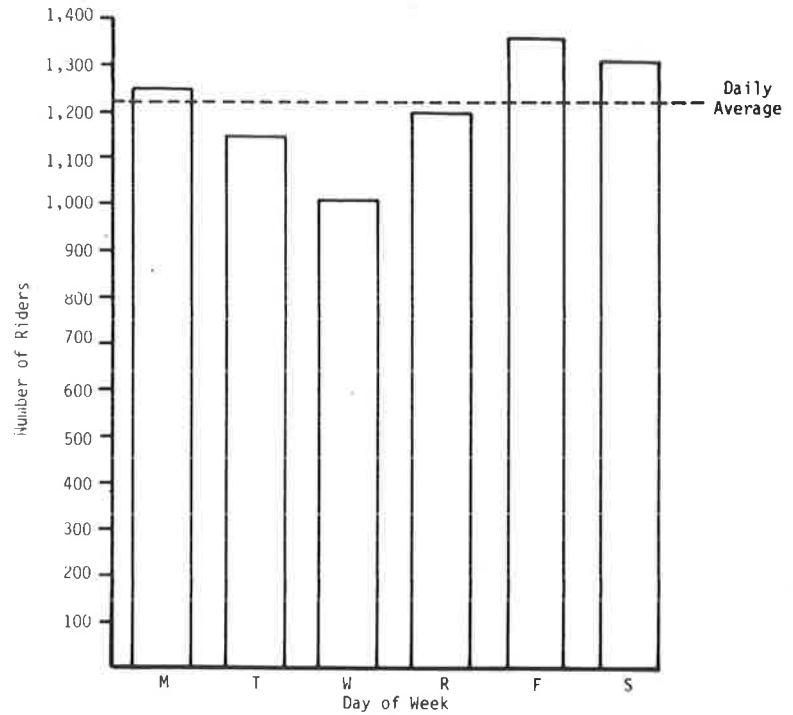
JCT system ridership grew from an average of 940 rides/day during October 1979 to an average of 1,235 rides/day during May 1980. The average ridership by day of the week during the period from April 21 to May 17, 1980, is shown in Figure 1, which also shows the interesting fact that ridership on Saturdays was relatively high. Another interesting phenomenon revealed by the hourly distribution of ridership was the absence of peaking of demand during the morning and afternoon commuting hours.

**Transit User Characteristics**

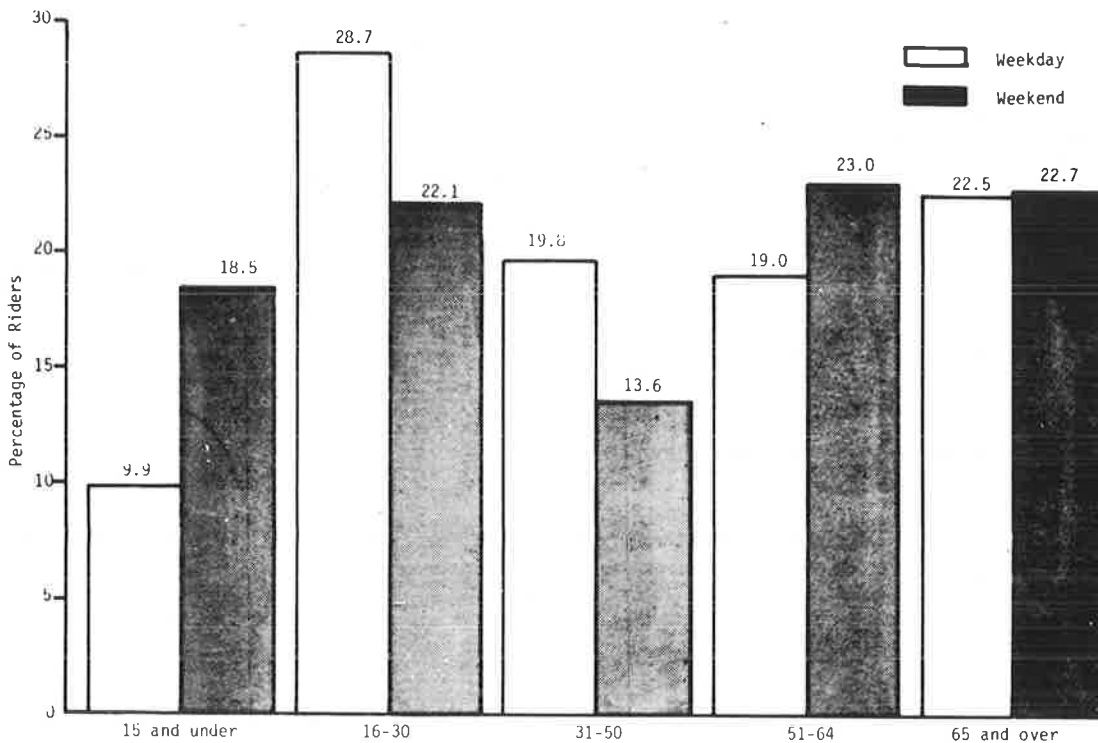
It was estimated that an average of approximately 500 persons used the bus service every day. The age distribution of these riders is shown in Figure 2. It can be seen that the two most prominent groups were persons aged 16 to 30 years and 65 years and older. Senior citizens used the bus service more frequently during the first 2 weeks of each month.

