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UMTA-76-05-2



# Small City Transit

AMHERST, MASSACHUSETTS

Free-Fare, Student Operated  
Transit in a University  
Community



March 1976

U. S. DEPARTMENT OF TRANSPORTATION  
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16. Abstract <p>Amherst, Massachusetts, is an illustration of a free-fare transit service serving a university campus. This case study is one of thirteen examples of a transit service in a small community. The background of the community is discussed along with a description of the implementation process and operational characteristics of the transit service. The process through which the community responds to the specific needs for transit service within the local context is stressed.</p> <p>Examples of transit services operating in other communities are covered in UMTA-MA-06-0049-76-3, through -14 and include, respectively: Ann Arbor, Michigan; Bremerton, Washington; Chapel Hill, North Carolina; East Chicago, Indiana; El Cajon, California; Eugene/Springfield, Oregon; Evansville, Indiana; Merced, California; Merrill, Wisconsin; Sudbury, Massachusetts; Westport, Connecticut; Xenia, Ohio.</p> <p>Separate reports cover an overview of small city transit characteristics (UMTA-MA-06-0049-76-1) and summary of state aid programs (UMTA-MA-06-0049-76-15).</p>					
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## Preface

This document was prepared by the Transportation Systems Center (TSC) as part of the information dissemination function of the Office of Service and Methods Demonstrations, Urban Mass Transportation Administration. This case study is one of thirteen studies of public transit systems in small communities and is intended to serve as an information resource for other communities in the process of planning or considering public transportation.

The information presented in this document is based on a visit to the site, interviews and phone conversations with the principals involved, and operating records obtained during 1975. The authors gratefully acknowledge the cooperation of local officials and transit operators at all of the sites selected for study, and of the TSC staff in compiling the information gained from these studies and assisting in its interpretation.



AMHERST, MASSACHUSETTS: Free-Fare, Student Operated  
Transit In A University Community

The Student Senate Transit Service of the University of Massachusetts at Amherst is an illustration of a free-fare transit system serving a university campus. The system has grown from a two-schoolbus campus shuttle to a 16 small transit coach fleet serving eight routes with over 90 round trip route miles. An UMTA demonstration grant was instrumental in the system growth. An UMTA capital grant is now being prepared in conjunction with the Lower Pioneer Valley Regional Transit Authority to purchase facilities and additional vehicles for further expansion with a greater emphasis on serving the residents of Amherst.

Setting

Amherst is located in the western half of Massachusetts, some twenty-five miles north of Springfield, Massachusetts, across the Holyoke mountain range (Figure 1) Its 28 square miles include much open farmland and several distinct population centers, notably Amherst Center, North Amherst, South Amherst, and Sunderland. The local traffic generators are the Amherst Center office and shopping district, the University of Massachusetts, Amherst College, Hampshire College, and several large apartment complexes in the area surrounding these campuses.

The Town of Amherst has a population of 32,000 (as of 1973), and a population density of about 1,000 people per square mile. However, the University of Massachusetts campus area is far more dense. The core campus which is approximately one-third of a square mile in area, has 32 buildings of five stories or more including five 22-story dormitories and a 28-story library. This core area accomodates the University's 24,000 students and 6,000 employees. Twelve thousand of these students live on campus, five thousand more live off-campus in Amherst, and the remainder live in the surrounding towns and commute to the University.

Median family income in Amherst is \$11,600, and median income of unrelated individuals (mostly students) is \$1,250. There are 1.3 cars per household. Data on the number of households without cars are not available, but this number is probably small: even among undergraduate students, 75% had access to an automobile (according to 1973 statistics).

