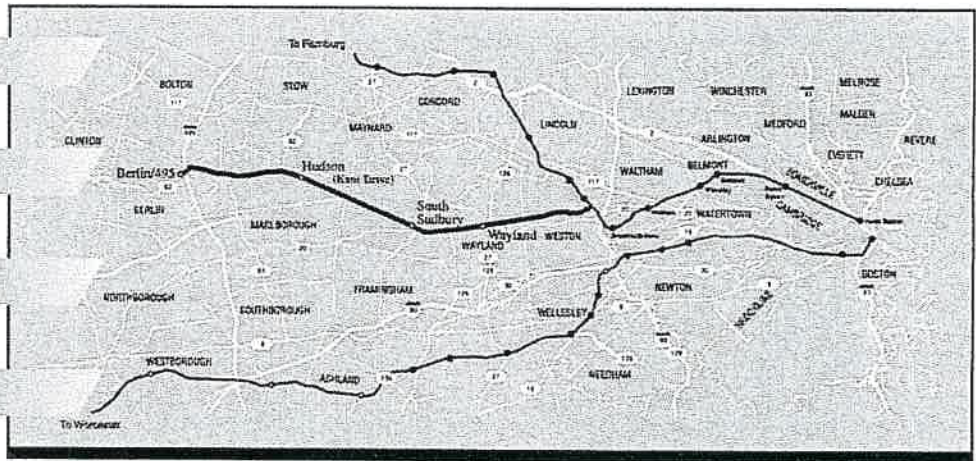


T CENTRAL MASS. COMMUTER RAIL FEASIBILITY STUDY



A report produced by the
Central Transportation
Planning Staff for the
Massachusetts Bay
Transportation Authority

T CENTRAL MASS.
COMMUTER RAIL
FEASIBILITY STUDY

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EXECUTIVE SUMMARY

Until 1971, commuter rail service was operated on the "Central Mass." rail line, branching from the Fitchburg commuter rail line at a connection in Waltham and extending to South Sudbury. Until 1965, this service continued to Hudson, and until 1958 it ran to Berlin and Clinton. Except for a brief demonstration during the final weeks, Central Mass. service after 1959 consisted of one inbound A.M. peak and one outbound P.M. peak train. Freight service on the segment between Waltham and Hudson continued until 1980.

Because of population growth in the Central Mass. corridor since 1971, there has been recent interest in re-instituting service on the line. A provision of the Massachusetts state budget for fiscal year 1996 directed the Executive Office of Transportation and Construction to study the feasibility of re-opening the Central Mass. as far as Route I-495. This study was performed by the Central Transportation Planning Staff in the spring of 1996.

