Financing Capital Expenditures in Massachusetts

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Spending on capital projects in Massachusetts has not contributed in any significant fashion to the state's budget crisis. Rather, this state, like others, has probably spent too little, and not too much, on public infrastructure. The reasons for underspending are clear. The states nationwide are caught between the increased requirements of localities and decreased funding from the federal government. The result everywhere is infrastructure in disrepair and a host of unmet capital needs.

The Massachusetts situation is particularly troublesome. The state spent most of the 1980s embroiled in conflict with the Administration over federal funding for the Central Artery Depression/Third Harbor Tunnel project. During the same period, the state's federal grants for other projects dropped sharply and the condition of much of the Commonwealth's infrastructure deteriorated markedly compared to the rest of the nation. This deterioration occurred during a period of rapid economic growth, which placed enormous demands on public capital, and of rising tax revenues, which could have been used for public capital investment. Now the condition of Massachusetts' public capital can be best described as average. Belatedly, federal funding for most of the Central Artery/Tunnel project has been appropriated and activity is underway. But these initiatives coincide with a serious downturn in the state's economy, which raises questions about the state's ability to come up with its share of the financing. More generally, if funding for infrastructure other than the Central Artery/Harbor Tunnel project did not materialize during the boom, where will the money come from during the 1990s? These are the issues addressed in this article.

The first section briefly sets out the role for the state in financing physical infrastructure and compares that role to the present division of responsibilities among the federal, state, and local governments. It also describes the major federal grant programs for capital investment.

The second section assesses Massachusetts' ability to meet its

infrastructure needs. It compares capital spending here with that in comparable states. It also examines the effectiveness of that spending by looking at the physical condition of roads and bridges in Massachusetts and other states. New data on state-by-state public and private capital provide an opportunity to compare the net effect of investment in Massachusetts with that undertaken elsewhere.

The third section examines the budgeting and decision-making process that produces the current level of capital expenditure, and explores both the capital budgeting process of the state government and the role of public authorities in capital spending.

The fourth section summarizes the state's capital spending plans for the 1990s. This includes a discussion of how the "mega" projects—the Central Artery Depression/Third Harbor Tunnel project and the Boston Harbor Cleanup—fit into the Commonwealth's infrastructure agenda. It also highlights the pressure that these projects and the unmet capital needs of the 1980s will put on the budgets of the 1990s.

The article concludes that Massachusetts' current complex and ambitious capital spending agenda requires centralized decision-making and a mechanism for ranking projects by their importance. The current fragmentation of initiatives and financing among the state and independent authorities is no longer workable.

I. The Role of the State in Financing Public Infrastructure

The basic rationale for government financing of capital expenditures is that some necessary and desirable investments would not be undertaken if left to the private sector. The problem arises because certain capital projects immediately provide benefits to everyone in a town or state or nation, as soon as they are available to one person. A typical example is a park. The benefits of a park cannot be divided up and meted out only to those willing to pay. The inability to exclude those unwilling to pay means that a profit-seeking builder would have no incentive to construct such a project.

Sometimes government provision is called for even if exclusion is possible. For example, it might be possible for a private entrepreneur to build a park with a fence around it and admit only those persons who paid an entrance fee. Such a setup would be extremely inefficient, however, since parks, as well as bridges or roads, produce services with enormous economies of scale. The initial fixed cost might be quite large, but the marginal cost of providing one more entry, crossing, or road trip is nearly zero. Therefore, excluding those unwilling to pay would simply deny some individuals the enjoyment of a service that costs next to nothing to produce.

The level of government that should undertake a particular capital investment depends on the nature of the project and the location of the people who will benefit. A small park, local road, hospital, or police station, which will be used primarily by residents of a town, should be financed by the individual locality. If the benefits of a capital investment spill over to several communities, then either the towns will have to band together or a higher level of government will have to participate in the financing in order to ensure that adequate money will be devoted to the project. A clear example is an urban beltway, which benefits residents of all the surrounding towns. If benefits spill over from one state to another, as with the interstate highway system, then a role exists for financial contributions from the federal government.

Broadly speaking, the share of total costs paid by the higher level of government should correspond to the share of total benefits enjoyed by those who live outside the participating jurisdictions. Thus, the construction of a local police station should be paid for by the residents of the local community served by the station. The urban beltway could be financed by a regional special district composed of the towns that encircle the central city; if other residents of the state benefit from the beltway, the state could provide some matching support to the district. Segments of the interstate highway system should be financed jointly by the states and the federal government, with the federal share reflecting the use of the highway by out-of-state drivers.

The level of government that should undertake a particular capital investment depends on the nature of the project and the location of the people who will benefit.

Efficient allocation also requires that, whenever possible, the construction of public capital be financed by bonds with approximately the same maturity as the expected life of the project, and that debt service of public capital investments be financed by fees or taxes that come as close as possible to user charges. Thus, if the police station has a 20-year life, it should be financed with bonds that match the real costs to the taxpayers with the stream of benefits. Explicit user charges would not be sensible for a police station, but the servicing of the bonds should be paid out of a local revenue source, such as the property tax, so that the burden falls on those individuals who benefit from the service. The construction of the beltway, again, would be financed by debt, and the interest and principal payments should be derived from a source that reflects use of the road—registration fees for automobiles in the surrounding towns might be one source. Servicing debt for the construction of the interstate highway could come primarily from gasoline taxes.

In the real world, who pays for public infrastructure, and where does the money come from? States and localities undertake almost all spending on nonmilitary public capital investment. In 1989, they spent $112 billion on highways, buildings, water supply and treatment facilities, utilities, and other initiatives (Table 1).[1] Of this total, the federal government supplied $24 billion, or 22 percent.[2]

Table 1
Public Capital Expenditures by All State and Local Governments, Fiscal Year 1989

Function	Capital Expenditures (Billions)	Percent Financed by Federal Grants
Total	$111.8	22
Transportation		
Highways	33.9	39
Mass Transit	4.3	62
Aviation	3.1	37
Water	1.0	0
Schools and Hospitals	23.6	0
Wastewater Treatment	8.9	27
Water Supply	6.5	1
Other Utilities	5.0	0
Other	25.5	19

Note: Total capital outlays were available for 1989 but outlays by function had not yet been tabulated by the Census Bureau. Capital outlays by function were estimated for 1989 by calculating the share of total expenditures by function in 1988, and applying this share to the 1989 total capital outlay.

Source: Congressional Budget Office Infrastructure Database; U.S. Bureau of the Census, 1989, *Government Finances in 1987–88*, Table 24; U.S. Bureau of the Census, 1990, *Government Finances: 1988–89 (Preliminary Report)*; U.S. Office of Management and Budget, 1990, *Budget of the United States Government, Fiscal Year 1991, Historical Tables*, Tables 9.5 and 12.3.

The Federal Role

The federal government's contribution toward financing nonmilitary capital expenditures is directed primarily at achieving transportation and, more recently, environmental objectives. The government's commitment to transportation stems from its responsibilities to promote interstate commerce and provide for national defense. Environmental responsibilities arise because the harmful effects of pollutants spread beyond the localities or states that house the polluters, and therefore would not be corrected without intervention from a higher level of government.

Most of the federal money is distributed by the Federal Highway Administration, which runs six major highway programs for construction and, to some extent, rehabilitation. While most of the money goes to the federal-aid highway system (through five separate programs aimed at different levels of roads), the Highway Bridge Replacement and Rehabilitation Program also provides some funds for the nonfederal highway system. For projects that qualify under any of these six grant programs, the federal government contributes between 75 and 90 percent of the total costs. (See Appendix A for the specific provisions of the major grant programs.)

These grants are paid from the Highway Trust Fund, created by Congress in 1956 to finance the ambitious plan to build the interstate and national defense highway system. It is funded by numerous excise taxes derived from transportation activity. Most of the money comes from a fuel tax of 9 cents (14 cents beginning December 1990) per gallon for gasoline, 3 cents (8.6 cents beginning December 1990) for gasohol, and 15 cents (20 cents beginning December 1990) for diesel fuel, but sales taxes on tires and trucks, as well as truck usage taxes, also support the trust fund. One cent of the gasoline tax is dedicated to the Urban Mass Transit System and maintained as a separate account within the Highway Trust Fund.

Funding for aviation capital expenditures is channeled through the Airport and Airways Trust Fund, established in 1970 and financed by excise taxes on passenger ticket sales, freight charges, and aircraft fuel. The matching percentages for airport capital construction range from 75 percent for the

largest airports to 90 percent for the rest, and vary by type of project.

The major grants for wastewater treatment began with the Clean Water Act of 1972, when the federal government first assumed responsibility for controlling water pollution. The Act required the Environmental Protection Agency (EPA) to establish minimum standards for municipal and industrial wastewater treatment and significantly increased federal funding. The grants are distributed to the states based on population and EPA standards of need; the states then allocate funds to local communities for building or improving publicly owned treatment facilities.[3] The program was never intended to be permanent and, as the result of amendments enacted in 1987, municipal construction grants will be phased out by 1991. Until 1994, a temporary federal program will provide seed money on a matching basis ($.20 state money for every $1 of federal funds) to establish state revolving funds, which will provide loans for future construction.

All the grant programs require periodic reauthorization, when Congress establishes a dollar cap on the amount of funds that can be appropriated for matching grants.[4] Thus, the current system has caps to limit use, but also very high matching rates that stimulate use. The matching rates are probably much higher than can be justified by any spillover effect. The Department of Transportation estimates that only 30 percent of the drivers on the average interstate highway are out of state (Gramlich 1990). The large subsidy provides an enormous windfall to states with high levels of capital spending on highways, while the cap means that at the margin the federal government provides no incentive for states to spend on federal roads. Economists have suggested that a more efficient solution would be to return funds to the states in the form of uncapped matching grants with a matching rate of 30 percent, rather than the current system of capped 90 percent grants (Gramlich 1990). The Administration is moving in this direction with its proposals for the 1992 reauthorization of the Surface Transportation Act, which significantly reduce the matching rates for highway and mass transit grants.

The goal of this review, however, is not to reform the federal system, but rather to highlight the decline in the federal government's contribution to public capital investment. This is shown clearly in Table 2, which reports expenditures (in 1989 dollars) under the major capital grant programs since 1970. The decline in the level of subsidy, which began in 1980, is projected to extend into the 1990s under the most recent federal budget proposals. Most of the decline to date reflects the phasing out of the wastewater treatment grant program, but the bulk of the projected drop rests on the sharp reduction in matching grants for highway construction under the Bush Administration's new transportation plan (U.S. Department of Transportation 1990). Mass transit grants are also projected to decline.

Moreover, judging the performance of any effort on the basis of absolute dollar amounts, even if adjusted for inflation, does not provide an accurate picture of trends in a growing economy. If the grants are measured as a percent of total state and local capital expenditures or of total federal budget outlays, the decrease in federal government support becomes even more striking. Between 1980 and 1989, federal capital grants declined from 36 percent to 22 percent of total state and local capital spending. Grants as a percent of total federal outlays fell from

Table 2
Federal Capital Grants to State and Local Governments by Function, Selected Fiscal Years
Billions of 1989 Dollars

Function	1970	1980	1989	1995 (est.)
Total	23.4	29.6	24.4	16.9
Transportation				
Highways	14.3	11.8	13.2	9.7
Mass Transit	0.5	2.7	2.7	1.4
Aviation	0.3	0.8	1.1	1.2
Wastewater Treatment	0.5	5.9	2.4	1.0[a]
Water Supply	0.3	0.3	0.1	0.1
Other	7.4	8.1	4.9	3.5
Addendum:				
Federal Grants as a Percent of State and Local Capital Expenditures	23.7	35.7	21.8	n.a.
Total Federal Outlays	3.6	3.4	2.1	1.4

n.a. = not available.