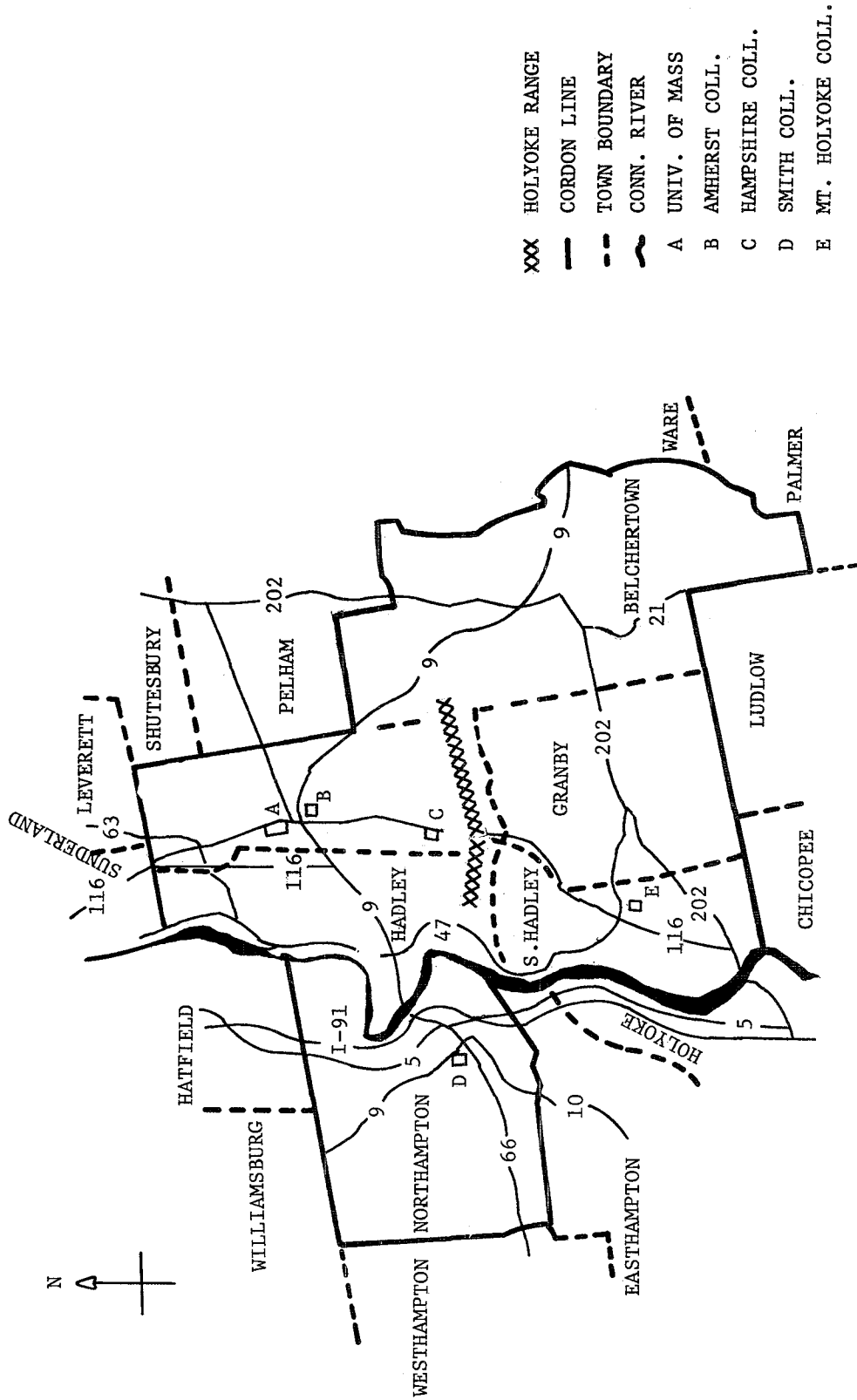


Figure 1. Five College Area Map



## Service Evolution

The idea of beginning a bus service on the U Mass campus originated in the Student Senate in 1968. At the urging of one of its members, the Senate voted to begin a campus shuttle service and appointed its chief proponent to run it. The purpose of this service was to help students to move around the campus during short class-change periods, and to improve campus mobility in general, especially during bad weather. The University administration supported the idea and agreed to register the vehicles, as well as to pay for fuel and maintenance, which currently amounts to about 50% of the operating expenses. There was no opposition to the creation of the service.

The Student Senate purchased two 1966 GMC schoolbuses for use on two campus shuttle routes, and for classroom related field trips. The service was entirely student run. The Student Senate paid the wages of the managers and the drivers. With the assistance of personnel from the physical plant staff, a somewhat loose schedule was established for the shuttle routes. However, during the operation of this service, there were frequent breakdowns in equipment and the shuttle service sometimes did not operate when the buses were needed for field trips. In addition, staffing was limited such that the manager's office was sometimes empty during the service hours.

In the 1970 fall semester two 45-seat GMC transit buses of 1956 and 1957 vintage were added to the fleet. These buses were in very bad repair - the inexperienced buyers had not judged their condition correctly. Consequently, in all of 1970-71, there were only a few days when both of these buses were actually in service.

In spring, 1971, another route was added to service the apartments housing students north of the campus. Three vehicles were operated, one on each route. The fourth vehicle, if not out of service for repairs, was used as a backup vehicle.

During the summer of 1971, a project director and a project coordinator were appointed to oversee the operation of the system and to aid in the preparation of the UMTA demonstration grant application. As the passenger demand continued to grow, a new 33-passenger GMC bus was purchased in 1972, and minor route modifications were implemented.