Project Description

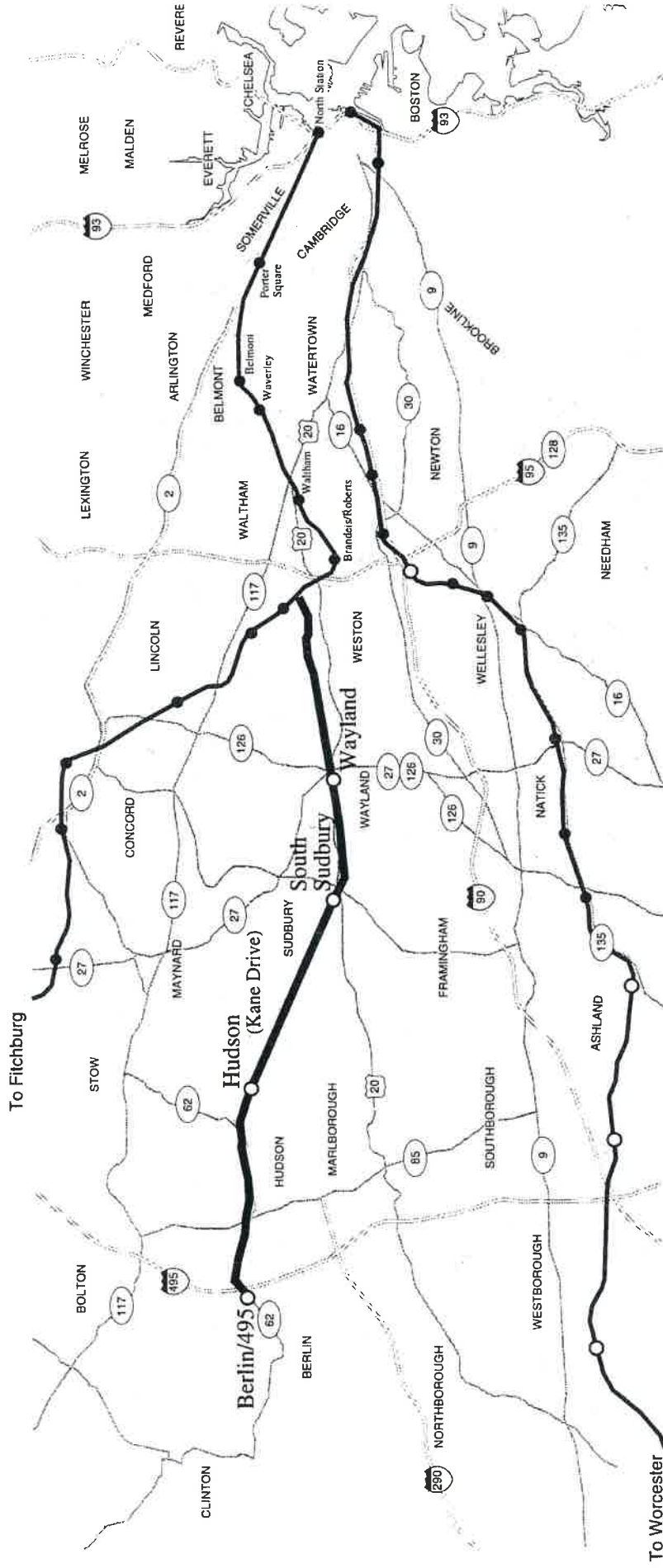
The line being examined is part of the former Central Massachusetts, or Central Mass., Branch of the Boston & Maine Railroad system. A Route 495 terminal would be in the town of Berlin. The line would also pass through Hudson, Sudbury, Wayland, and Weston (see map on next page). When last operated, Central Mass. trains diverged from the Fitchburg commuter rail line at a junction 1.5 miles east of the current Waltham Station. Future service would most likely use a new connection to the Fitchburg Line located between the Brandeis/Roberts and Kendal Green stations.

Most portions of the Central Mass. that would be used for the extension have been inactive since at least 1980. (Freight service on the 1.5 miles of the Central Mass. nearest the old junction with the Fitchburg Line in Waltham was operated until 1994.) The outer end beyond Hudson has been inactive since 1975. The right-of-way to a point about two miles west of I-495 is owned by the MBTA. The line beyond that to Clinton was dismantled in 1959, and ownership of the property has become fragmented.






Identification of specific station locations would require further study. The demand analysis, and preliminary examination of present land use in the corridor, indicate that in addition to the terminal at I-495, a Central Mass. extension should include one station each in Sudbury, Hudson, and Wayland.

T CENTRAL MASS COMMUTER RAIL
Feasibility Study

ALIGNMENT & STATIONS



T MASSACHUSETTS BAY
TRANSPORTATION AUTHORITY

-  Potential commuter rail line and station
-  Existing commuter rail line and station
-  Planned future station on existing line
-  Interstate
-  State highway

Ridership Potential

The four outer towns on a Central Mass. commuter rail extension to Route I-495 do not currently have direct commuter rail service, but Weston has three stations on the Fitchburg Line. In addition, Wellesley Farms Station on the Framingham Line is less than half a mile outside of Weston, and a new station on that line in Weston is planned. Wayland adjoins three towns with commuter rail stations and Sudbury adjoins two.

Because of the proximity of the Central Mass. route to other commuter rail lines, virtually all ridership on a Central Mass. extension would be drawn from nine municipalities: Wayland, Sudbury, Hudson, Stow, Bolton, Berlin, Marlborough, Clinton, and Boylston. (See map on page 4 of main report.) Total ridership would be relatively low. On weekdays, there would be about 1,300 riders in each direction, and over half of these would be diverted from other MBTA services. Central Mass. ridership would be generated from the markets discussed below. These results are summarized in Table ES - 1.

Work Trips to Boston and Cambridge

The predominant source of ridership on all MBTA commuter rail lines is work trips to Boston and Cambridge. Based on the shares of work trips captured by existing North Side commuter rail lines from communities at comparable distances from Boston, a Central Mass. extension with service frequency similar to that on the Fitchburg Line, but with unconstrained parking, could be expected to capture about 40% of the work trips to Boston Proper and 15% to other parts of Boston or to Cambridge from its service area. The 1990 Census Journey-to-Work tabulations (the most recent such figures available) show combined totals of 1,665 Boston Proper, 1,465 Boston Other, and 950 Cambridge work trips from the Central Mass. service area by all modes. With the shares listed above, a Central Mass. extension would capture 1,030 of these trips.