[a]Current legislation requires that the wastewater treatment grant program administered by the Environmental Protection Agency be phased out by 1991. Spending continues beyond this point, however, because these construction grants represent multiyear commitments, which are paid out over the construction period. Thus, grants to be paid out in 1995 represent spending that was authorized prior to the phaseout of the program.

Source: Congressional Budget Office Infrastructure Database; U.S. Office of Management and Budget, *Budget of the United States Government, Fiscal Year 1991* and *Fiscal Year 1989, Historical Tables*, Tables 9.5 and 12.3.

3.4 to 2.1. In short, the federal government has been quietly shifting responsibility for capital spending from the federal government to the states and localities for nearly a decade. With the Bush Administration's new transportation policy the shift now has become an explicit goal of the federal government.

The Local Role

Local governments have been the traditional providers of public infrastructure; they have built the schools, hospitals, police stations, sidewalks, and local streets. These governments historically have relied on the local property tax to support not only capital projects, but also the vast array of services supplied by cities and towns. The property tax provided an ample supply of money for local government initiatives and served as a nice proxy for both ability to pay and benefits received.

Local governments can no longer rely on obtaining adequate revenue from the property tax. Repeated property tax increases to support public services and economic development for a growing population have met with serious taxpayer resistance. This resistance has frequently culminated in state initiatives that place limits on local taxes. Even before 1970, local jurisdictions in 25 states faced limits on the tax rates they could impose on local property owners; eight more states had set limits by 1985 (ACIR 1987). California's Proposition 13 and Massachusetts' own Proposition 2½ are the best known.

Federal grants to localities have declined at the same time that state limits have been imposed on local property taxes.

At the same time that revenues have been limited, demands on the fiscal capacities of cities and towns have increased. The costs of education, law enforcement, and low-income housing have all continued to soar. Simultaneously the federal government, through the EPA, promulgated new environmental standards that significantly increased both capital and operating expenses for localities. Lack of funds led many cities to postpone both rehabilitation of old plants and new construction, only to find that the costs of these legally mandated improvements have skyrocketed. New York, Boston, and other large cities face huge infrastructure maintenance deficits and major costs to upgrade outdated wastewater treatment facilities to meet EPA standards.

Localities also suffered from the cutback in a number of federal government programs for which they were the major beneficiaries. These include revenue sharing, grants provided for low-income housing, and funds for the construction of wastewater treatment facilities.

In short, federal government grants to localities have declined at the same time that state limits have been imposed on local property taxes. Yet responsibilities of the cities and towns for schools, hospitals, and police, as well as new federally mandated environmental projects, have all increased. Given these pressures, the cities and towns have turned to the only possible source of support—the states.

II. Massachusetts' Capital Spending

How has Massachusetts performed in the changing environment? How much money has Massachusetts been spending on public infrastructure? And what is the state of repair of its capital investments?

Before looking at the data, consider the importance of public capital investment. Public investment has received much attention recently as stories abound of deteriorating public capital, especially roads and bridges. Two of the largest public capital investment projects in the state's history—the Central Artery Depression/Third Harbor Tunnel and the Boston Harbor Cleanup—have also sparked interest in the potential benefits that new construction activity might bring to a declining economy. Once built, public capital investment continues to be important to the economic vitality of the state, because it affects the locational decisions of households and firms and the productivity of businesses.

Although most observers acknowledge that public infrastructure has a positive impact on economic activity, only in the past few years have economists included measures of public capital explicitly in their models of productivity and growth. Work by Aschauer (1989) showed a strong relationship between output per unit of private capital and the stock of public capital. Munnell (1990a), examining the labor productivity slowdown in the 1970s, found a similarly strong relationship between the nation's stock of

public capital and the level of productivity growth.

These nationwide results were confirmed at the state level in a recent study that examined the impact of public capital on output, employment growth, and private investment on a state-by-state basis (Munnell 1990b). The results clearly showed that those states that have invested more in infrastructure tend to have greater output, more private investment, and higher employment growth.

Given the economic importance of public capital, how does Massachusetts measure up? The answer is that, no matter how spending or quality is measured, Massachusetts today appears more or less average. Table 3 shows the most recent data for Massachusetts capital expenditure by function; in terms of the relative shares in each category, Massachusetts looks very much like the nation as a whole (Table 1). The table also compares Massachusetts and the nation in terms of the percentage of each expenditure that is financed by the federal government. Again, the figures are very close; the only noticeable discrepancy is in the area of mass transit, where Massachusetts appears to receive a much lower rate of federal contribution than the rest of the nation.

Table 3
Public Capital Expenditures by Massachusetts' State and Local Governments and Federal Government Contributions, Fiscal Year 1989

Function	Capital Expenditures (Millions)	Percent Financed by Federal Grants	
		Massachusetts	U.S. Total
Total	$2,803.7	20	22
Transportation			
Highways	613.0	38	39
Mass Transit	426.7	25	62
Aviation[a]	a	a	37
Schools and Hospitals	357.7	0	0
Wastewater Treatment	339.5	27	27
Water Supply	116.7	1	1
Other Utilities	45.8	0	0
Other[a]	904.4	13[b]	19

Note: Total capital outlays were available for 1989 but outlays by function had not yet been tabulated by the Census Bureau. Capital outlays by function were estimated for 1989 by calculating the share of total expenditures by function in 1988, and applying this share to the 1989 capital outlay.

[a]The Census Bureau lists capital outlays on aviation for all state and local governments, but does not provide the same information for individual states. Hence, Massachusetts' expenditures for aviation are included in the "Other" category.

[b]The percent financed by federal grants could be somewhat higher because for a large component of the "Other" category it is not possible to identify the grants received by Massachusetts. The reason for this problem is that the source for grants by state is organized by agency and program, while the source for total grants for physical capital investment is organized by broad functional area. In most cases it is possible to match these two sources. Much of the "Other" category of total grants, however, includes no listing by program, which makes it impossible to estimate the grants in this category received by individual states.

Source: U.S. Bureau of the Census, 1989, *Government Finances in 1987–88*, Table 24; U.S. Bureau of the Census, 1990, *Government Finances: 1988–89 (Preliminary Report)*; U.S. Bureau of the Census, 1990, *Federal Expenditures by State for Fiscal Year 1989*, Table 2.

Table 4
Federal Grants, Fiscal Years 1980 and 1989
1989 Dollars

Item	1980	1989	Percent Change 1980–89
Federal Grants to			
Massachusetts (millions)	$787	$561	−29
U.S. Total (billions)	30	24	−18
Federal Grants as a Percent of Capital Outlays in			
Massachusetts	46	20	
U.S. Total	36	22	

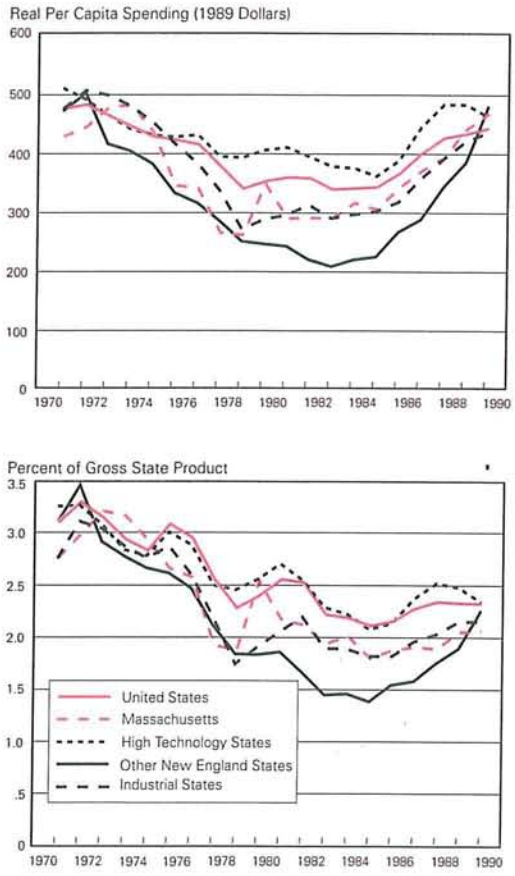
Source: Table 2 and Appendix Table B1.

On the other hand, Massachusetts appears to have been relatively hard hit by the cut in federal grants during the 1980s. Total federal money flowing to the Commonwealth in constant dollars declined from $787 million in 1980 to $561 million in 1989, or roughly 29 percent, compared to a decline of about 18 percent for the nation as a whole (Table 4). As a result, Massachusetts fell during the 1980s from enjoying a significantly greater federal contribution to capital expenditures than other states to being slightly below average. This decline largely reflects the holdup in highway money for the Central Artery Depression/Third Harbor Tunnel project. Now that funds for 80 percent of the project have been appropriated, Massachusetts is receiving enormous amounts of federal highway money. Data for fiscal 1991 show $737 million, or 14 percent of total federal highway funds, flowing to Massachusetts; this is the largest single amount going to any state and accounted for nearly half of the money allocated to the combined Middle Atlantic and New England regions.

Figure 1 compares Massachusetts state and local capital expenditures since 1970 with the average for the United States, other New England states, the

Figure 1

State and Local Capital Spending, Fiscal Years 1970 to 1989



Source: U.S. Bureau of the Census, *Government Finances*, various years; U.S. Bureau of Economic Analysis, Gross State Product, Machine Readable Data.

industrial states, and the high technology states, measured first on a per capita basis in 1989 dollars and then as a percent of Gross State Product (GSP).[5] The most striking feature is the overall pattern of spending: real per capita expenditures for infrastructure began to decline in the early 1970s, dropped sharply in the wake of the 1974–75 recession, and bottomed out—at a very low level—in the recession of 1981–82; since 1982 expenditures have been rising almost everywhere. (Individual state data appear in Appendix Table B2.) The pattern for spending as a percent of GSP is similar. (See Appendix Table B3 for state-by-state data.) Within this great swing, Massachusetts, which has consistently spent more than other New England states and less than the average for the nation or the high technology states, looks very much like the other industrial states.

The outcome of this spending on capital investment is that Massachusetts' stock of public capital, measured in constant dollars on a per capita basis, has converged toward that of the comparison states (Appendix Table B4).[6] Nevertheless, Massachusetts' per capita public capital remains slightly below that in all the comparison states except New England (Table 5). Interestingly, Massachusetts and New England as a region also have relatively low levels of private capital per person. The differences in both the public and the private capital stocks suggest that Massachusetts and New England more generally have tended to substitute highly skilled labor for physical capital.

Not only does Massachusetts have relatively low levels of capital per person, but also it no longer excels in maintenance of its infrastructure. The Federal Highway Administration regularly publishes information on the miles of pavement and number of bridges rated deficient. As shown in Table 6, almost 10 percent of highway miles in the United States are rated deficient. (See Appendix Table B5 for individual state data.) Looking solely at the 1989 data, Massachusetts appears comparable to the nation.

Comparing data from the early 1980s with data for 1989, however, reveals a disconcerting trend. While the percentage of highway mileage rated deficient has fallen for the United States as a whole and

Table 5

Public and Private Capital Stock Per Capita, 1989

States	Per Capita Stock of: Public Capital	Per Capita Stock of: Private Capital	Ratio of Public to Private Capital Stock
U.S. Total	$6,860	$18,804	.36
Massachusetts	6,598	16,510	.40
Other New England States	5,907	15,609	.38
Industrial States	7,216	17,010	.42
High Technology States	6,706	19,162	.35

Source: Authors' estimates. See Appendix Table B4.

noticeably for the industrial and high technology states, it has increased somewhat for other New England states and tripled for Massachusetts. Thus, the condition of Massachusetts' infrastructure now could be viewed as about average, but a continuation of the trends of the last decade will soon put Massachusetts (and New England) at the bottom of the heap.