As the University expanded, on-campus parking lots were replaced by new buildings and the demand for parking

increased. Campus parking permits were sold for a dollar per year at a rate (in 1971) of 1.8 permits per space. Consequently, it was often difficult to find a parking place. Traffic delays were also common. Reportedly, lines of automobiles waiting at traffic lights to get on campus were often 1/4 to 1/2 miles long during peak hours. The Faculty Senate reached an impasse over measures to deal with these problems, and appointed an ad hoc committee to discuss them. Later in 1972, this committee was reconstituted formally as the Transportation and Parking Council, and consisted of three representatives from the student body, three from the faculty, and three from the administration and staff. This Committee served as a sounding board for campus opinion on transportation and parking policy, and, in addition, served as an advisory board to the Chancellor of the University. Among the members serving on this council, feeling was divided between those who wanted no change, and those at the other extreme who wanted to reduce the number of cars, lots, and eventually roads, on campus in order to "green the core." The majority of the Council came to advocate parking restrictions, increased parking fees, and an increase in bus service. The University administration adopted the policy supported by the Council majority.

In April, 1972, an UMTA demonstration grant of \$475,441 was awarded and the planning process intensified. During this time, a consultant was used to advise on experimental design. The resultant service was to be a demonstration of the combined effects of a free-fare bus service and parking restrictions "leading to the creation of an auto-free zone" at some time after the conclusion of the demonstration. The original plans for the demonstration were first to expand bus service in the spring of 1973, and later to increase parking fees in the fall, 1973 semester, while making no further change in the bus system. This would permit separate observation of the effects of the two changes.

The three existing bus routes (Figure 2) were retained under the expanded system. In addition, addresses of all University students and employees were obtained from the administrative computer data bank, and the number living within each quarter mile square segment along all streets was displayed on large maps. Possible new routes were laid over these maps, and those routes which would maximize potential ridership were selected. (The four new routes chosen are shown in Figure 3.) The planners drew up the new schedules with some caution, allowing enough slack time to be sure that the schedules could be kept under the unknown impacts of weather conditions and traffic to come.