Work Trips to Other Locations and Non-Work Trips

The 1993 survey results show that work trips account for 86% of total commuter rail trips to Boston and Cambridge on North Side lines, and that Boston and Cambridge trips for all purposes account for 92% of trips to all destination. With similar proportions, a Central Mass. line would be expected to attract about 165 non-work trips to Boston or Cambridge, and about 100 trips to other destinations.

Total Ridership

The combined ridership from all sources above would total 1,295 per day in each direction for a Central Mass. extension terminating at Route I-495 in Berlin. Almost as many riders (1,245) would be served by an extension terminating near

the intersection of Main Street and Kane Industrial Drive in the east end of Hudson. With the same service frequency (16 round trips per day), an extension to South Sudbury would have 1,160 riders each way. With the minimum level of service analyzed (8 round trips on weekdays), this would drop to about 950.

Adjustment of 1990 Demand Estimates to 1996 and Future Years

The overall population in the Central Mass. service area towns increased by about 5% between 1990 and 1996. A proportional increase in travel would have raised Central Mass. ridership on an I-495 extension by about 65. As a result of economic conditions, however, total Boston employment was about the same in 1996 as in 1990. Therefore, it was concluded that Central Mass. ridership projections based on 1996 travel data would not have differed significantly from those based on the 1990 data.

The Metropolitan Area Planning Council (MAPC) estimates that total population in the Central Mass. service area will increase by about 15% between 1990 and 2020. A proportional increase in ridership on the Central Mass. as a whole would raise weekday inbound boardings to 1,490. The projected employment increase in the City of Boston between 1990 and 2020 is only 5%, however. Unless a disproportionate share of new jobs in Boston went to Central Mass. area residents, a maximum of about 1,360 riders would be more likely.

Shifts From Other Transit Services

Currently about 655 residents of cities and towns in the Central Mass. service area use MBTA commuter rail, express bus, or rapid transit lines for all trip purposes combined on a typical weekday. Another 60 use private-carrier express buses. Current transit users would be among the most likely travelers to shift to a Central Mass. extension. If all of them diverted, only 580 of the 1,295 inbound Central Mass. riders at present levels would be new transit users. Future service improvements on the Fitchburg and Framingham/Worcester commuter rail lines will increase their attractiveness to residents of the Central Mass. service area. By the year 2020 this would reduce the number of Central Mass. riders who would not otherwise be transit users to around 520 per day. At present ridership levels, an extension to a Hudson terminal would attract about 550 new transit users. An extension to South Sudbury with reduced service levels would attract about 420 new riders.

The ridership figures above include only boardings on the Central Mass. extension itself. As a result of diversions to stations on the extension, about 140 parking spaces would be vacated at Fitchburg Line stations where ridership is now severely constrained by parking capacity. Most of the vacated spaces would be re-filled by passengers who currently drive to Alewife station.

Central Mass. trains could stop at some or all of the existing stations on the Fitchburg Line between North Station and the junction with the extension. This could be done either to increase the frequency of service at these stations or to allow Fitchburg Line trains to omit them to speed up service from points further west. Based on sensitivity of ridership to frequency and travel time, the strategy of increasing service at the inner stations would have the larger ridership impact. Up to 200 additional inbound boardings per day would be attracted to these stations. Speeding up service at the outer stations would generate more new revenue, however, because of the higher average fares at these stations.

Table ES - 1
Central Mass. Extension
Estimated Weekday Inbound Riders by Category

<u>Ridership Category</u>	<u>I-495 Terminal</u>	<u>Hudson Terminal</u>	<u>So. Sudbury Terminal</u>
Boston and Cambridge Work Trips	1,030	990	825
Boston and Cambridge Non-Work Trips	165	160	75
Other Destinations or Trip Purposes	100	95	50
Total	1,295	1,245	950
 New Transit Users in Total Above	 580	 550	 420
Diversions from Other Transit Services	715	695	530

Operating Cost and Revenue Estimates

Operating costs for a Central Mass. extension would be determined primarily by the length of the route and the number of trips operated each day. The study examined shorter extensions terminating at Main Street near Kane Industrial Drive in the eastern edge of Hudson or at South Sudbury as well as an extension to I-495. The maximum service frequency analyzed was the same as that currently operated on the inner half of the Fitchburg Line: 16 round trips on weekdays, eight on Saturdays, and seven on Sundays. The minimum frequency considered was weekday service the same as that operated on the outer end of the Haverhill Line (eight round trips), but with no weekend service.