Transit users represented less than 2 percent of the population of the city, and trips made on transit represented approximately 1 percent of trips made by city residents. More than 90 percent of the transit trips (or rides) were made by captive riders, who were defined as persons meeting any one of three criteria: (a) did not own a vehicle, (b) did not have a valid driver's license, and (c) did not have an automobile available for the trip.

**Figure 1. Average bus ridership by day of week between April 21 and May 17, 1980.**



**Figure 2. Distribution of bus ridership by age.**



**Table 1. Trip purpose distribution for weekday and Saturday.**

| Purpose                | Distribution (%) |         |                      |         |           |         |
|------------------------|------------------|---------|----------------------|---------|-----------|---------|
|                        | Home-Based Trips |         | Non-Home-Based Trips |         | All Trips |         |
|                        | Weekday          | Weekend | Weekday              | Weekend | Weekday   | Weekend |
| Work                   | 18.27            | 5.53    | 18.32                | 8.51    | 18.28     | 5.82    |
| Shop                   | 42.30            | 70.74   | 42.75                | 34.04   | 42.37     | 67.15   |
| Medical                | 7.48             | 1.61    | 6.11                 | 2.13    | 7.26      | 1.66    |
| Personal business      | 6.91             | 2.30    | 5.34                 | 4.26    | 6.66      | 2.50    |
| School                 | 14.82            | 0.92    | 10.69                | 0       | 14.16     | 0.83    |
| Social or recreational | 7.63             | 13.83   | 11.45                | 19.15   | 8.23      | 14.35   |
| Other                  | 2.59             | 5.07    | 5.34                 | 31.91   | 3.03      | 7.69    |

**Table 2. Prior mode of travel for current bus trip.**

| Mode                        | Captive Riders (%) |         | Noncaptive Riders (%) |         | Total (%) |         |
|-----------------------------|--------------------|---------|-----------------------|---------|-----------|---------|
|                             | Weekday            | Weekend | Weekday               | Weekend | Weekday   | Weekend |
| Drive                       | 6.2                | 6.5     | 61.5                  | 35.7    | 14.6      | 8.8     |
| Rode with family or friends | 23.5               | 26.4    | 9.0                   | 35.7    | 21.1      | 27.1    |
| Social service agency       | 1.0                | 0.9     | 0                     | 0       | 0.8       | 0.9     |
| Taxi                        | 11.0               | 10.2    | 3.8                   | 3.6     | 10.0      | 9.6     |
| VA bus                      | 19.1               | 17.0    | 1.3                   | 3.6     | 16.4      | 16.4    |
| Walk                        | 29.1               | 22.3    | 12.9                  | 17.8    | 26.6      | 21.9    |
| Other                       | 10.1               | 16.7    | 11.5                  | 3.6     | 10.4      | 15.7    |

Note: Weekday sample size = 512 and weekend sample size = 351.