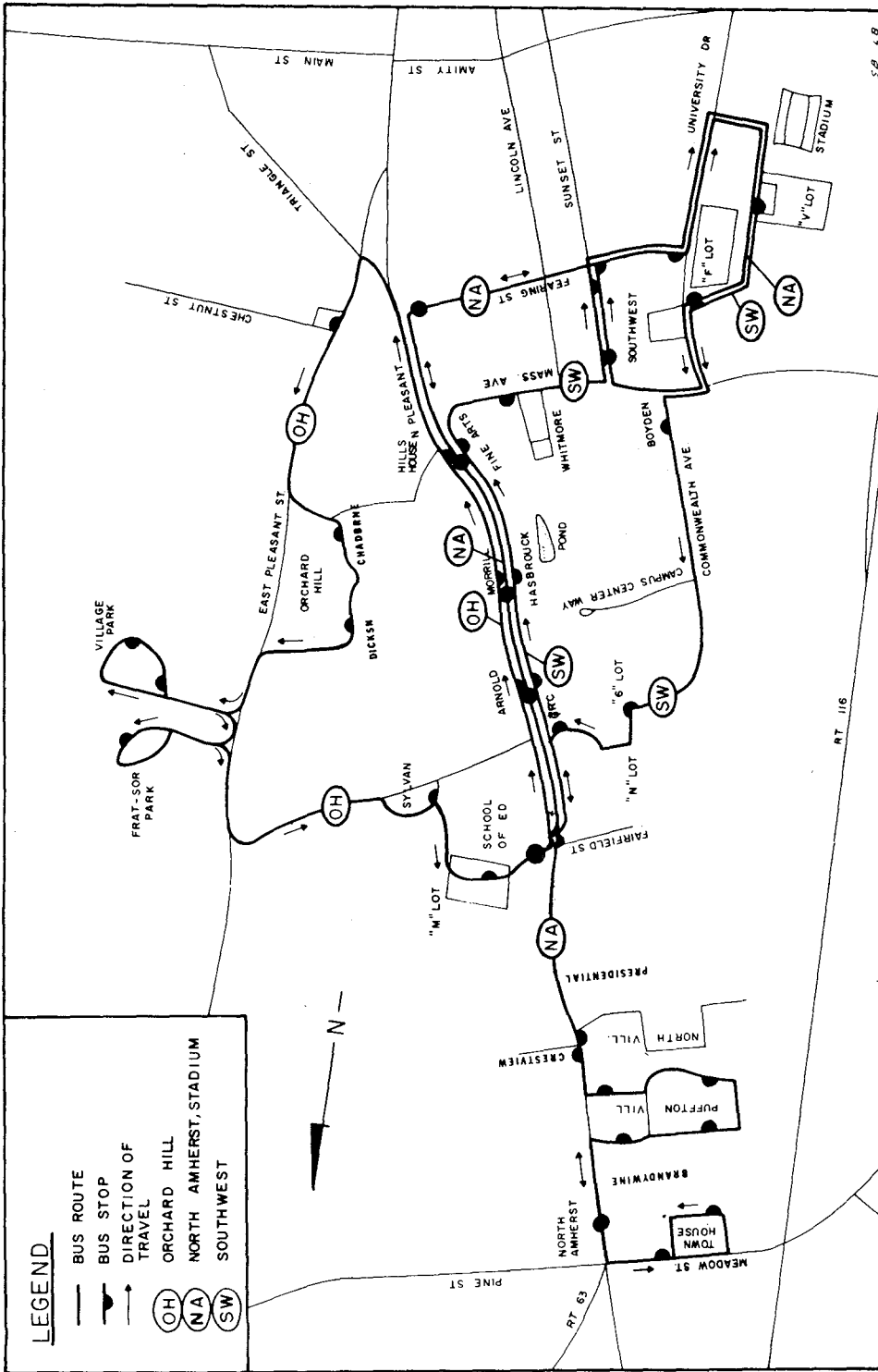


Figure 2 . University of Massachusetts On Campus Routes

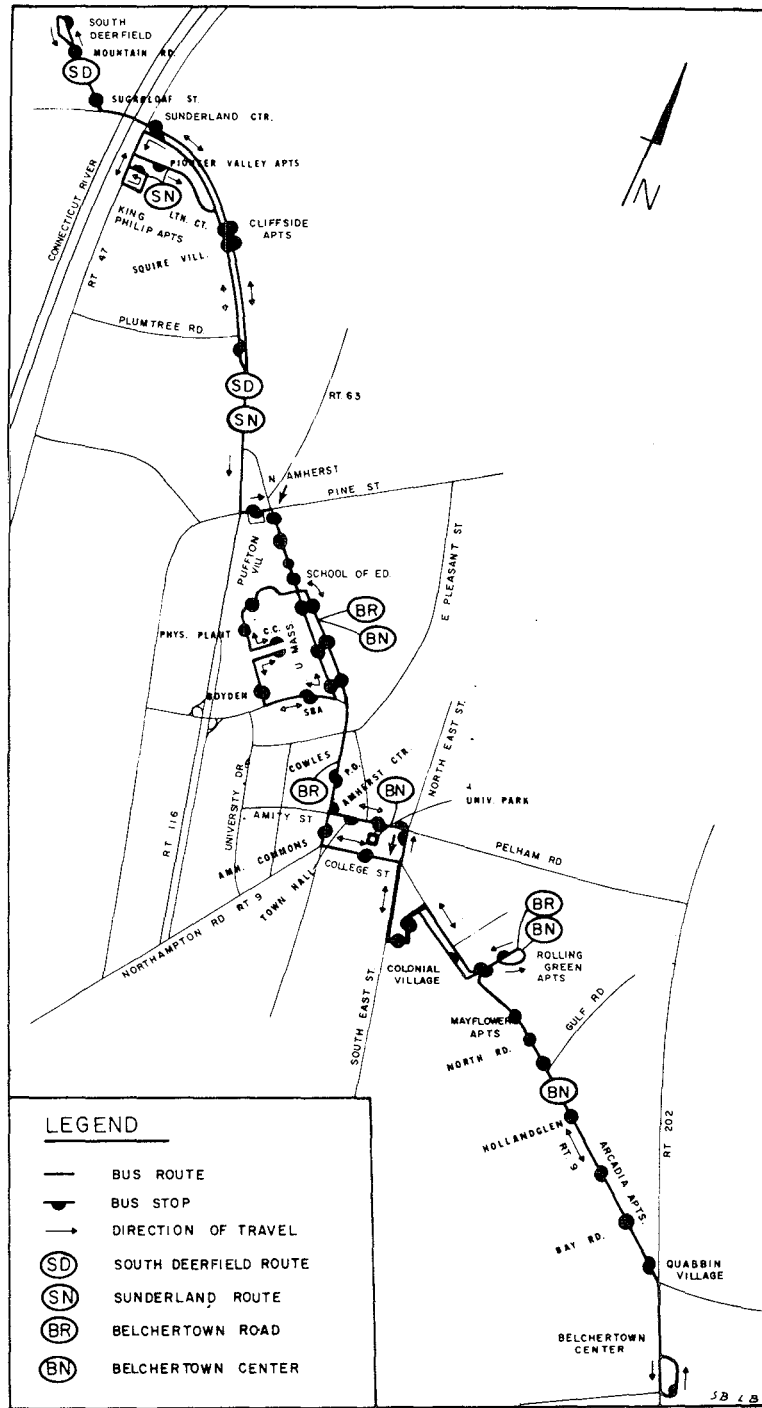


Figure 3. University of Massachusetts Off Campus Routes

It was originally planned to run non-polluting propane-fueled vehicles, but this plan had to be abandoned because adequate supplies of propane were not available. It was then decided to purchase ten gasoline-fueled 1972 Twin Coaches. The number of buses to be purchased was selected by estimating ridership using classical modal split models.

Before the expanded service began, the ten new transit coaches were displayed in Amherst and surrounding towns as a publicity measure. The University's Public Affairs News Bureau conducted a media campaign. Schedules and maps were passed out at the display points, published in the campus newspaper and made available at central locations.

In February, 1973, following the month-long January break, service began for the expanded system. The hours of operation were initially 7:30 a.m. to 5:30 p.m. However, two weeks later after a series of attacks on women students the service hours were extended to 11:30 p.m.

The bus system included 88 round trip route miles, and thirteen buses providing 120 vehicle hours of service a day (the two old schoolbuses had been retired to field trip service, except for occasional service as backup vehicles). Service was offered only on class days. Headways on the three "on-campus" routes were about 20 minutes during the day and 45 minutes during the evening. The other routes did not operate with constant headways, but the average headway was 30 minutes during the day and 85 minutes at night.

Bus service was discontinued during the summer break, but planning for the fall semester went on. The very success of the first semester created a problem: ridership was too high for the existing vehicle capacity. At the time the UMTA grant was awarded, University planners anticipated the thirteen bus fleet would be operating with excess capacity during the spring, 1973 semester, and would saturate in the fall when demand would be increased by the parking restrictions. The feeling that capacity had to be increased for the fall semester was very strong. The non-professional staff unions were already upset at the proposed parking regulation, and an inadequate bus service could only increase their disaffection with a "balanced transportation policy." UMTA agreed to issue a letter of "no prejudice" permitting U Mass to make capital expenditures and to apply for a supplemental grant to cover them after the fact.

The first solution proposed was to add seven buses to increase capacity, keeping schedules and headways identical by running buses in two's and three's where necessary.