The data for bridges reveal a similar pattern. For the nation as a whole, the problem is serious, with more than 40 percent of all bridges rated as deficient. Massachusetts in 1988 looks slightly better than the nation and the industrial states. But again, comparing 1980 with 1988 reveals a disturbing pattern; while the percentage rated deficient nationwide has remained relatively stable, the percentage of Massachusetts bridges rated deficient has more than doubled. The current data show that Massachusetts simply reflects the national problem of infrastructure disrepair, but the trends of the 1980s indicate that the Commonwealth's problems could soon become significantly more serious.

One area where Massachusetts' infrastructure improved was mass transit. During the 1980s, the Massachusetts Bay Transportation Authority (MBTA) undertook substantial capital investment. It expanded the Red Line northward from Harvard Square to Alewife, depressed and relocated the Orange Line, renovated South Station, and replaced rolling stock. Urban Mass Transportation Administration statistics show that from 1979 to 1988 the average age of the MBTA's fleet declined from 12 years to 11 years, mirroring the improvement nationwide. At the same time, the number of MBTA road calls per 10,000 vehicle revenue miles fell from 6.4 to 2.2, reflecting both the drop in age of the fleet and improved maintenance procedures.

Table 6
Infrastructure Quality, Selected Years

	Percentage Rated Deficient[a]			
	Highway Mileage		Bridges	
States	1982	1989	1980	1988
U.S. Total	13.7	9.5	40.5	41.3
Massachusetts	3.2	9.8	18.8	38.7
Other New England States	11.9	12.5	37.4	46.8
Industrial States	16.2	8.3	38.0	40.9
High Technology States	13.2	7.1	36.1	33.6

[a]The Federal Highway Administration (FHA) uses a numerical rating system from 0 to 5 to quantify pavement condition. Zero represents pavements that are extremely deteriorated, perhaps needing complete reconstruction, and 5 represents pavements in very good condition, usually only new or recently resurfaced pavements. Deficient pavement carries a rating of 2 or less, or 2.5 or less for the Interstate System, which requires a higher standard of performance. A similar system is used in rating bridges. The sufficiency rating of a bridge is a weighted composite of three major areas: structural adequacy and safety (55 percent), serviceability and functional obsolescence (30 percent), and essentiality for public use (15 percent). The lower the sufficiency rating of a bridge, the higher its priority for replacement or rehabilitation. A bridge is classified as deficient if its rating is 80 or below.

Source: See Appendix Table B5.

Putting all of the pieces together suggests two conclusions. First, from today's perspective, the picture is neither overly encouraging nor discouraging. Massachusetts suffers from the same problems plaguing all states—declining federal dollars and increased local demands. This has produced a situation where roads and bridges are in disrepair and mandated environmental work remains undone; on the other hand, Massachusetts' major mass transit system has been improving. At this point, the condition of Massachusetts infrastructure must be categorized as average. Whether this is the position the state would choose for itself, given the importance of public capital in promoting growth, is another question.

A less sanguine conclusion emerges from the trends of the 1980s. Massachusetts appears to have received relatively little in the way of federal grants and undertook relatively little infrastructure investment, outside of the activities of the MBTA, during the 1980s. The primary reason seems to be that state officials were preoccupied with planning for the Central Artery/Harbor Tunnel project, which ran into serious opposition in Washington. Regardless of the explanation, statistics on the condition of roads and bridges show rapid deterioration in the quality of Massachusetts' infrastructure during the last ten years. Although Massachusetts is now roughly at the national average, another decade of neglect could create serious problems.

III. Decision-Making in Massachusetts

How are physical capital investment decisions made in Massachusetts? Who decides on the tradeoffs between current and capital expenditures and between different types of investments? The most striking feature of capital spending in Massachusetts is that only a small portion of the spending plans goes through the state budget process (Table 7).[7] Instead,

Table 7
Public Capital Expenditures in Massachusetts by the State, Authorities, and Localities, 1989

Level of Government	Public Capital Expenditure (Millions)	Percent of Total
State	$ 698	25
Authorities	990	35
Massachusetts Bay Transportation Authority	346	12
Massachusetts Port Authority	53	2
Massachusetts Water Resources Authority	135	5
Massachusetts Turnpike Authority	37	1
Other	418	15
Localities	1,116	40
Total	$2,804	

Note: The figures for total state and local spending and for local spending come directly from the publication *Government Finances*. The figure for state spending is the Census Bureau figure for state spending minus Census Bureau tabulations of capital spending by off-budget entities. Local spending here represents spending by cities, counties and towns. Spending by level of government was not yet available for 1989, thus an estimate for spending of cities, counties and towns was made as follows: the share of 1988 local capital spending done by cities, counties, and towns was applied to the 1989 total of local government capital spending. The total for authorities is then the remainder. Within the authorities category, the numbers for the Massachusetts Bay Transportation Authority, the Massachusetts Water Resources Authority, the Massachusetts Port Authority and the Massachusetts Turnpike Authority are derived from the authorities' annual reports or from their Treasurer's office.

Source: U.S. Bureau of the Census, 1989, *Government Finances in 1987–88*; U.S. Bureau of the Census, 1990, *Government Finances: 1988–89 (Preliminary Report)*; U.S. Bureau of the Census, unpublished tabulations; Authority annual reports.

public authorities play the major role, creating a fragmented and uncoordinated maze of decision-making. Massachusetts is not unique in this regard; special districts and public authorities have proliferated in many states, particularly in response to recent state limitations on local property tax revenues and debt issuance.

The state government itself makes capital investments for construction and renovation of state buildings (including correctional facilities), environmental projects, housing, and transportation. (The Central Artery/Harbor Tunnel project is a state initiative.) On paper, the state appears to take a systematic approach to evaluating capital spending initiatives. The *Capital Budgeting Procedures Manual* contains detailed instructions to guide state agencies in preparing their long-range capital development plans. These plans are then transmitted to the Division of Capital Planning and Operations within the Office of Administration and Finance. They are reviewed, ranked by importance, approved by the Governor, and then sent, in the form of a separate capital budget, to the legislature. The legislature can reassess the relative merits of the various investment initiatives and compare the merits of spending on capital projects as opposed to current services.

While the approach seems reasonable, it has two problems. The first is the usual phenomenon that as soon as budget pressures emerge, capital plans get squeezed out in favor of spending on current services. As Governor Dukakis indicated in his 1991 Capital Budget recommendations, capital spending restrictions were instituted in November 1988 in order to "ensure that the Commonwealth's capital program remains affordable from year to year and that debt service costs do not crowd out other important operating budget priorities" (Commonwealth of Massachusetts 1990b, p. I-2). The spending controls limited capital spending in fiscal 1989 and 1990 and will continue to do so in the future. As a result of the controls on spending, the Commonwealth carried forward into fiscal 1991 unissued bond authorizations totaling more than $6 billion, and the Governor requested no increase in appropriations for capital projects in 1991.

The second problem is that most of the non-local capital spending decisions are not made at the state level but rather reflect a series of independent initiatives by public authorities. The concept of a public authority was imported from England and first used in the United States for constructing ports in New York and New Jersey. Robert Moses of New York embraced the concept in the late 1930s to build an innovative network of roadways, tunnels, and bridges that was the marvel of contemporary transportation. Moses characterized authorities as "non-political organizations in which the speed, flexibility and absence of red tape, traditionally associated with private industry, could be used for public purposes" (Caro 1974, p. 633). The question is whether this romantic assessment applies to Massachusetts' independent authorities today. Do they enhance or hinder the state's effort to have a rational program of infrastructure construction?

Since much of the state and local capital spending in Massachusetts is done by four major authorities (20 percent of the total), it is useful to take a quick look at why they were established, how they operate, and the nature of their relationship to the state. (For further information on the authorities, see the first box.)

Massachusetts' Public Authorities

The Commonwealth currently has over 500 individual authorities. Although the exact structure of the authority varies with the project's financing needs, the roles to be played by existing subdivisions, and numerous other administrative considerations, a general description is possible. An authority is a public entity established by the state legislature to perform specific tasks that have a public purpose. A board of directors, appointed by the Governor, is responsible for the entity's activities, and the board appoints a director to administer the authority. Employees of an authority are not subject to civil service or other state personnel laws. Authorities are provided with the means to fund their activities, and therefore can operate independently of the state budget process. They can generally issue debt to finance capital expenditures and that debt is free of state and

Box Table 1
Major Public Authorities in Massachusetts, 1989

Name	Year Established	Number of Employees	Operating Budget (million $)	Capital Budget (million $)
Operating Entities				
Mass. Bay Transportation Authority	1964	6,710	629.6	346.1
Mass. Municipal Wholesale Electric Co.	1975	140	205.0	
Mass. Water Resources Authority	1985	1,712	182.9	135.1
Mass. Port Authority	1956	968	119.0	53.1
Mass. Turnpike Authority	1952	1,398	117.0	37.3
Steamship Authority	1960	487	25.2	
Mass. Convention Center Authority	1982	101	14.6	12.4
Mass. Technology Park Development Corporation	1982	45	2.7	[a]
Bay State Skills Corporation	1981	18	2.3	[a]
Mass. Corporation for Educational Telecommunications	1982	7	1.2	
Government Land Bank	1975	15	1.0	[a]
Mass. Technology Development Corporation	1978	10	.8	[a]
Community Economic Development Assistance Corporation	1978	7	.6	n.a.
Community Development Finance Corporation	1975	8	n.a.	[a]
Worcester Business Development Corporation	n.a.	n.a.	n.a.	n.a.
Financing Entities				
Mass. Housing Finance Agency	1966	236	15.2	—
Mass. Educational Loan Authority	1981	13	12.1	—
Boston Metropolitan District	1929	1	11.3	—
U. Mass. Building Authority	1963	0	15.7	—
U. of Lowell Building Authority	1961	25	2.7	—
State College Building Authority	1963	4	.7	—
Southeastern Mass. U. Building Authority	1964	0	.1	—
Mass. Industrial Finance Agency	1978	23	3.2	—
Mass. Health & Educational Facilities Authority	1968	19	1.8	—
Total 24 Authorities		11,947	1,366	613.4
State		93,550	12,641	698.1

n.a. = not available.

[a]According to the *Annual Financial Report*, these five authorities together in 1989 spent $29.4 million for acquisition of fixed assets.

Source: "Massachusetts Public Authorities," 1990, Background Report to Crozier Commission; U.S. Bureau of the Census, unpublished tabulations; Commonwealth of Massachusetts, Office of the Comptroller, 1990, *Comprehensive Annual Financial Report for Fiscal Year 1989;* Authority Annual Reports.

federal tax.

Authorities can be classified as either financing or operational entities. Most financing entities issue tax-exempt bonds to reduce the cost of financing certain public purpose activities, such as affordable housing (Massachusetts Housing Finance Agency) or tuition loans (Massachusetts Educational Loan Authority). Operational authorities provide many basic public services to the residents of the Commonwealth and are the ones responsible for the capital investment.

Twenty-four authorities account for the bulk (roughly 90 percent) of authority employment and spending. In 1989, this group employed 12,000, compared to total state employment of 94,000, and had operating budgets totalling $1.4 billion, compared to the state figure of $12.6 billion (Box Table 1). Spending for capital projects is even more concentrated and larger relative to the state. Four authorities, the MBTA, MWRA, Massport, and the Turnpike Authority, spent almost as much on capital projects in 1989 as the entire state government.

This pattern was true for the entire 1980s (Box Table 2). The big spender was the MBTA, which undertook major capital improvements. Two of the largest projects involved expanding the Red Line north from Harvard Square to Alewife and relocating and depressing the southern portion of the Orange Line. The MBTA also bought new rolling stock and upgraded other tracks and platforms.

Lesser amounts were spent by the other three authorities. The Turnpike Authority repaired bridge decks, resurfaced roadways, and improved the tunnels. Since its creation in 1985, the MWRA has been replacing water pipes and improving its capacity to handle sewer overflows. Massport completed projects at Logan Airport, including a new international terminal and soundproofing schools and homes in the area, upgraded facilities at the port, and developed other waterfront property, such as the World Trade Center. It also made improvements to the Tobin Bridge, including a pipe to provide water pressure for fire fighting, a traffic monitoring system, and road and deck repairs.