**Table 3. Economic indicators of transit operation.**

| Item              | Per Vehicle Mile (cents) | Per Vehicle Hour (\$) | Per Revenue Ride <sup>a</sup> (cents) | Per Ride <sup>b</sup> (cents) |
|-------------------|--------------------------|-----------------------|---------------------------------------|-------------------------------|
| Revenue           | 26.2                     | 3.46                  | 32.9                                  | 26.9                          |
| Cost <sup>c</sup> | 84.0                     | 10.88                 | 103.4                                 | 84.3                          |
| Subsidy           | 57.2                     | 7.42                  | 70.5                                  | 57.5                          |

<sup>a</sup>Not counting transfers.  
<sup>b</sup>Includes transfers.  
<sup>c</sup>Not including capital expenditure for vehicles and other facilities.

Among users of the transit service during weekdays, 56 percent did not own a car, 60 percent did not have a valid driver's license, and 62 percent did not have a car available for the trip.

**Trip Purpose**

Travel on the JCT system was not commuter oriented; only 18 percent of the weekday trips were reported to be work trips. Table 1 gives the distribution of trips by purpose. The major trip purpose on both weekdays and Saturdays was shopping. The survey on a Saturday indicated that 67 percent of the trips were for shopping.

**Latent Travel Demand**

When a new transit service is initiated, it is expected to induce some travel that did not occur before. In Johnson City, the survey of bus riders revealed that 11 percent of weekday trips and 16 percent of weekend trips were induced or new trips. This amounts to 150 to 200 trips/day. Approximately 24 percent of these new trips during weekdays were work trips and about 55 percent of these trips on weekends were for shopping.

**Mode Shift**

An interesting phenomenon with regard to new transit

service is how people shift from other modes of travel. The findings on this question for Johnson City are given in Table 2. The predominant alternative modes for captive riders are walking and riding with family or friends. For noncaptive riders driving was the major alternative mode. It is interesting to note that approximately 10 percent of all trips, or approximately 100 to 120 trips/day, switched to JCT from taxi. As discussed later, this particular mode shift appears to have had serious adverse impact on the taxi companies.

**Transit Service Supplier**

The revenue and cost data for the JCT system were analyzed periodically during the study period. Because the early months of operation represented a period of transition and adjustment, the data for the last two months of the study period--April and May 1980--were analyzed in detail to develop several evaluation indices (see Table 3).

The comparison of the revenue and cost indicators reveals a wide disparity. Because only about one-third of the operating cost was being recovered from farebox revenue, the subsidy was relatively high. The greatest room for improvement in the economic situation appeared to be on the revenue side, which reflected the low ridership on the system (about one passenger per vehicle mile of travel). From the standpoint of revenue-generating potential, it should be noted that the JCT system was occupied strictly with providing service on fixed routes and had not been involved with charter service and other special services that have been found to be lucrative for other transit operations.

Operating costs appeared to be low in comparison with those of other transit operations. For example, the operating cost of the bus system in Knoxville, Tennessee, at that time was \$1.61/vehicle mile as opposed to an operating cost of \$0.84/vehicle mile for Johnson City. One of the major reasons for the lower operating cost was the low wage rate of JCT system drivers, who were nonunionized. In spite of the favorable cost-related statistics, there were

some opportunities for further improvements. These included curtailment of service during hours of low ridership, such as before 7:00 a.m. on weekdays and before 9:00 a.m. and after 5:00 p.m. on Saturdays. The route structure could also be modified to eliminate service on segments with poor ridership. These opportunities were being investigated by the director of transit.

It should be pointed out that a large portion of the subsidy--i.e., the difference between operating costs and revenue--was provided by the city itself. As of 1981 the community's commitment to public transportation was approximately \$200,000/year or about \$5/resident/year. In the beginning JCT did not receive any operating assistance from UMTA. The state of Tennessee provided \$25,000 for operating assistance during FY 1979. Effective May 30, 1980, the Section 18 fund of the Urban Mass Transportation Act of 1964 (as amended) was available and it provided \$40,000/year.

#### Other Public Transportation Suppliers

Public transportation in Johnson City before the beginning of the new JCT service was practically limited to two taxicab companies, one with a 15-vehicle fleet and the other with a 10-vehicle fleet. The only other public transportation was the VA hospital bus service, which was discontinued when the new service began. From the early planning stage of the transit system, the taxi companies were concerned about the competition and even filed a petition in court to prevent the implementation of a dial-a-ride service, which was being considered during the early phase of the planning process. The petition was dismissed because the dial-a-ride service was not implemented.