However, the University was committed in writing to maintain the same level of service after the UMTA demonstration ended, which meant that the University would have to continue the fleet at twenty vehicles if the second expansion took place in this manner. The Chancellor's Office asked if there was not some other way to increase capacity. It appear that there was. It was found that many of the routes were operating with idle time at bus stops so as to ensure schedule adherence. More service could be obtained from the same buses by reducing this idle time. If the new, tighter schedules could be kept, and if service to the outlying points could be cut back, only three new buses would be needed. It was decided to adopt this solution. In June, 1973, three 1969 GMC 45-seat transit coaches were purchased. Buses were equipped with two-way radios and a system of regular reporting of vehicle position was instituted to assist drivers in keeping to schedule. In December, 1973, a supplemental UMTA demonstration grant in the amount of \$191,950 was awarded, and detailed contracts between UMTA and the University were finalized the following June.

The University administration negotiated with the two non-professional staff unions, the American Federation of State, County, and Municipal Employees and the Massachusetts Association of Government Employees, concerning the proposed parking changes. The non-professional staff felt that they had the least to gain and the most to lose from the new policies. They objected to the increased parking fees, since many of them lived in rural communities, which were too scattered to be well-served by the bus system. Furthermore, they had no trouble in parking under the previous system since their working hours forced them to arrive on campus early. The University held to its basic parking policy of raising fees and limiting sales of core permits, but it did offer some compromises. It agreed to set the parking range at \$5 to \$55 (instead of the initially proposed maximum of \$75), depending on the distance from the campus core and to drop a plan to offer reserved spaces at \$120. It also agreed to set up an early morning shuttle (5:30 a.m. - 7:30 a.m.) to carry people from the most distant and inexpensive parking lots to any building requested, and to offer summer service. The unions were not satisfied, however. On September 6, one union went out on "strike" but returned the next day. The administration did not change its position.

For the fall semester, the number of core parking spaces were cut from 3,900 to 2,100 and the ratio of core parking permits to spaces was reduced from 1.8 to 1.1.