While most authorities are financially independent, several receive state support in the form of operating or debt service assistance. In 1989, the state provided $353 million to the authorities, 80 percent of which went to the MBTA. The MBTA has a unique and complex relationship to the state and over the years has become an increasing drain on state resources. As indicated in the text, the legislation enabling the MBTA to issue debt also provides for state assistance toward debt service and operating costs. The state has contracted to pay 90 percent of the debt service on up to $2 billion of bonds and is responsible for the annual MBTA deficit (operating deficit plus debt service costs).

The timing of the reimbursement process for the MBTA further complicates the relationship. The MBTA operates on a calendar year basis and will cover its 1990 operating costs by issuing short-term notes (guaranteed by the Commonwealth). In December 1990, the MBTA will submit a bill to the Commonwealth, which will be in the middle of its 1991 fiscal year. The Commonwealth will bill the cities and towns for their share and put its share in the state's 1992 budget. The state receives payments from the cities and towns and reimburses

Box Table 2
Capital Spending of the State Government and Authorities, Fiscal Years 1980 to 1989
Millions of 1989 Dollars

		Authorities			
Year	State	MWRA	Massport	MBTA	MTA
1980	404	0	41	397	13
1981	503	0	64	422	11
1982	492	0	49	399	16
1983	579	0	49	402	15
1984	452	0	33	398	19
1985	513	0	61	390	32
1986	506	25	80	315	32
1987	682	47	63	299	32
1988	672	124	48	354	37
1989	698	135	53	346	37
Total	5500	332	541	3722	245

Note: The state total shown here is different from that shown in Table 8 because of differences in the methodology used to count capital spending by the state and the Census Bureau. The figures here represent Census tabulations of state spending that exclude off-budget entities. See footnote 7 for a reconciliation of Census Bureau capital spending figures with those of the state government. Numbers may not add to totals because of rounding.

Source: U.S. Bureau of the Census, special tabulations; authority annual reports; background data to Crozier Commission.

Massachusetts' Public Authorities, continued

the MBTA at the end of the Commonwealth's fiscal year 1992. Thus, a dollar spent by the MBTA in January 1990 is financed at short-term rates until the authority is paid off in June 1992.[8]

State costs for the MBTA have increased rapidly as income from fares has grown more slowly than expenses and the localities' share has declined in the wake of Proposition 2½. State assistance represented 59 percent of total 1989 MBTA expenses, compared to 41 percent in 1980. Despite this large contribution, the state has little authority over MBTA operating or capital expenditures.

In addition to operating or debt service assistance, several authorities also have a state debt guarantee. The debt of local housing authorities and higher education building authorities is backed by the Commonwealth's full faith and credit. Bonds of the MBTA, regional transit authorities, the Convention Center Authority, and the Steamship Authority represent contingent liabilities of the state, which means that the state must provide the authorities with sufficient funds to meet interest and principal payments if the funds are otherwise not available. Even if the state had no explicit commitment to authorities' bondholders, the need to protect its bond rating would probably force the Commonwealth to assist any authority in financial difficulty.

On paper it may appear that the state has some knowledge and control over authority activities. The Secretary of Environmental Affairs is the Chairman of the MWRA's Board, the Secretary of Transportation is the Chairman of the MBTA'S board, and the Governor appoints board members of the other authorities. However, no formal centralized process exists for assessing the relative merits of their plans or even for collecting employment and financial data. The MBTA and the MWRA have Advisory Boards, which must approve their budgets, but the Boards have no way to make trade-offs among authorities or between authorities and state agencies. Furthermore, whatever limited information emerges is usually distributed only to the executive branch; the legislature and the public are rarely informed.

The Senate Ways and Means Committee (1985) noted that 1979 legislation that required all authorities with bonding power (except Massport and the Turnpike Authority) to file quarterly reports, detailing their outstanding and unissued bonds, projected debt service over the next two years, and bonds to be sold over the ensuing year, has been virtually ignored. In short, authorities represent a significant financial responsibility of the state, but the state has almost no control over their activities.

The Massachusetts Turnpike Authority was established in 1952 and charged with the construction, operation, and maintenance of the Massachusetts Turnpike, a 135-mile toll highway running from the western border of Massachusetts to the City of Boston. Why an authority? The need for such a road was indisputable; the difficulty was that the state had already committed unprecedented sums to highway bond issues. Thus, the Massachusetts Turnpike Authority was born out of the demand for a critical public works project in a time of diminished revenues. The idea of a public authority was not untested. Moses had used them in New York, and Maine and New Jersey had just created authorities to manage the construction of their high-speed toll roads. Authorities were very popular throughout the country in the early 1950s.

In 1958, the legislature authorized the Turnpike Authority to construct the Callahan Tunnel and to operate and maintain both the Sumner and Callahan Tunnels, one-mile harbor crossings connecting Boston with East Boston and Logan Airport. All funds for the maintenance, capital improvement, operation and policing of these facilities, as well as payment of principal and interest on bonds issued, are derived solely from tolls and other revenues generated by users. In other words, the Authority is entirely self-supporting and receives no money or guarantees from the state. It is directed by a board of three members appointed by the Governor, one of whom is designated as Chairman.

The Massachusetts Turnpike Authority was scheduled to dissolve in 1992 upon repayment of the original bonds. Instead, the Turnpike has a $603 million capital plan to rebuild the road and a $58 million program of repair and reconstruction for the tunnels. The Authority estimates that these projects will require doubling its current annual capital expen-

diture. In anticipation, the Turnpike Authority has already raised tolls on both the turnpike and the tunnels, and has shown no evidence of planning ever to dissolve itself.

In 1956, the legislature created the Massachusetts Port Authority (Massport) as an independent authority charged with the operation, maintenance, and improvement of the Tobin Bridge, the seaport, and most important, Logan Airport. The motivation for establishing a separate entity was the belief that the vital links in the Commonwealth's transportation system were so critical to the well-being of Massachusetts that they needed to be overseen by a single entity, which would not only manage their day-to-day operations but also plan for the long term. The hope was that such a structure would protect these projects from changes in the economic and political climate. The Massport Board consists of seven members appointed by the Governor for staggered terms of seven years each. It is financed by user charges and debt, and has an extensive program of maintenance, improvements, and new construction.

Four major authorities now undertake almost as much capital spending each year as the entire state government.

The Massachusetts Bay Transportation Authority (MBTA), which was established in 1964, was charged with developing, financing, and operating mass transportation for the 78 cities and towns within its jurisdiction.[9] The MBTA has a complex financial relationship with the state. Technically, the MBTA has its own bonding authority and the bonds are not backed by the full faith and credit of the Commonwealth. On the other hand, the state by statute has contracted to pay 90 percent of the debt service on up to $2 billion of bonds. (The MBTA currently has $1.1 billion outstanding.) In addition, the Commonwealth is responsible for the annual MBTA deficit (operating deficit plus debt service costs). The state can assess the cities and towns for a portion of the cost, but, in the wake of Proposition 2½, it provides most of the subsidy.

In 1985, the state legislature created the Massachusetts Water Resources Authority (MWRA) in response to a 1984 warning from Judge Paul Garrity and a pending lawsuit. Garrity had threatened to halt all new sewer hook-ups in the City of Boston, because he believed that not enough was being done by the Commonwealth to clean up Boston Harbor—among the nation's filthiest waterways—and new sewer hook-ups would lead to even worse pollution.

Responsibility for water and sewer systems at that time rested with the Metropolitan District Commission (MDC), whose budget came under the control of the state legislature. Because the MDC was perpetually underfunded, the water and sewer system serving almost half of the state's population had fallen into terrible disrepair. Aqueducts leaked millions of gallons of clean water; rain caused raw sewage to overflow from old sewer pipes into local rivers and into Boston Harbor; and the sewage that did reach the main treatment plant on Deer Island received minimal treatment and was dumped into the Harbor.

The Massachusetts Water Resources Authority took over from the MDC all responsibility for improving the water quality of Boston Harbor and modernizing the vast water and sewer system. The Authority is governed by an eleven-member board, whose chairman is the Secretary of the Office of Environmental Affairs. It is financed by user charges and debt, and receives no support from the state in the form of revenues or guarantees. Some observers suggest, however, that residents may find the scheduled doubling (in real terms) of water bills over the next ten years to pay for the cleanup of Boston Harbor unacceptable, and may force the MWRA to come to the legislature for financing in the future (Commonwealth of Massachusetts, Senate Committee on Ways and Means 1989).

These four authorities, the Turnpike Authority, the MBTA, Massport, and the MWRA, now undertake almost as much capital spending each year as the entire state government (Table 7). The desirability of such an arrangement is not a simple issue. On the one hand, the authorities were created for good reasons. Their structure permits the development of a focused and politically insulated organization that is not subject to the vagaries of the annual budget process or the rigidities of civil service or contract bidding laws. It is an attractive option when projects require the bridging of existing government jurisdictions, or when the state wants to ensure that individuals living in, say, a huge urban area of a largely rural state pay for significant public capital investments for which they are the primary beneficiaries. Financial

advantages arise from the taxpayers' willingness to pay user charges for specific services and from underwriters' preferences for a dedicated stream of revenues outside of the Commonwealth's general funds.

Moreover, the authorities appear to have had considerable success in accomplishing their assigned tasks. The underfunding of the old MDC emphasizes the problems with raising the money for necessary capital expenditures through the state budget process. The limits established in 1988 on state government capital expenditures further demonstrate the vulnerability of capital projects in periods of serious budget constraints.

On the other hand, the authorities fragment decision-making enormously, since each entity comes up with its own plans for capital projects and funds them out of its own financial sources. No process exists for evaluating the merits of providing an additional toll collection lane on the Mass Pike as compared to a new trolley car for the MBTA, or for comparing the desirability of capital spending by the authorities in general with the state's need for new prisons and other facilities.

In addition to the lack of coordination, the authorities are in the privileged position of controlling a monopoly with no regulation of their activities. The steady flow of income from fees and charges creates little incentive to search for least-cost approaches to solving projects or to forgo activities with relatively small returns. Newspaper reports and opinion polls indicate that residents of the state believe that, in some cases, the authorities have abused their positions.

Two of the authorities, the Massachusetts Turnpike Authority and Massport, both appear flush with revenues; most of the infrastructure under the control of these authorities also appears in excellent condition.[10] One could question, from the overall perspective of the state, whether an additional capital expenditure for, say, the turnpike represents the best use of public money. If it does not, the issue becomes how to reallocate the funds.

Dissolving authorities once they have completed their missions is certainly one option; tolls or other charges could then accrue directly to the state. These monies could be placed in a special fund allocated to public capital investment.

An alternative is to retain the organizational structure and expand the authorities' responsibilities; this would relieve some of the budget pressure on the state. Specific suggestions made by the Massachusetts Senate Ways and Means Committee include: Massport assuming the financing of certain tourism and economic development programs currently funded in the Executive Office of Economic Affairs; and the Massachusetts Turnpike Authority assuming the cost of snow and ice removal operations for the entire state highway system, currently paid by the Department of Public Works.[11]

Another variant is to transfer major capital projects, rather than operating activities, to the exist-

Table 8
Capital Spending by the State and Four Major Authorities, 1980 to 1989 and 1990 to 1999
Billions of 1989 Dollars

	1980 to 1989			1990 to 1999		
Entity	Total	Federal	State/ Local	Total	Federal	State/ Local
State	7.3	2.3	5.0	17.1	7.2	9.9
Authorities						
Massachusetts Bay Transportation Authority	3.7	2.0	1.7	3.6	1.6	2.1
Massachusetts Port Authority	.5	.1	.5	2.2	.1	2.1
Massachusetts Water Resources Authority	.3	.1	.2	4.5	.2	4.3
Massachusetts Turnpike Authority	.2	0	.2	.6	0	.6
Total	12.2	4.5	7.7	28.1	9.1	19.0

Note: Columns may not sum to totals due to rounding.
Source: See Appendix Table B6.

ing authorities. Such a shift would provide a source of funding and steady administration in a rapidly changing political and economic environment. One obvious option is to make the Turnpike Authority responsible for the Central Artery/Harbor Tunnel project, or merge Massport and the Mass Turnpike Authority and place the new entity in charge of the scheduled effort.