There was an observable change in the status of the taxi companies after the transit service began. One of the companies went out of business 7 months after the bus service began. Several of its drivers, however, were hired by the other company and one by the JCT system.

The taxi companies attributed their declining business to the new JCT service and to increasing operating costs. It should be pointed out that, although the JCT service apparently contributed to the decline in taxi patronage, the general economic slowdown during that time was probably also a factor. As mentioned previously, the on-board bus survey revealed that approximately 10 percent of bus trips, or 100 to 120 trips/day, used to be made by taxi.

Some of the social service agencies that provide transportation to clients can be viewed as suppliers of public transportation. Their case is discussed later in this paper.

#### Traffic Congestion and Parking

A transit service has the potential of reducing automobile traffic and parking demand. In Johnson City, however, the JCT service was found to have an insignificant impact on vehicle flow and parking. Although traffic counts at control stations showed a decline, the change was attributable to other factors, such as higher gasoline prices. It was pointed out earlier that only a small number of noncaptive riders used transit instead of the automobile. It was estimated that the bus service replaced no more than 1,000 vehicle miles of automobile travel per day, which is less than the vehicle miles traveled daily by the eight JCT buses.

The bus service did not have a significant impact on parking in the downtown area because there was really no shortage of parking, although some citi-

zens and merchants believed that a shortage did exist.

#### SOCIAL SERVICE AGENCIES, RETAIL BUSINESS, AND EMPLOYERS

A public transit service can potentially generate a variety of secondary benefits by increasing the mobility of transportation-disadvantaged groups and also by making certain areas in a city more accessible. To trace these types of impacts, before and after surveys were conducted of several social service agencies and retail merchants in the city.

#### Social Service Agencies

The study group identified a total of 28 social service agencies in Johnson City. All of these agencies were contacted during the before and after surveys. The agencies were classified in three categories: (a) agencies that provide transportation service for their clients (e.g., the Dawn of Hope Development Center, Inc., and the Senior Citizen Center); (b) agencies that reimburse the transportation expenses of their clients (e.g., the East Tennessee Dialysis Center, Inc., and Tennessee Rehabilitation); and (c) agencies that do not participate in transportation in any way (e.g., the Tennessee Department of Human Services and the First Tennessee Regional Health Office). The number of social service agency clients who used the JCT system to get to the facility was found to be small.

In all cases but one, the agencies that provided transportation service for their clients did not feel that the JCT system had eliminated the need for their service. The service areas of most of these agencies were larger than that of the JCT system, and many clients required door-to-door service. The Senior Citizen Center, which operated two buses and one van for recreation and other client activities, was found to be the only agency that considered eliminating services that overlapped with JCT service to reduce costs. Most of the agencies viewed the JCT system as a positive community resource and felt that it was making a contribution to their functions.

#### Retail Merchants

The study group selected 97 retail establishments for the before and after surveys. These businesses were located in four areas of the city: downtown (55 establishments), a suburban shopping mall (24 establishments), two locations along bus routes outside the central area (12 establishments), and a control area located outside the coverage of bus routes (6 establishments). It should be pointed out that all bus routes converged on the downtown area and two of the eight route legs provided access to the suburban mall.

The analysis of the response of retail merchants to questions on sales, number of customers, and so on indicated that the bus service had some positive impact on business but the improvement appeared to be masked by the downturn of the areawide economy during that time. It was found that a higher percentage of establishments located within the transit service area showed a gain in business sales than did businesses in the control area located outside transit service coverage. Similarly, a lower percentage of businesses in the transit service area than in the control area experienced a decline in business. It seems probable that the bus service helped to lessen the decline of retail business, especially in the downtown area. Only 25 percent of the merchants on bus routes indicated that they

believed that the buses were responsible for changes in their business volume. Two merchants in the downtown area believed that the new bus service diverted customers from the CBD to the suburban mall.

Retail merchants did not appear to have taken full advantage of the new bus service to promote sales. Only a few merchants were found to have offered incentives to customers riding the bus system.

#### Major Employers and Employment

The on-board bus survey indicated that work trips represent only 18 percent of the weekday trips carried by JCT. A survey of major employers also indicated that their employees were not making much use of the transit service. Only one employer with approximately 200 employees reported substantial use of the transit service by employees. This suggests that even with high operating costs the comfort and convenience of the private automobile are still valued by the Johnson City workers.