These permits were sold on a first-come, first-served basis at \$41 to \$55 each. They sold out immediately. Permits were sold at \$17 for edge spaces and at \$5 for spaces in previously unused, distant lots such as the stadium parking lot, and in a new peripheral lot. The total number of cars registered to park on campus dropped from 15,000 in 1972 to 11,000 in 1973.

Bus service resumed on September 9, the start of the fall semester. The Belchertown Center and South Deerfield routes were discontinued, and the route mileage was reduced by 17% to 73 round trip route miles. A new campus shuttle (three round trip route miles) was added to serve the peripheral lots. Hours of full system operation were 7:30 a.m. to 11:30 p.m. There were 170 vehicle hours of service per day. Headways on all routes were 10 minutes during the 7:30 - 9:30 a.m. and 3:30 - 5:30 p.m. peaks, 20 minutes during the midday and 30 minutes in the evening.

Ridership picked up quickly, as did complaints from the areas where routes had been dropped. South Deerfield and Belchertown Center residents asserted that they had signed leases expecting services to continue, and that they were now without adequate transportation to campus. In response to these protests, a limited outreach service consisting of several off-peak runs per day was implemented in October, 1973.

The system now being operated on the U Mass campus is very similar to the one which existed in the fall of 1973. System characteristics and operating data are summarized at the end of this report. The bus fleet consists of sixteen vehicles. There are five regular routes and three outreach routes, 90 round trip route miles, and 170 vehicle hours of service offered per day. The system employs 130 students on a part-time basis.

### Results

Even though the initial service was plagued with breakdowns and overloaded buses, the students, by and large, were pleased to have it. Ridership quickly grew to 2,000 per day and the Student Senate support continued. By 1972, ridership had reached 2,500 per day.

Ridership response to the spring, 1973 service expansion was dramatic. The project director reports that peak ridership during the first few weeks of operation reached "crush" levels. Ridership remained high during most of the semester, but declined in April with the arrival of

good weather. Over the semester, daily ridership averaged 6,500, or 54 passengers per vehicle hour. Eighty-five percent of the riders were undergraduate and graduate students, 10% University faculty and staff, and 5% other. About 1/3 of the University population living within 1/4 mile of a bus stop used the system.

On-campus traffic volumes increased somewhat while on-campus automobile travel times fell slightly, perhaps as a result of improved traffic flow caused by a reduction in hitch-hiking (some 40% of bus riders reported that they would have hitch-hiked if no bus service had been available). No significant traffic changes were observed off-campus.

Operating costs for the spring, 1973 semester were about \$70,000 which amounted to \$7.50 per vehicle hour, or 14¢ per passenger trip. One factor holding down costs was that the system remained entirely student-run (the project director and coordinator were not engaged in supervision or daily administration). Student drivers were paid between \$2.25 and \$3.25 per hour and student managers were paid between \$3.00 and \$4.00 per hour. No fringe benefits were given. It should also be noted that some overhead costs usually borne by a transit operator were paid directly by the University and thus not counted as part of the bus system's costs. These costs included office, garage and land rental, electricity, building maintenance, and other overhead costs. The construction cost of the new garage built as part of the demonstration, however, was included as a capital cost to the system.

At the start of the fall, 1973 semester ridership, once again, reached "crush" levels at peak loading points. Average daily ridership rose to 13,000. About half of all University students and staff living within a quarter mile of a bus stop used the service.

As a consequence of the decrease in bus idle time, the average speed of the buses, including stops, rose from 10 mph to 14 mph. Productivity reached 88 passengers per vehicle hour and operating cost per ride fell to 8.5¢.

Campus congestion was apparently relieved. Traffic volumes on campus fell by 10% as compared to the previous semester, despite an increase in enrollment of 1,500. Lines of traffic waiting to get on or off campus were reduced significantly, and time spent trying to find parking spaces on campus was reduced markedly. As noted earlier, the number of cars registered to park on campus fell by 25%.



Traffic volumes off-campus decreased as well. These decreases, however, have apparently not been accompanied by a drop in car ownership.

An on-board survey taken in October, 1973, indicated that ridership composition was about the same as in the previous semester (see Table 1). Some idea of the amount of diversion from other modes may be gathered from responses to the survey question, "If there were no bus service, how would you normally commute?" Thirty-five percent would have driven an automobile, 33% would have hitch-hiked, 4% would have been driven by someone else, 21% would have walked, and 5% would have bicycled.

Transit system capital costs for the year 1973 came to \$438,500 including \$333,000 for the purchase of thirteen buses. Operating costs for the fall semester were approximately \$100,000, or \$7.70 per vehicle hour. Student wages remained the same.