The proposed increases in responsibility, however, do not resolve the fragmented nature of decision-making for capital expenditures. On efficiency grounds, it would be better to integrate all capital spending plans in order to establish the relative importance of the individual projects. This would require standardization of reporting, which does not currently exist. It would also require some way of trading off the proposals of the self-supporting authorities with those that must be financed through the general fund. This may be difficult, but it seems desirable given that the four major authorities plan to spend almost $11 billion on capital projects over the next 10 years (Table 8). The difficulty, of course, is that many more parties become involved in the decision-making, which may complicate and delay the process. Skeptics of centralizing characterize the choice as one between disaggregation and professionalism on the one hand, and comprehensiveness and political wheeling and dealing on the other.

IV. Massachusetts' Capital Spending Plans for the 1990s

Massachusetts' capital spending plans for the 1990s consist of three pieces: activities of the state government, the mega projects, and initiatives of the authorities. In each case, the money slated to be spent in the coming decade dwarfs expenditures during the 1980s.

The State's Plans

According to the Census Bureau, the Commonwealth of Massachusetts (excluding the authorities) did not spend a great deal on capital projects for most of the 1980s. In constant dollars, annual outlays hovered between $400 million and $500 million and generally declined as a share of total state spending. It appears that, around 1986, government officials began to recognize that important infrastructure projects had been deferred. In part, this may have been a response to the work of the National Council on Public Works Improvement, which highlighted the nationwide problem of infrastructure deterioration.

In Massachusetts, a Special Commission on Infrastructure Finance was established in 1986 to address the status of the state's public capital. In a 1989 report entitled *A Survey of Massachusetts Infrastructure Needs in the 1990s*, the Commission identified a host of capital spending projects. More recently, the Governor's Management Task Force completed an updated survey and found $31 billion of needed capital investment, excluding the Central Artery/Harbor Tunnel project and initiatives by the authorities. Of the total, $7 billion would be provided by the federal government, leaving $24 billion to be paid from the state coffers. The bulk of this money would go to badly needed road and bridge repairs, wastewater treatment, solid and hazardous waste disposal, state hospitals, prisons, and public housing. One possible scenario for the 1990s, then, is the state spending $2.4 billion annually to eliminate its infrastructure deficit.

Such a level of annual expenditure seems unrealistic. First, $2.4 billion is more than double the state's current outlay for capital expenditure; an increase of that magnitude is unlikely given the continuing budget problems. Second, the state has instituted a cap of $925 million on its own-source spending for capital projects, which it appears committed to meeting for the foreseeable future. The cap is in nominal dollars, but the assumption for this study is that the legislature will index the amount.

Assuming that the $925 million cap holds for the entire decade implies total state expenditures during the 1990s of $9.25 billion. On the one hand, this number looks large; total state spending during the 1980s amounted to about $5 billion. Thus, even if the limit is adhered to, capital spending in the 1990s will place increased demands on state revenues. On the other hand, $9.25 billion meets less than 40 percent of the $24 billion of infrastructure needs documented by the Governor's Management Task Force. Given the disparity between estimated needs and realistic spending levels, state officials and legislators will have to consider carefully the merits of alternative projects identified by the Commission and establish clear priorities.

The Mega Projects

The second piece of Massachusetts' capital spending plans is the mega projects. The Central Artery Depression/Third Harbor Tunnel project and the Boston Harbor Cleanup are the two largest capital

Table 9
Capital Spending on the Central Artery/Third Harbor Tunnel and Boston Harbor Cleanup Projects, Fiscal Years 1990 to 2000
Millions of 1989 Dollars

	Central Artery			Harbor Cleanup		
Year	Total	Federal	State	Total	Federal	Local
Total	4972	4325	648	2659	118	2541
1990 or before	32	28	3	181	18	162
1991	303	273	30	147	15	133
1992	455	409	45	366	19	347
1993	557	481	76	431	15	416
1994	712	615	97	479	9	469
1995	879	759	119	384	9	375
1996	841	727	114	205	10	195
1997	662	572	90	119	6	113
1998	430	371	58	153	7	146
1999	104	90	14	140	7	133
2000	—	—	—	55	3	53

Addendum: Massachusetts Capital Spending for Highways and Wastewater Treatment, Fiscal Year 1989

	Highways			Wastewater Treatment		
	Total	Federal	State & Local	Total	Federal	State & Local
1989	613	234	379	340	92	248

Note: Columns may not sum to totals due to rounding.
Source: Yearly construction expenditures and grants obtained from Central Artery/Harbor Tunnel Public Information Office and MWRA Budget Office; Addendum information from Table 3 and Appendix Table B1.

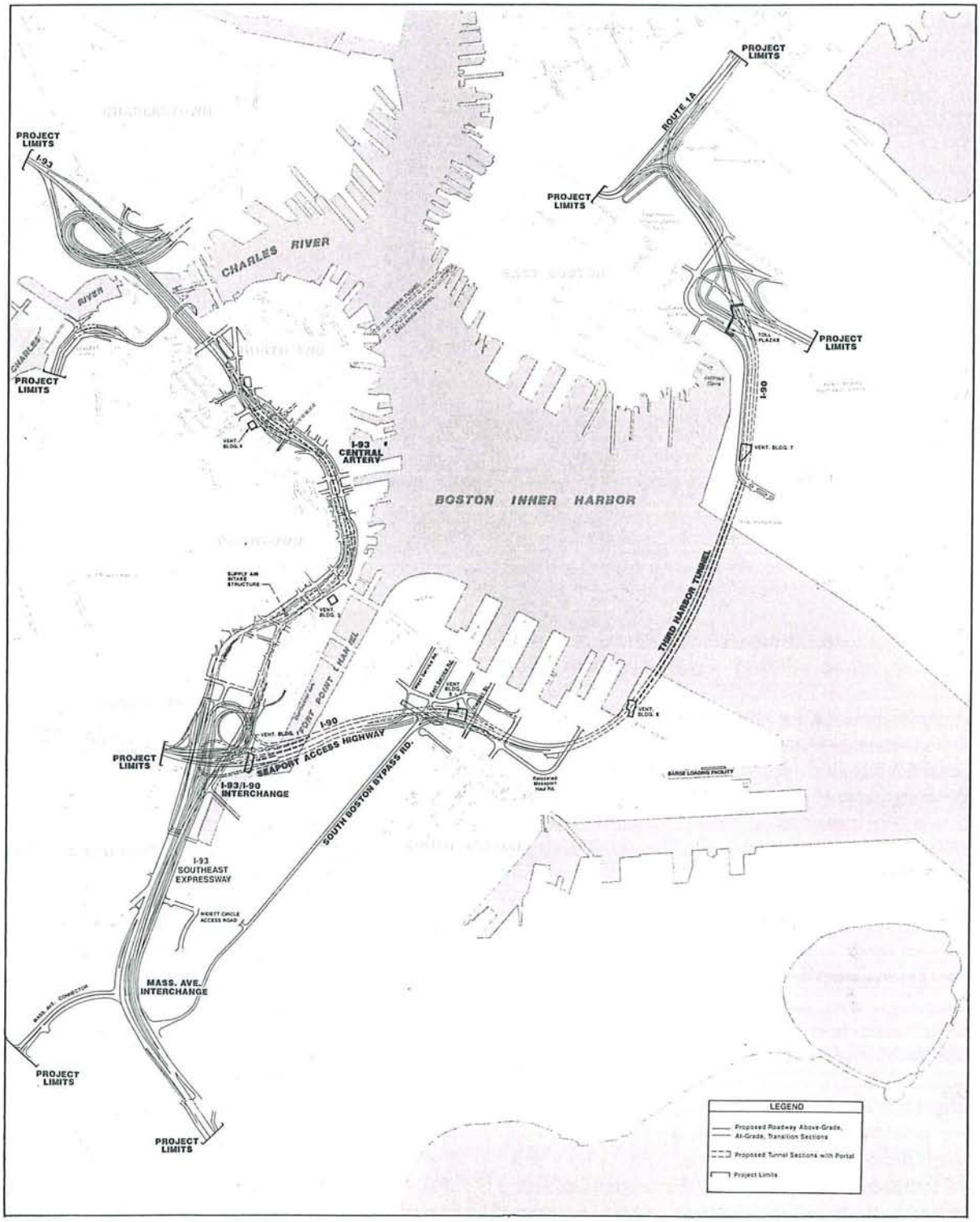
spending initiatives in the state's history. The costs of the two projects are estimated (in 1989 dollars) at $5.0 billion and $2.7 billion, respectively (Table 9).[12] The Central Artery/Tunnel is a 7.5 mile interstate highway project covering portions of both I93 (north-south) and I90 (east-west), which is currently scheduled for completion in 1999 after a 10-year construction period (Figure 2). The primary justification for this project is that, when built in the 1950s, the artery was never designed to meet interstate standards: it has too many entrances and exits too closely spaced, too much forced crossing of traffic, no breakdown lanes, and no entrance and exit lanes. Furthermore, the road was designed to carry 75,000 vehicles daily, and the volume has grown to about 190,000 vehicles daily. Even if it were not rebuilt entirely, the existing structure needs substantial repair. The repair would entail significant traffic disruption and would not produce the capacity, safety, and environmental improvements included in the new design.

The project was made eligible for federal Highway Trust Fund money in the 1987 Surface Transportation Act. Currently 80 percent of the $5.0 billion (1989 dollars) project has been approved for interstate completion funds; the funding is structured to cover inflation's effects on project costs and will be available until the project is completed. Under the current interstate program, the federal government contributes 90 percent of the funds required for new construction on the interstate network, and the most likely scenario is that the entire portion of the approved 80 percent will be eligible for a 90-percent federal match.

A very slight possibility exists that the match on the approved portion might turn out to be somewhat lower. The interstate highway system is now largely complete and the Bush Administration wants to revamp the highway grant program when Congress reauthorizes the Surface Transportation Act in 1992. Two key components of the restructuring would be a shift from narrow categorical programs to broad multi-purpose grants and an increase in the share of total costs paid by the states. The Administration proposes that the federal matching share for new

Figure 2

Map of the Central Artery/Third Harbor Tunnel Project



Source: Central Artery/Third Harbor Tunnel Public Information Packet.

grants be reduced to 75 percent. If for some reason the Central Artery/Tunnel project were not grandfathered, money received after 1992 could be subject to a lower federal match. Such an outcome is unlikely, but not impossible.

The other 20 percent of the project, the portion of the Artery between High Street and North Station, is currently eligible for 90 percent federal funding through the "4R" program (for resurfacing, restoring, rehabilitating, and reconstructing interstate state roads) or other federal programs, but funding for this portion of the program has yet to be authorized. Congress is expected to decide on funding for the High Street–North Station segment as part of the reauthorization of the Surface Transportation Act in 1992. Proponents of the project say that no approved interstate highway project in the history of the system has ever been left incomplete due to lack of funds, and see large amounts of money available for refurbishing now that construction of the interstate highway system is virtually finished.

On the other hand, if the Bush Administration proposals are adopted, it is quite possible that no special money would be available for a project such as depression of the High Street–North Station portion of the Artery. Instead, the state would receive a multi-purpose highway grant for the Commonwealth's major roads and would have to decide whether to spend the money on the Artery or other desirable highway programs. Moreover, the new grant money would be unlikely to cover 90 percent of the costs; as noted earlier, the percentage will probably be 75 percent.