A terminal at I-495 in Berlin would be 31.1 miles from North Station. At the upper-bound service level and the current average operating cost per train mile, the annual operating cost for this alternative would be \$12 million. (This assumes that there would be a layover facility at the outer terminal, so that no non-revenue miles would be needed.)

Under the present fare structure, at the estimated ridership level of 1,295 weekday riders, and weekend ridership in typical proportion to this, annual

revenue would be \$1.9 million, equal to 16% of the annual cost. Net changes in ridership on other MBTA services as a result of the Central Mass. extension would reduce revenue on those services by about \$0.4 million, however. Therefore, incremental system revenue would equal only 12% of the operating cost of an I-495 extension with maximum service levels.

Of the alternate terminal and service level strategies examined, an extension only to South Sudbury with reduced weekday frequency and no weekend service would have the highest incremental revenue-to-cost ratio, at 27%.

Capital Cost Estimates

Estimated capital costs for Central Mass. extensions to I-495, Hudson (Kane Drive) and to South Sudbury are summarized in Table ES-2. It should be noted that these are based on a preliminary examination of the facilities needed, rather than on detailed engineering studies. From a connection with the Fitchburg Line between Brandeis/Roberts and Kendal Green to I-495, the length of a Central Mass. extension would be 18.4 miles. Most of the rails and ties on the Central Mass. line are still in place, but they were in poor condition even before freight service was discontinued in 1980. Normal weathering since then has caused further deterioration of the ties and roadbed. The track structure would have to be entirely rebuilt for future service. In the past, the only signals on the Central Mass. were at the approaches to junctions with other rail lines, so an entirely new signal system would be needed.

Between the connection with the Fitchburg Line and I-495, the Central Mass. right-of-way has 26 crossings of public roads and at least five crossings of private roads. When service was last operated, the public crossings were protected by automatic flashing lights but not gates. The crossing protection devices have all either been removed or vandalized beyond repair. Future service would require new lights and gates at all of the public crossings. The crossings are most heavily concentrated on the west end of the line, with 18 public and two private crossings between South Sudbury and I-495. Of these, 14 would be west of a Kane Drive Hudson station site.

The Central Mass. crossed two roads on bridges. Both of these were in Hudson, west of Kane Drive, and both have been removed. Four rivers or streams were crossed on long wooden-pile trestles. Although these are still in place, they would need to be rebuilt or replaced for future rail service. Three of these are west of Kane Drive.

Eight roads crossed the Central Mass. right-of-way on bridges. Two of these bridges in Hudson (both west of Kane Drive) and one in Weston have been removed and replaced with solid fill. The other five road bridges are still in place and do not appear to require any upgrading.

The I-495, Hudson, and Wayland stations would be at locations where there have not previously been stations, so entirely new facilities would be needed. South Sudbury still has a low-level platform, but lacks a shelter, wheelchair ramp, and parking lot. The operating cost calculations assume that there would be a layover facility at the outer terminal to avoid costs for non-revenue train trips.

At the projected ridership levels on the Central Mass. the maximum load on an individual train (excluding boardings at stations on the Fitchburg Line) would be about 360. To provide seats for all of these passengers, trains of either two double-deck or three single-level coaches would be sufficient. The costs in Table ES-2 are based on double-deck coaches. At the estimated running times, an extension to I-495 would require three train sets for five A.M. peak trips.

If the operating strategy for the Central Mass. resulted in significant numbers of present Fitchburg Line riders using Central Mass. trains at the inner stations, additional cars would be needed on some Central Mass. trains. (The most heavily used A.M. peak train on the Fitchburg Line has about 160 passengers boarding at all stations in Waltham and Belmont combined.) The capital cost calculations assume that if this occurred some cars now assigned to Fitchburg Line trains would be re-assigned to Central Mass. trains. If this were not possible, rolling stock costs for the Central Mass. trains would be higher than shown.

It does not appear that Central Mass. service would cause any capacity problems at North Station when added to other existing and currently planned services there.