TABLE 1. USER CHARACTERISTICS, OCTOBER, 1973

<u>Occupation</u>	<u>Percent of Ridership</u>	<u>Income<sup>1</sup></u>	<u>Percent without Access to Auto</u>
Undergraduate students	61	\$2,000-5,000	24
Graduate students	24	\$3,000-8,000	8
Faculty	3	\$15,000-25,000	3
Professional Staff	2	\$12,000-25,000	4
Classified Staff	6	\$5,000-12,000	6
Other <sup>2</sup>	4	not available	

<sup>1</sup> Students' income includes an estimate of parent's contributions.

<sup>2</sup> The bus system is open to the general public.

Ridership on the bus system has continued to rise. For the fall, 1974 and spring, 1975 semesters, an average of over 15,000 passengers were carried on class days. Other operating statistics such as cost per vehicle hour (\$7.74),

cost per passenger trip (\$.09), and passengers per vehicle hour (85) were about the same as in 1973.

The Twin Coaches did not wear well. The manufacturer's stated capacity for the Twin Coaches is 45 persons, 31 seated and 14 standing. However, college students were able to crowd on sixty and more at a time. This put a strain on the vehicle's transmission. On one occasion five vehicles were simultaneously out of service for transmission repairs. Because of this problem, the system's managers expect the Twin Coaches to last only four or five years instead of the seven originally predicted.

During the course of the demonstration, the Parking Office and bus system were merged under a new title: Balanced Transportation and Parking Office. The FY 1974-75 budget of this office was made up of \$183,000 in parking fees, \$45,000 from parking meters, \$103,000 from the Student Senate, and \$128,000 from the University administration. It expended about \$140,000 on parking, and \$320,000 on the bus system. The non-professional staff unions feel that the students are getting the best of the arrangement (fifty percent of the parking fees are paid by students, fifty percent by faculty and staff) and they resent it. It is true that those who park in the expensive central lots subsidize those who park in distant lots and take the shuttle as well as those who leave their cars at home and take the bus all the way to the campus (it may be recalled that 83% of the 1973 bus passengers had access to cars).

One union official has commented that the union members would like to see bus fares replace parking fees as a source of funds for the bus system because the people receiving the benefit would be paying for it. To counter this, the managers of the bus system cite the ease of operation possible without fares such as quicker loading, convenience to riders, and vastly simpler accounting for the student administrators. In addition, they also cite that the Student Senate contributes substantially toward the operation of the bus service. The same union official also has stated that the unions do not object to closing parking lots in order to improve the campus, a move which affects all drivers equally, but to the method of using price as a means of rationing parking.

The bus system has affected the economic activity within the community. Fifty percent of responding retail merchants in Amherst Center attribute increased business to the bus service and another 40% who experienced no increase believe that it has minimized the effect of a new shopping

plaza in the neighboring town of Hadley. In a telephone survey of University students and personnel, a majority answered "yes" to the question, "Would a convenient bus service influence your choice of residence?" In fact, in 1973, rent increases for apartments along bus routes were significantly higher than increases in rent elsewhere.

### Future Plans

Managers of the bus system are planning a second expansion. They are currently preparing a request for an UMTA capital grant totalling \$1,600,000 for the purchase of 21 new buses (fourteen for replacements and seven for expansion) as well as for improved maintenance facilities. This grant request also covers the cost for full title to the bus garage and the thirteen vehicles originally acquired during the demonstration (UMTA retained partial title to these).

The University is moving ahead with the planned closing of parking lots in the campus core area. Petitions against these closings have been circulated in the departments whose buildings are closest to the lots, but there is also wide support for these closings.

A northeast by-pass road, which will divert on-campus traffic from North Pleasant Street is scheduled to open in 1977. This road may make it possible to ban automobile traffic on campus altogether. Advocates have hoped to replace the street with grass, but the transit planners believe that it should be kept open for use by the buses and emergency vehicles.

The development of a regional transit organization is now underway. It is anticipated that both the University of Massachusetts Student Senate Transit Service and a small system operating between the five colleges in the region will be integrated into the Pioneer Valley Transit Authority. The target date for obtaining these operating agreements is July 1, 1976. The Town and the University are currently negotiating concerning the apportionment of the local cost of service.

### Conclusions

While the Student Senate bus system is an example of a well-run and well-used, free-fare service, it is not a test of a free-fare strategy because no other fare was ever tried. High productivities may also have been due to the

natural advantage of highly concentrated trip patterns and the artificial stimulus of parking restrictions.