One additional element further complicates the picture. Even if the entire project becomes eligible for federal funding, the annual costs must first be financed by the state and then reimbursed by the federal government. Thus, the feasibility of raising the initial money becomes an issue, given the state's current fiscal situation. Uncertainty about the state's ability to carry out its share of the financing could make the federal government wary about committing or recommitting resources to the project, particularly given the hostility in Washington to this project.

The state has taken a step to demonstrate its commitment to the Central Artery/Tunnel project. The legislature raised the gas tax by 6 cents per gallon effective July 1990, and by another 4 cents per gallon beginning January 1991, nearly doubling the previous 11 cents per gallon tax. The bulk of this revenue increase will be deposited in an infrastructure fund, an account within the state's highway fund. The infrastructure fund will be used to pay debt service on special obligation revenue bonds for infrastructure projects, including the Central Artery.

The same legislation also says that "not more than ten percent" (Section 93 of Chapter 121 of the Acts of 1990) of *all* gas tax receipts can be devoted to the Central Artery Project. If the state spends less than 10 percent in any year, it can carry over the unexpended balance to any future year provided that the sum of expenditures from the carryover and the current year do not exceed 20 percent of gas taxes collected in that fiscal year. No limitations apply to spending on the Central Artery project out of other Highway Fund receipts.

Despite this sign of commitment, the extent of federal participation has yet to be finalized. This means that the state's liability remains undefined. Under the most likely scenario, the entire approved 80 percent of the project would be eligible for the 90-percent match and the state would allocate some of the general highway money received after 1992 for depression of the Artery with a matching rate of 75 percent. This would require a contribution from the state of roughly $650 million. (A Lazard Frères and Co. report (1990) also anticipates federal funding of roughly the same magnitude, $697 million.)[13] This figure is shown in Table 9. In the worst case, federal funds for the approved 80 percent received after 1992 would be subject to the new lower matching rate and the 20 percent of the project not yet approved would receive no federal funds. In this case, the state's costs would be about $2 billion.

Given these two scenarios of federal funding, it is possible to generate rough estimates of the annual debt service requirements of the Central Artery/Tunnel project. Comparing these estimates to the constraints in the 1990 legislation can shed some light on the feasibility of the state's funding plans. Assuming an 8 percent coupon rate, the state could support annual debt service in the most likely case of federal funding. In the worst case, however, the state could not support debt service solely from gas tax receipts, even including the carryover provisions. The state would have to draw on other highway fund receipts in the latter years of the project to cover annual debt service costs. While this is not impossible, it would be difficult given the competing demands on highway fund resources from other highway projects and operating expenses.

While the Central Artery/Tunnel project is a state initiative financed by federal funds, the Harbor Cleanup is a federally mandated project that must

rely primarily on local revenues. In July 1985, Federal Judge A. David Mazzone found that Massachusetts had violated federal water pollution control laws.[14] In May 1986, he issued an order and a schedule for the cleanup of Boston Harbor. By December 1991, sludge disposal into Boston Harbor must stop, and by 1994 one-half of the construction of a new primary treatment plant must be completed, with the entire plant operational by 1995. Construction on a secondary treatment plant must start in 1992, with one-quarter of the plant completed by 1996, and the entire plant operational by 1999. These two plants, when completed, will be the second largest system in the country, able to treat a peak flow of 1.2 billion gallons of sewage daily.

The Harbor Cleanup project is expected to cost approximately $2.7 billion in real (1989) dollars over the construction period, which began in 1988 with completion now scheduled for 2000. Limited federal help is available, but the project will be financed primarily through bonds, which will be paid off by increasing user charges. The Massachusetts Water Resources Authority (MWRA) estimates that the average homeowner in the service area will see a rise in the water and sewer bill from the current level of $350 annually to more than $600 (in 1989 dollars) by the year 2000.

Despite the costs, most reports indicate that residents of Massachusetts support the mega projects, particularly now that other construction activity has plummeted and the rest of the economy has weakened. In addition to remedying serious infrastructure needs and improving the environment, the projects will boost local employment and income. At their peak these two projects could generate on the order of 25,000 jobs.[15] In the average year, however, the employment gains are substantially lower at approximately 13,000 jobs (8,900 from the Artery and 4,100 from the Harbor Cleanup), which represents less than 1 percent of total employment in the Greater Boston area in 1988. Given the current economic climate these jobs will certainly be beneficial, but should not be expected to reverse the current slowdown.

On the other hand, if both the Central Artery/Tunnel project and Harbor Cleanup proceed as scheduled, the capital spending picture and the contribution of the federal government to these efforts will look very different in the 1990s than the 1980s. Spending for the Central Artery/Tunnel project will amount to $879 million in 1995, nearly twice the 1989 level of spending for highways; the annual federal contribution (under the most likely scenario) far exceeds any highway grants received by Massachusetts in recent decades (Table 9). The annual spending for the Harbor Cleanup alone during the 1990s will roughly equal all spending by the state and localities on wastewater treatment in 1989. The vast majority of the financing for the Harbor Cleanup will be provided locally, with a small amount of state support available in the form of loans from the State Revolving Fund, so the project does not change the grant situation in this area. Nevertheless, if both projects are completed, Massachusetts in the year 2000 should look like a state that undertook major investment in infrastructure and received considerable federal support.

Authority Initiatives

The spending plans of the independent authorities constitute the final piece of Massachusetts' capital spending picture for the 1990s. Massport, the Turnpike Authority, and the MBTA all have significant initiatives for the coming decade (Table 8). The MWRA also has capital plans in addition to those projects directly related to the Harbor Cleanup.

Massport's investment program for 1990 to 1999 calls for $2.2 billion dollars of improvements, including terminal and runway enhancements and noise abatement efforts at Logan Airport, port improvements, and major rehabilitation on the deck and supporting piers of the Tobin Bridge.

The Turnpike Authority plans to reconstruct many of the bridges along the turnpike, resurface about 10 miles of roadway annually, and replace one-quarter of the guard rail which is over 30 years old, at a total cost of $603 million. This total planned spending also includes upgrading toll plazas to reduce congestion and improving service and maintenance areas. The Authority also plans a $58 million dollar program of repairs to the Sumner and Callahan tunnels, including ceiling and tile replacement, renovations of ventilation systems, and roadway resurfacing.

According to the Governor's Management Task Force, the MBTA needs to spend about $4 billion over the next ten years to purchase rolling stock and upgrade tracks and stations.

In addition to the Harbor Cleanup already discussed, the MWRA plans expenditures of about $2 billion during the next ten years. Its capital plan includes, on the water supply side, replacing corroded water pipes, rehabilitating pump stations, improving chlorination facilities, and upgrading aque-

ducts. Similar improvements are planned for the sewer system, primarily replacing old pipes and pump stations.

Summary

It is apparent that Massachusetts as a whole has ambitious capital spending plans for the 1990s. While these estimates are uncertain, especially in the later years, they represent a monumental increase in capital spending over the previous decade (Table 8). The estimate of state spending in the 1990s is almost double its spending during the 1980s. MWRA, Massport and the Turnpike Authority all have plans that represent even larger increases over the 1980s. The current estimate for the MBTA is about the same as its spending over the previous decade.

If the state and the authorities actually undertake this ambitious plan, Massachusetts in the year 2000 ought to be a state with a substantial, well-maintained infrastructure. Whether this plan is realistic is another question. Massport and the Turnpike Authority appear to be in sound financial condition and thus able to carry out their plans. The MWRA currently has no leeway where the Harbor Cleanup is concerned, so this project must proceed. The MWRA also has a good credit rating, which puts it in a favorable position to implement its other programs. However, if rates increase too quickly, it may run into resistance from customers and be forced to curtail its efforts. The MBTA's projected expenditures, which are about equal to 1980s levels, may well be curtailed by the state's fiscal problems. While the state itself needs to undertake capital investment, it may also face substantial difficulties unless it can bring its operating budget under control.

V. Conclusion

Massachusetts' infrastructure, like public capital in the rest of the country, is in need of repair. Moreover, Massachusetts faces the huge task of cleaning up Boston Harbor. The Commonwealth's plight is not difficult to understand; the federal government has reduced grants to states and localities, while localities are faced with mandated environmental projects and caps on their property taxes. As a result, the demands on state government resources have expanded enormously, and capital spending is always the first item to go during periods of budget pressures.

To compensate for low spending during the 1980s, to complete the Central Artery Depression/Third Harbor Tunnel project, and to execute the mandated cleanup of Boston Harbor, Massachusetts has constructed an ambitious capital spending agenda for the 1990s. A conservative estimate of the total cost of state, authority and mega project activity over the next ten years is $28 billion (in 1989 dollars), $19 billion of which must be financed either directly or indirectly by the taxpayers of Massachusetts. These projections dwarf actual capital expenditures during the 1980s, which totalled $12 billion (in 1989 dollars) with $8 billion paid by Massachusetts taxpayers. Some of the funding may be derived from fees and charges, but a significant burden may fall to the state government. Hence, any long-range planning effort should incorporate the debt service costs from these capital spending initiatives in expenditure projections.

The ambitious agenda also underlines the need for coordinating efforts and establishing priorities. The state cannot control the artificial incentives created by the high matching rates of federal government grants; the only sensible response is to take full advantage of the offer. It can and must, however, eliminate the incentives for low-priority investments created by overfunded authorities. It must also carefully evaluate authority initiatives as compared to state-funded projects, and the merits of alternative state capital spending proposals. Massachusetts must create a mechanism for the oversight of the capital investment activities of both the Commonwealth and the authorities.

In this regard, Massachusetts does not have to reinvent the wheel; other states have faced the same problems and have developed a variety of approaches to make systematic assessments of their capital spending proposals. For example, in 1975 New Jersey instituted a Capital Planning Commission, which is considered by the National Conference of State Legislatures to be one of the best in the nation. Kentucky recently adopted the New Jersey model in an effort to revamp its capital planning and budgeting process. The major advantage of the New Jersey/Kentucky approach is that, through the Commission, the executive branch, legislators, and private individuals are fully involved in the capital planning process; they have consistent, detailed information on the capital plans, and the Governor has knowledge of and veto power over the activities of authorities. (See the second box.) The New Jersey/Kentucky system, or a system that at least gives the Governor information about and veto power over authority projects, is badly needed for Massachusetts.

The New Jersey Capital Budget Process

New Jersey's Capital Planning Commission was established in 1975 in response to complaints from Wall Street and bond raters that New Jersey's capital budgeting process was haphazard with no coherent methodology.

The Commission consists of four legislators (two from each house, two from each party), who have traditionally been the ranking people on their respective finance or appropriations committees; four members appointed by the Governor, who have traditionally been the Director of the Office of Management and Budget, the Treasurer, the Counsel to the Governor, and the Director of Planning and Management; and four private sector members (two from each party), who are appointed by the administration and confirmed by the Senate. The Commission has a small staff to do most of the technical work.

The annual capital planning process begins with the capital planning officer within each state agency compiling and establishing priorities for all capital requests. (The current year requests are always proposed within the context of longer range, three-year and seven-year, plans.) The officers forward the documentation to the Commission, which holds informal meetings with staff-level people who submitted the capital plans. At these meetings, the Commission members ask for justification for projects, and may request that an agency scale down its requests. Generally, the Commission tries to get the agencies to make as realistic a request as possible, given its members' knowledge of the budget process and the demands on the operating side of the budget.

The next step is a formal hearing, where the Secretary of the agency makes a personal appearance before the Commission either to review individual requests or to describe the agency's overall agenda. In the wake of the hearings, the Commission compiles a list of recommendations, which forms the basis for the Governor's capital budget.

While this process does not explicitly include the authorities, it does allow the Governor some power over authority activity. The executive branch has an office (the Governor's Authorities Unit) to review the plans and budgets of all state-level authorities, and the Governor can ask for clarification and further information on any project. The Governor has the power to veto the minutes of any independent authority and thereby stop a proposed project, if necessary.