Table ES-2
Summary of Capital Costs for Central Mass. Extension

<u>Item</u>	<u>To I-495</u>	<u>To Hudson</u>	<u>To South Sudbury</u>
Track and Signals	\$47,710,000	\$33,045,000	\$20,695,000
Connection to Fitchburg Line	3,000,000	3,000,000	3,000,000
Grade crossing surface, lights, gates	3,415,000	1,705,000	1,080,000
Fencing	710,000	500,000	315,000
Bridges	17,370,000	6,690,000	2,975,000
Station platforms and shelters	3,215,000	2,410,000	1,610,000
Parking	2,670,000	2,580,000	2,040,000
Layover Facility	1,000,000	1,000,000	1,000,000
10% Contingency Factor	7,910,000	5,095,000	3,270,000
Rolling Stock	<u>16,200,000</u>	<u>16,200,000</u>	<u>10,800,000</u>
Grand Total	\$103,200,000	\$72,225,000	\$46,785,000

Environmental Impacts of Central Mass. Extension

Impacts on Air Quality

Based on the present travel modes of the expected users of Central Mass. rail service, and including new ridership on the Fitchburg Line resulting from operation of Central Mass service, a Berlin extension would reduce automobile vehicle miles of travel (VMT) by about 32,700 per day. With a Hudson terminal, the reduction would be about 30,800. For an extension only to South Sudbury with a reduced service level, the VMT reduction would be about 21,000. Taking into account increased emissions from diesel locomotives used on Central Mass. trains, the net impacts on air quality would be as shown in Table ES - 3.

Table ES - 3
Central Mass. Extension
Net Changes in Average Weekday Emissions

	<u>I-495/Berlin</u>	<u>Hudson</u>	<u>So. Sudbury</u>
CO change	-282.7 kg	-271.1 kg	-195.1 kg
NOx change	+436.5 kg	+354.0 kg	+134.6 kg
VOC change	-14.8 kg	-15.6 kg	-14.0 kg
PM change	+6.5 kg	+5.3 kg	+2.2 kg

These impacts would be about average compared with other commuter rail extensions examined in the 1994 Program for Mass Transportation. The capital cost relative to air quality improvement would rank among the least cost-effective of those extensions, however.

Impacts on Water Resources

The impacts of a Central Mass. extension on water resources would occur mainly at stations. Parking facilities would require appropriate drainage system to prevent run-off of motor oil and other pollutants deposited by automobiles. Two of the most likely station sites (I-495 and South Sudbury) would probably require some filling of wetlands in order to provide sufficient parking. The Wayland station would most likely be at one of several vacant industrial sites, where construction of a station would allow mitigation of past impacts on water resources.

All track bridges over rivers and streams on the Central Mass. alignment would be reconstructed as part of the extension project. The present open-deck structures would be replaced with closed-deck bridges, which would have appropriate drainage systems to prevent water pollution.

Impacts on Cultural and Community Resources

A Central Mass. extension would affect community and cultural resources in two towns. In Wayland Center, the right-of-way passes directly through the town historic district, and also runs near the town library. In Hudson, it passes close to two churches and an elementary school. (The impacts in Hudson would occur only with an extension west of Kane Drive).

Traffic Impacts on Major Arterial Routes

The reductions in vehicle miles of auto travel as a result of a Central Mass. extension would be distributed over many different routes. The greatest reduction at any individual location would occur on Route 20 at the Wayland/Weston town line. With an I-495 or Hudson terminal, the daily reduction at this point would be about 485 cars in each direction. The highest concentration of these would occur between 8:00 and 8:30 A.M. when about 135 cars would be removed. This would be about 17% of the eastbound traffic on the road in this interval. A South Sudbury terminal with reduced service would have a slightly lower impact in the peak half hour. The daily reduction would be about 400 vehicles in each direction.

Traffic Impacts of Station Access

With stations at I-495, Kane Drive in Hudson, South Sudbury and Wayland, the most heavily used of the four, regardless of specific location, would be the one serving Wayland. At this station, with the maximum service level examined the most heavily used train would have about 180 boardings. About 150 of the passengers for this train would use some form of auto access. In the final minutes prior to train departure, auto arrivals would average about 16 per minute, but not all of these would approach from the same direction. (One potential Wayland station site would be accessed both from Route 20 and from Route 27. Approaching traffic there would be divided among four directions.)

An extension to I-495 with the maximum service level analyzed would require parking capacities of approximately 90 spaces each at I-495 and Hudson, 300 at South Sudbury and 410 at Wayland. If the extension terminated in Hudson, parking capacity would need to be expanded to 150 there, with no changes at the other two stations. With a South Sudbury terminal and the minimum level of service analyzed, South Sudbury would require 345 spaces, but Wayland would need only 335.