Only a few instances were identified in which transit opened up additional job opportunities. In fact, the major employment-related impact of the system has been in providing job opportunities for the drivers. Before the initiation of transit service, eight to nine of the bus drivers were unemployed. For the rest of the drivers their employment with JCT meant higher income and more consistent work hours.

#### CONCLUSIONS

Some conclusions can be drawn from the study of the new bus service in Johnson City that can provide useful guidelines for transit planning in small urban areas.

1. Transit services in a small community with little roadway congestion and few parking problems would be used primarily by persons with limited mobility--those who do not own automobiles, those who cannot drive, and those without access to automobiles for trips. Therefore, it is important that the service be designed to serve the needs of this group, which includes the elderly and low-income families. These transportation-disadvantaged persons usually represent a small proportion of a community's population; thus, the level of transit ridership should not be expected to be high.

2. Transit service in a small community may not be used for work trips to a significant extent as it is in large cities. Other trip purposes such as shopping may be more important. Therefore, a higher frequency of service during the morning and afternoon rush hours and special commuter-oriented services such as park-and-ride and express bus service would not be necessary in a small community.

3. In establishing the initial routing and service hours, it should be kept in mind that it is difficult to curtail a service after it is offered even if the ridership is low. It is not a pleasant task, and it may not be fair to ask people to revert to their old life-style after they have become accustomed to using the transit service. Therefore, the routes and service hours should be developed in an incremental manner. The initial routes and service hours should cover areas and time periods with the greatest potential for ridership. Subsequent expansions should be built on previous experience.

4. The route structure and schedule should be simple to understand and remember. Integration of routes by means of timed transfer is highly desir-

able. Through routes may be used to eliminate transfer.

5. The cost of providing a fixed-route transit service even with small buses and nonunionized drivers would not be low by any means. In Johnson City, the cost per vehicle mile was \$0.84 and the cost per vehicle hour was \$10.88. With a regular adult fare of \$0.50/ride and an average daily ridership of approximately 1,250, the subsidy amounted to \$0.572/vehicle mile and \$7.42/vehicle hour. If a community is seriously concerned with the economics of operation, alternatives to the fixed-route bus service should be fully explored.

6. A fixed-route bus service in a small community would compete with taxicab services and might affect their business adversely. Means of minimizing this adverse impact and maximizing coordination of services should be examined. On the other hand, the availability of fixed-route transit will not eliminate the need for social service transportation functions. Coordination should be pursued to identify those situations in which transit can satisfy social service agency transportation needs.

7. The institutions served by transit should be urged and encouraged to take complementary actions to promote transit use to and from their establishments. For example, downtown merchants should not expect to attract more customers just because of the availability of transit service in their area. They should launch promotional programs coordinated with the transit service in order to make the use of transit more attractive and to compete with other retail shopping centers that may also be served by transit.

8. City policies on public transit, urban development, and parking must be coordinated and consistent. Sometimes a city may face a dilemma. For example, in Johnson City a parking garage was built downtown to make the CBD more attractive. However, convenient parking is not conducive to public transit. Again, in Johnson City the bus transit system, with all its routes converging on the central area, was expected to increase retail sales in the CBD. However, the service to the suburban mall, which was evidently liked by the users, probably took some CBD customers away. Although these dilemmas would be difficult to solve, they need to be recognized.

The foregoing observations are based on the facts unveiled by the study in Johnson City. These by no means represent a complete set of guidelines for transit planning in small urban areas. It is quite obvious that operating a fixed-route transit service in a small city would require substantial financial commitment from the community. It would be wise to fully recognize all difficulties and dilemmas and proceed cautiously.

#### ACKNOWLEDGMENT

The impact study of the JCT system was funded by UMTA. We acknowledge the contribution of the graduate students of the University of Tennessee who participated in the study, especially Wilford Sommerkorn, Andrew Michaels McAdams, and Donald Taylor. We also appreciate the cooperation of city staff, especially the assistance of then transit director Steve Githen in several matters.

*Publication of this paper sponsored by Committee on Transportation Planning Needs and Requirements of Small and Medium-Sized Communities.*

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