New Jersey has also established a coordinating committee of all agencies and authorities that are involved with any aspect of transportation so that their plans can be designed to best meet the needs of the state. The chairman of the committee is the Secretary of Transportation.

Thus, the key elements of New Jersey's plan that could benefit Massachusetts are early involvement of legislators in the capital planning process, detailed and consistent information about state projects and their alternatives, and knowledge of and veto power over the activities of authorities. In serving on a capital planning commission, legislators can evaluate the merits of specific capital requests from the perspectives of individuals who see the full spectrum of the state's obligations, both operating and capital. Once they have participated in the construction of a proposed capital budget, they, as ranking members of the finance and appropriations committees, can convince their committees and other legislators that the plan is realistic and valuable. The second important element, full and consistent information, allows the Commission to make rational choices between projects. Finally, the oversight of authorities is crucial when they constitute such a large part of capital spending.

Two factors attest to the success of the New Jersey plan. First, since the establishment of the Commission voters have approved 94 percent of bond issues that the state has proposed, compared to 50 percent approval in the nine years before the Commission was established. Second, when Kentucky recently decided to revamp its capital planning process, it examined the processes used in many other states and eventually selected the New Jersey model.

Appendix A

Descriptions of Federal Capital Grant Programs

Function	Agency	Program	Federal Matching Rates and Requirements
Transportation			
Highways			
Prior to 1992	Federal Highway Administration	Interstate	90 percent of new construction costs for roads on the Interstate network.
		Interstate 4R	90 percent of costs for resurfacing, restoring, rehabilitating, or reconstructing the Interstate System. If needs of Interstate roads are fully met, the money may be used for primary roads.
		Primary	75 percent of costs for non-Interstate major roads that serve as intrastate, regional, or cross-state linkages (258,000 miles of road eligible for program).
		Secondary	75 percent of costs for major rural roads (400,000 miles of road eligible for program).
		Urban	75 percent of costs for roads primarily serving urban areas (148,000 miles of road eligible for program).
		Bridge Replacement and Rehabilitation	80 percent of costs to restore or replace bridges.
1992 and Beyond	Federal Highway Administration	National Highway System	75 percent of construction costs for all types of projects, except for repair or improvement of the Interstate system which will remain at 90 percent. This program will encompass the existing Interstate system and portions of the current Urban, Primary, and Secondary systems (150,000 miles).
		Urban/Rural Program	60 percent of construction costs. This program will include the rest of the current Urban, Primary, and Secondary systems (700,000 miles). Recipients may use grants either for highway or mass transit projects.
		Bridge Program	75 percent of costs to restore or rehabilitate bridges.
		Toll Projects	A new program will provide up to 35 percent of the costs of toll projects and will encourage private participation in these projects.
Mass Transit Prior to 1992	Urban Mass Transit Administration	Discretionary Capital Grants	Up to 75 percent of costs, except projects to improve accessibility for the elderly or handicapped, which receive a 95-percent match. A state may increase the priority of a project by supplying more than 25 percent of the funding.
		Nonurbanized Formula Grant, Urban Formula Grant	80 percent of costs, except projects to improve accessibility for the elderly or handicapped, which are eligible for a 95-percent match. Both programs also offer grants for up to 50 percent of operating costs (Note: Estimates of mass transit grants reported in tables exclude operating grants.)
		Capital Assistance for the Elderly and Handicapped	For private nonprofit organizations that provide transportation services for the elderly or handicapped. Organizations apply through the state and receive grants for up to 80 percent of project costs.
1992 and Beyond	Urban Mass Transit Administration	Discretionary Capital Grants	Up to 50 percent of project costs for significant new transit investment projects and 60 percent of costs for other capital projects.
		Nonurbanized Formula Grant, Urban Formula Grant	60 percent of project costs. Both programs will continue to offer grants to cover up to 50 percent of operating costs, although no operating assistance will be available for urban areas with a population of 1 million or more.
		Capital Assistance for the Elderly and Handicapped	60 percent of project costs.
Aviation	Federal Aviation Administration	Airport Improvement Program	For primary commercial service airports (those enplaning more than 0.25 percent of passengers nationwide), the matching rates are 75 percent for airport development, terminal development, master planning and noise compatibility planning, and 80 percent for noise compatibility program implementation. For all other public use airports, the rates are 90 percent for airport development, planning, noise compatibility planning and noise compatibility program implementation, and 75 percent for terminal development.
Wastewater Treatment	Environmental Protection Agency	Construction Grants	55 percent of costs for projects employing conventional technologies and 75 percent of costs for projects using innovative technologies. These grants will be phased out by 1991.
	Farmers Home Administration	Rural Water and Waste Disposal	Provides grants for rural waste disposal systems. These grants are distributed on a formula basis with no matching requirements specified.
Water Supply	Farmers Home Administration	Rural Water and Waste Disposal	Provides grants for rural water systems. These grants are distributed on a formula basis and have no matching requirements.
Community and Regional Development	Dept. of Housing and Urban Development	Community Development Block Grants, Urban Block Grants	Provides grants to promote development, which can be used for either capital or operating expenses. No matching requirements are specified, rather the grants are distributed by formula.

Source: U.S. Office of Management and Budget and U.S. General Services Administration. 1990. *Catalog of Federal Domestic Assistance 1990.* Washington, D.C.: Government Printing Office.

Appendix B: Tables not in numerical order because of space limitations.

Appendix Table B1
Federal Capital Grants to Massachusetts by Function, Fiscal Years 1980 and 1989
Millions of 1989 Dollars

Function	1980	1989
Total	$787.0	560.6
Transportation	466.0	351.8
Highway	220.8	234.1
Mass Transit	231.2	107.9
Aviation	14.0	9.8
Wastewater Treatment	135.3	92.4
Water Supply	2.1	1.2
Other	183.5	115.2
Addendum:		
Grants as a Percent of Capital Outlays		
Massachusetts	46.1	20.0
U.S. Total	35.7	21.8

Sources: U.S. Department of the Treasury, 1981, *Federal Aid to States, Fiscal Year 1980;* U.S. Bureau of the Census, 1990, *Federal Expenditures by State for Fiscal Year 1989*, Table 2; U.S. Office of Management and Budget, *Budget of the United States Government, Fiscal Year 1991* and *Fiscal Year 1989, Historical Tables*, Tables 9.5 and 12.3.

Appendix Table B5
Infrastructure Quality, Selected Years

	Percentage Rated Deficient			
	Highway Mileage		Bridges	
States	1982	1989	1980	1988
United States Average	13.7	9.5	40.5	41.3
Massachusetts	3.2	9.8	18.8	38.7
Other New England States	11.9	12.5	37.4	46.8
Connecticut	9.6	3.6	33.2	64.0
Maine	11.7	13.5	18.0	29.7
New Hampshire	13.5	25.2	51.3	43.7
Rhode Island	32.4	27.8	17.0	19.4
Vermont	6.9	5.6	54.5	49.2
High Technology States	13.2	7.1	36.1	33.6
Arizona	7.0	20.0	5.1	7.3
California	9.7	10.3	23.4	25.7
Maryland	8.4	5.4	17.7	40.9
North Carolina	7.8	5.4	75.7	52.5
Texas	19.6	5.0	36.7	34.2
Washington	8.5	2.2	12.0	27.0
Industrial States	16.2	8.3	38.0	40.9
Illinois	9.7	3.2	37.0	28.9
Michigan	21.5	9.9	36.0	31.3
New Jersey	.4	11.4	25.0	35.1
New York	11.3	2.5	58.4	68.2
Pennsylvania	26.4	17.0	24.8	39.7

Source: U.S. Department of Transportation, *Highway Statistics 1989*, and *Highway Statistics 1982*, Table HM-63; U.S. Department of Transportation, 1989, *The Status of the Nation's Highways and Bridges: Conditions and Performance*, Tables 4A and 4B; U.S. Department of Transportation, 1981, *Highway Bridge Replacement and Rehabilitation Program, Second Annual Report to Congress*, Tables 5A and 5B.

Appendix Table B4
Public and Private Capital Stocks Per Capita
1989 Dollars

	Public Capital Stock per Capita			Private Capital Stock per Capita		
	1970	1980	1989	1970	1980	1989
United States Average	5,940	6,726	6,860	12,501	16,026	18,804
Massachusetts	4,652	6,323	6,598	8,045	10,931	16,510
Other New England States	5,828	6,432	5,907	9,564	11,937	15,609
Connecticut	6,313	7,153	6,672	9,582	12,389	17,292
Maine	4,702	5,366	5,094	11,308	13,333	15,133
New Hampshire	5,027	5,710	4,961	9,709	11,242	14,609
Rhode Island	5,480	5,634	5,249	6,913	9,136	11,418
Vermont	7,106	7,175	6,293	10,964	12,560	16,353
High Technology States	6,755	6,942	6,706	13,827	16,770	19,162
Arizona	6,848	7,272	8,057	15,915	15,024	16,639
California	7,774	7,141	6,046	10,450	13,043	16,669
Maryland	5,880	8,052	8,002	8,943	11,583	14,469
North Carolina	4,000	4,968	5,077	10,331	13,494	16,979
Texas	5,763	6,068	6,715	22,958	26,219	26,313
Washington	9,121	10,273	10,666	13,249	16,681	18,379
Industrial States	5,888	7,286	7,216	10,550	14,259	17,010
Illinois	5,667	6,773	6,871	12,471	17,286	18,603
Michigan	6,070	6,779	6,489	11,514	15,588	17,945
New Jersey	4,178	5,521	5,855	9,747	12,424	17,358
New York	7,079	9,240	9,207	9,050	12,224	15,830
Pennsylvania	5,160	6,382	6,017	10,820	14,460	16,285

Source: Authors' calculations, see Munnell (1990b).

Appendix Table B2

State and Local Capital Spending Per Capita, Fiscal Years 1970 to 1989

1989 Dollars

State	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
United States Average	483	490	471	453	435	430	422	385	348	360	367	365	346	348	350	373	407	433	440	450
Massachusetts	436	452	485	489	443	353	348	273	269	356	298	298	297	323	312	349	377	401	448	474
Other New England States	479	510	423	412	390	341	323	293	259	255	251	228	217	228	233	275	296	351	392	488
Connecticut	527	583	478	468	459	378	306	239	231	248	258	238	212	227	233	292	331	418	428	611
Maine	356	405	340	353	351	288	305	386	316	280	242	212	217	232	231	227	261	307	372	396
New Hampshire	453	485	440	421	357	417	485	440	351	257	263	238	228	243	225	252	247	336	374	419
Rhode Island	409	328	275	252	202	220	270	253	193	207	218	194	205	192	215	274	263	231	355	366
Vermont	621	670	525	485	455	321	305	253	271	324	264	251	246	265	294	327	318	305	326	340
High Technology States	518	499	472	449	438	435	439	402	400	413	418	402	386	383	369	395	452	490	490	470
Arizona	554	568	644	581	694	632	602	639	628	686	626	574	523	622	575	641	771	810	806	793
California	558	507	461	412	412	393	376	316	315	275	295	304	281	293	295	331	369	395	407	407
Maryland	499	576	536	548	599	601	574	518	484	440	512	411	442	409	425	395	481	506	543	532
North Carolina	354	349	333	323	312	338	404	338	311	379	289	253	225	221	226	301	353	402	417	398
Texas	457	430	455	443	414	416	408	385	392	458	485	451	423	427	431	433	540	578	540	500
Washington	732	785	634	691	525	583	717	791	822	907	838	881	934	781	582	595	499	612	625	543
Industrial States	482	514	506	488	460	423	391	345	279	297	304	320	298	305	310	326	365	398	429	443
Illinois	416	448	445	447	376	373	405	385	301	310	341	371	283	288	305	331	356	383	388	361
Michigan	438	400	432	398	387	392	379	324	272	298	331	278	232	243	258	232	264	271	372	336
New Jersey	437	441	400	380	389	307	296	281	226	274	256	311	283	269	268	271	386	427	445	466
New York	558	640	670	664	630	560	437	395	338	326	322	357	394	393	413	455	486	549	569	624
Pennsylvania	489	511	431	392	382	358	373	286	310	252	249	257	232	260	225	234	258	268	292	323

Source: U.S. Bureau of the Census, *Government Finances*, various years.