Grade Crossings

The Central Mass. alignment from Weston to I-495 has 26 grade crossings of public roads. Of these, eight are east of South Sudbury, five between South Sudbury and Kane Drive in Hudson, and 13 between Kane Drive and I-495. Two of the busiest crossing locations are of Route 20, on the Wayland border and just east of South Sudbury. Elimination of at least one of these by elevating the track appears to be feasible, but the cost has not been included in the capital cost section.

Traffic at each grade crossing would be stopped for about 45 seconds for each train. With schedules similar to those on the Fitchburg Line, there would be three to four trains per hour in both directions combined during peak hours. The impact on traffic would be smaller than that of any of the signalized intersections along Route 20.

In addition to the grade crossings on the Central Mass. route itself, Central Mass. trains entering the Fitchburg Line at a junction between Kendal Green and Brandeis/Roberts would pass through eight grade crossings on that line. This would include four crossings in Waltham, one each in Belmont and Cambridge and two in Somerville. The most heavily traveled of these are the Moody and Elm Street crossings in Waltham, which are located at either end of the existing Waltham Station inbound platform. These crossings are viewed by the City of Waltham as serious impediments to traffic flow even with existing rail service levels. Additional traffic studies would be needed to determine the impact of adding Central Mass. service.

Impact of Extension on Abutters

The segments of the Central Mass. line that would be used for a commuter rail extension have had no train operation at all since 1980 or longer. In the final years before abandonment, traffic on the line consisted at most of one local freight train per day in each direction. Negative impacts on abutters of the commuter rail service would include vibration and noise and blocking of road crossings while trains are passing. Sounds that would carry furthest would be those of train horns at the crossings.

There are currently about 150 houses within 200 feet of the Central Mass. right-of-way. Of these, about 50 are east of South Sudbury, 40 between South Sudbury and Kane Drive in Hudson, and 60 between Kane Drive and I-495. Many of these have been constructed since rail service was last run on the line. Additional subdivisions are now being developed close to the line in Wayland.

Most of the houses close to the right-of-way would be too far from the most likely station sites to be impacted by station traffic. Traffic past houses along

Route 20 east of South Sudbury would decrease slightly because of diversions to the rail line.

Conclusions

A Central Mass. commuter rail extension to either Route I-495 in Berlin or to South Sudbury would be feasible from an operations standpoint, but would produce very limited benefits for the costs involved.

Depending on the outer terminal location and level of service, the extension would carry about 950 to 1,300 inbound riders per day, at current travel levels. About half of these would be new transit users. The total would increase only slightly in future years. Incremental fare revenue from an I-495 extension would cover only about 12% of incremental operating cost. An extension only to South Sudbury with minimum acceptable service would have a revenue-to-cost ratio of about 27%. The capital cost per new transit user would be \$171,931 with an I-495 terminal, \$131,318 with a Hudson terminal, or \$111,393 with a South Sudbury terminal. All three alternatives would be among the most costly per new transit rider of any MBTA commuter rail extensions analyzed recently.

Line-haul rail travel times to Boston would, at best, be about the same as those for single-occupant auto trips from Sudbury, Wayland, or Hudson, but several minutes longer than auto times from I-495. Rail times would be significantly faster than current scheduled express bus times from the corridor, but few corridor residents now use the buses.

A Central Mass. extension to any of the terminals examined would produce a relatively small improvement in air quality. The capital cost per weekday kg of VOC elimination would range from of \$3.3 million for a South Sudbury extension to \$6.8 million for an I-495 extension. In this measure, it would rank among the least cost-effective of the commuter rail improvement projects examined in the MBTA's 1994 Program for Mass Transportation, when increases in locomotive emissions are included.

Table ES-4
 Summary of Performance Measures for
 Central Mass. Extension to I-495, Hudson, or South Sudbury

<u>Item</u>	<u>To I-495</u>	<u>To Hudson</u>	<u>To South Sudbury</u>
Weekday Inbound riders	1,295	1,245	950
New Transit Riders Included Above	580	550	420
Annual Operating Cost	\$11,995,000	\$9,830,000	\$3,315,000
Incremental Fare Revenue	\$1,445,000	\$1,375,000	\$910,000
Incremental Revenue/Operating Cost	0.121	0.140	0.274
Capital Cost	\$103,200,000	\$72,225,000	\$46,785,000
Capital Cost/New Transit Rider	\$177,931	\$131,318	\$111,393
Capital Cost/kg of weekday VOC reduction	\$6,973,000	\$4,630,000	\$3,342,000

Notes South Sudbury figures are based on reduced service, on weekdays only.