The bus system reports a very low operating cost of seven cents per passenger trip in the 1974-75 academic year. Other universities have obtained comparable cost figures, often around 10-15¢ per ride. This is due in part to indirect University subsidies, as well as to high vehicle productivity and extensive use of relatively inexpensive part-time student labor. Student tripmaking is usually tied to campus destinations and dense housing facilities, parking is limited, and car ownership may be lower than it is among the general population. Students are also a ready source of part-time labor, and they are usually not unionized.

Many university systems operate with a low-fare or free-fare. This serves the purpose of their systems, which is to provide easy mobility for students and staff. Costs and benefits are felt by the University community, so that University administrations see no great inequity in financing low fares. The University of Massachusetts is a special case in that the bus system is subsidized directly from parking fees, as well as from the general fund. This provides a target for protest, but even so, the bus system might not have faced so strong a protest if it were not for the fact that the staff unions by State statute can only negotiate over working conditions, which includes parking. Planners in other systems may encounter less difficulty in raising parking fees to subsidize transit, although they should expect to encounter some opposition.

As the University bus system moves toward a merger with the Pioneer Valley Transit Authority, the free-fare policy at Amherst will face a new challenge and some means of dividing the cost among the towns and colleges will become necessary. Charging a fare ties payment directly to use and consequently, fares often seem to be the obvious way to apportion costs. The Transit Authority and the localities hope that UMTA and Commonwealth of Massachusetts operating assistance funds will be available to defray three-quarters of the operating cost of the regional system, thus reducing the local subsidy required.

## SUMMARY OF AMHERST TRANSIT SYSTEM CHARACTERISTICS

### DEMOGRAPHICS

Population in service area: 17,000  
Population density: 1,000 persons per square mile  
Median household income: \$12,000  
Cars owned per household: 1.3  
Percent carless households: n/a  
Percent transit dependent: n/a  
Average distance to service: 65% total population  
within 1/4 mile of a bus stop  
Percent without cars (1974):  
    undergraduates       15%  
    faculty               3%  
    classified staff     5%  
    professional staff   3%  
    graduate students    13%

### COVERAGE AND SERVICE

Number of routes: five standard, three extended  
coverage (limited service, largely during  
off-peak or just before or after the peak -  
1974 through 1975)  
Average route length (one-way): 6 miles  
Average route time (one-way): 25 minutes  
Time of service and average headways:  
    regular service  
        normal service (fall, 1974)  
            7:30 - 9:30       10 minute headway  
            9:30 - 3:30       20 minute headway  
            3:30 - 5:30       10 minute headway  
            5:30 - 11:00      30 minute headway  
  
        parking shuttle    5:30 am - 7:30 am  
  
    winter weekend  
        Saturday: 7:30 am - 1:00 am 1 hr headway  
        Sunday: 10:30 am - 6:30 pm 1 hr headway  
  
    summer  
        Monday - Friday 7:30 am - 5:30 pm 1-1/2 hr headway  
  
    outreach service  
        Belchertown, South Deerfield, South Amherst  
        7:30 - 11:00    40 minute headways

winter weekend  
 Saturday: 7:30 am - 1:00 am 3-1/2 hr headways  
 Sunday: 10:30 am - 6:30 pm 3 hr headway  
 Number, types and average capacity of vehicles:  
 16 transit buses 35.4 seats per vehicle  
 2 school buses 39 seats per vehicle  
 Number of vehicles in service: 16

COST AND PRODUCTIVITY (June, 1974 - May, 1975)

Operating cost per month: \$18,000  
 Vehicle miles per day: 2,450  
 Vehicle hours per day: 170  
 Driver hours per day: n/a  
 Operating cost per vehicle hour: \$7.74  
 Operating cost per vehicle mile: \$0.52  
 Operating cost per passenger trip (one-way): \$0.09  
 Passengers per vehicle hour: 85  
 Passengers per vehicle mile: 5.9  
 Driver wage rate per hour: \$3.00

REVENUE AND SUBSIDY

Fares: zero fare  
 Revenue per passenger: \$0.00  
 Subsidy per passenger: \$0.09  
 Operating ratio: undefined  
 Lease or buy vehicles: Buy  
 Funding (1973):

	<u>Capital</u>
Federal	\$373,410
State	-
Local	-
University	65,090
Total	\$438,500

RIDERSHIP

Average Passengers per weekday: 15,200 (fall, 1974 -  
 spring, 1975); 5,400 (summer, 1974)  
 Ridership growth rate: Multiplied by 6 in 3 years  
 Ridership composition (fall, 1973):  
 students 85%  
 faculty and staff 11%  
 other 4%  
 Trip purpose: 85% university