Appendix Table B3

State and Local Capital Spending as a Percent of Gross State Product, Fiscal Years 1970 to 1989

1989 Dollars

State	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
United States Average	3.1	3.3	3.2	2.9	2.8	3.1	3.0	2.6	2.3	2.4	2.6	2.5	2.2	2.2	2.1	2.2	2.3	2.3	2.3	2.3
Massachusetts	2.8	3.0	3.2	3.2	2.9	2.7	2.6	1.9	1.9	2.5	2.2	2.1	1.9	2.0	1.8	1.9	1.9	1.9	2.1	2.1
Other New England States	3.1	3.5	2.9	2.8	2.7	2.6	2.5	2.1	1.8	1.8	1.9	1.7	1.5	1.5	1.4	1.5	1.6	1.8	1.9	2.3
Connecticut	3.0	3.5	2.9	2.8	2.8	2.5	2.0	1.5	1.4	1.6	1.7	1.5	1.2	1.3	1.2	1.4	1.5	1.8	1.8	2.4
Maine	2.9	3.5	2.9	3.0	3.0	2.7	2.9	3.3	2.7	2.4	2.2	1.9	1.8	1.8	1.7	1.6	1.8	2.0	2.3	2.3
New Hampshire	3.5	3.9	3.6	3.4	2.9	3.7	4.3	3.7	2.9	2.1	2.2	1.9	1.7	1.7	1.4	1.5	1.4	1.8	1.9	2.0
Rhode Island	2.9	2.4	2.0	1.8	1.5	1.8	2.2	2.0	1.5	1.7	1.8	1.6	1.6	1.4	1.5	1.8	1.7	1.4	2.1	2.1
Vermont	4.7	5.2	4.1	3.7	3.5	2.9	2.7	2.1	2.3	2.7	2.3	2.1	1.9	2.0	2.0	2.2	2.0	1.8	1.9	1.9
High Technology States	3.3	3.3	3.1	2.8	2.8	3.0	2.9	2.5	2.5	2.6	2.7	2.6	2.3	2.2	2.1	2.1	2.4	2.5	2.5	2.3
Arizona	4.1	4.3	4.8	4.1	4.9	4.9	4.8	4.8	4.6	5.0	4.8	4.4	3.8	4.6	4.0	4.2	4.8	4.8	4.7	4.6
California	3.2	3.0	2.8	2.4	2.4	2.6	2.3	1.9	1.8	1.6	1.8	1.8	1.6	1.7	1.6	1.7	1.8	1.9	1.9	1.9
Maryland	3.5	4.1	3.8	3.8	4.2	4.6	4.3	3.7	3.4	3.2	3.9	3.1	3.1	2.8	2.7	2.4	2.8	2.8	2.9	2.8
North Carolina	2.6	2.7	2.5	2.3	2.2	2.7	3.2	2.6	2.3	2.9	2.4	2.1	1.7	1.6	1.5	1.9	2.2	2.4	2.4	2.2
Texas	3.1	3.0	3.1	3.0	2.7	2.9	2.6	2.3	2.3	2.7	3.0	2.6	2.2	2.2	2.2	2.2	2.7	3.0	2.7	2.5
Washington	4.6	5.3	4.3	4.5	3.4	4.1	4.8	5.0	5.2	5.7	5.5	5.9	6.0	4.9	3.5	3.5	2.9	3.3	3.4	2.9
Industrial States	2.8	3.1	3.0	2.9	2.8	2.9	2.6	2.2	1.7	1.9	2.1	2.2	1.9	1.9	1.8	1.8	2.0	2.0	2.2	2.2
Illinois	2.3	2.6	2.6	2.5	2.1	2.3	2.5	2.2	1.7	1.8	2.1	2.4	1.7	1.7	1.8	1.8	1.9	2.0	2.0	1.8
Michigan	2.4	2.5	2.6	2.4	2.3	2.8	2.7	2.1	1.7	1.9	2.2	2.0	1.6	1.7	1.7	1.4	1.5	1.5	2.1	1.8
New Jersey	2.6	2.7	2.5	2.3	2.4	2.1	2.0	1.8	1.5	1.8	1.8	2.1	1.7	1.6	1.5	1.4	1.9	2.0	2.0	2.0
New York	3.0	3.6	3.8	3.7	3.6	3.7	2.8	2.5	2.1	2.1	2.1	2.4	2.4	2.3	2.2	2.3	2.4	2.5	2.6	2.7
Pennsylvania	3.2	3.5	3.0	2.7	2.6	2.7	2.8	2.0	1.5	1.8	1.9	2.0	1.6	1.8	1.5	1.5	1.6	1.6	1.7	1.9

Source: U.S. Bureau of the Census, *Government Finances*, various years; U.S. Bureau of Economic Analysis, Gross State Product, Machine Readable Data.

Appendix Table B6

Capital Spending of the State and the Four Major Authorities, Fiscal Years 1980 to 1999

Millions of 1989 Dollars

	State				Authorities											
					MWRA											
	Central Artery		Other		Harbor Cleanup		Other		Massport		MBTA		Turnpike		Total	
Year	Federal	State	Federal	State	Federal	State/ Local	Federal	State/ Local	Federal	State/ Local	Federal	State/ Local	Federal	State/ Local	Federal	State/ Local
1980	0	0	226	283	0	0	0	0	9	32	222	176	0	13	457	504
1981	0	0	252	373	0	0	0	0	9	55	236	186	0	11	496	625
1982	0	0	219	407	0	0	0	0	7	42	223	176	0	16	449	642
1983	0	0	225	483	0	0	0	0	8	41	224	177	0	15	458	716
1984	0	0	155	394	0	0	0	0	4	30	222	176	0	19	381	619
1985	0	0	188	461	0	0	0	0	5	56	218	172	0	32	411	721
1986	0	0	228	458	0	0	11	14	4	76	176	139	0	32	420	720
1987	0	0	249	581	0	0	14	33	16	46	167	132	0	32	447	823
1988	0	0	270	656	0	0	46	78	5	43	158	196	0	37	480	1010
1989	0	0	291	938	0	0	67	69	7	46	120	226	0	37	485	1317
1980–89	0	0	2305	5034	0	0	138	193	75	466	1965	1757	0	245	4483	7696
1990	28	3	291	925	18	52	38	94	10	68	95	284	0	69	480	1495
1991	273	30	291	925	15	133	11	151	10	68	130	220	0	100	728	1627
1992	409	45	291	925	19	347	19	162	10	68	142	188	0	95	890	1831
1993	481	76	291	925	15	416	38	155	10	231	150	180	0	80	985	2062
1994	615	97	291	925	9	469	15	122	10	263	160	175	0	66	1100	2117
1995	759	119	291	925	9	375	4	193	10	290	170	190	0	57	1243	2149
1996	727	114	291	925	10	195	0	207	10	357	180	205	0	55	1217	2058
1997	572	90	291	925	6	113	1	292	10	327	180	205	0	49	1058	2002
1998	371	58	291	925	7	146	1	258	10	256	180	205	0	48	860	1897
1999	90	14	291	925	7	133	1	271	10	155	180	205	0	31	578	1735
1990–99	4325	648	2905	9250	115	2378	128	1905	100	2083	1567	2057	0	650	9139	18971

Note: MWRA spending figures from 1986 to 1989 include $110 million of expenditures on the Harbor Cleanup project.

Source: Authority annual reports; Authority Budget/Planning Offices; Central Artery/Third Harbor Tunnel Public Information Office; Commonwealth of Massachusetts, *Annual Financial Report;* Background data supplied to Crozier Commission.

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[1] The federal government's direct expenditure on nonmilitary public capital in 1989 amounted to $19 billion.

[2] The following discussion focuses on federal grant programs, but the federal government also provides limited aid to states for physical capital investment in the form of loans. However, the only area of capital investment where loans represent a significant portion of total aid is water supply. Data compiled by the Congressional Budget Office show that in 1989 federal loans to states for the construction of water supply facilities represented 76 percent ($262 million out of $343 million) of all the aid in this area. These loans originate with the Farmers Home Administration and are targeted at rural communities. Since water supply is a very small portion of federal aid for capital investment, ignoring the loan programs does not significantly alter the relative importance of the federal government's role in financing capital investment.

[3] The actual assessments are made by the states based on EPA standards, and the EPA generally accepts the states' estimates. Until 1985, EPA provided 75 percent of the capital costs for systems employing conventional technologies and 85 percent for those based on innovative technologies. Since 1985, the matching rates have been lowered to 55 percent and 75 percent, respectively.

[4] Generally, Congress ends up appropriating somewhat less than the authorized amount.

[5] In this article (and throughout the report of which it is a part), Massachusetts is compared with a group of 16 similar states. The group includes the other New England states (Connecticut, Maine, New Hampshire, Rhode Island, and Vermont); six high technology states (Arizona, California, Maryland, North Carolina, Texas, and Washington); and five mature industrial states (Illinois, New Jersey, New York, Michigan, and Pennsylvania).

[6] This may seem surprising since Massachusetts began the period with the lowest level of per capita public capital, and its annual per capita investment over the period 1970 to 1989 was well below all but that for the other New England states. The explanation lies in the enormous difference in the rate of population growth between Massachusetts and other states. For example, the stock of public capital in the high technology states increased roughly 43 percent over the 1970–89 period, but this was inadequate to keep pace with the 44 percent increase in population; hence real per capita public capital declined by 1 percent. In Massachusetts, by contrast, the stock of public capital increased 46 percent, while population grew only 4 percent; as a result, per capita public capital rose 42 percent.

[7] Two basic sources provide data on capital spending by the state government: *Government Finances* published by the Census Bureau and Massachusetts' *Annual Financial Report*. The figures reported in these two sources are quite different. The 1989 Census Bureau figure for state government capital spending in Massachusetts is $1,093 million. Massachusetts' 1989 *Annual Financial Report* records capital expenditures of $1,230 million.

At first glance, these figures seem significantly different but not wildly divergent. A significant problem arises, however, because the Census Bureau includes as state government entities several public authorities whose expenditures do not pass through the state budget process, and thus do not appear in state documents. The Census Bureau performed a tabulation of these off-budget entities for Massachusetts. In 1989, these entities spent $395 million on capital outlays which, when subtracted from the Census Bureau figure for total state government capital spending, yields a value of $698 million in on-budget capital spending for the state government. This figure *is* wildly divergent from the $1,230 million recorded by the state.

After receiving some detailed state reports and having several conversations with the Census Bureau, a reconciliation of these figures was constructed. The major differences are discussed here, with a somewhat more detailed table appearing below.

First, a large portion of Massachusetts' state spending ($414 million) is classified as state aid/intergovernmental expenditure by the Census Bureau and is recorded as local, rather than state, government expenditure since localities are the final disbursing units. Second, some spending considered capital spending by the state is classified as operating expenditure by the Census Bureau ($67 million). Third, the Census Bureau classifies some expenditures ($20 million) as transfers or other expenditures. Subtracting these Census Bureau reclassifications from the state figure yields a capital spending figure of $728 million, just 4 percent larger than the Census Bureau figure of $698 million.

One may be tempted to ask: Which figure is correct, the Census Bureau estimate of $698 million or the state's figure of $1,230 million? The answer is that both have their merits. The Census Bureau figure is the most appropriate one to use when looking at spending of all levels of government within the state since it displays spending by final disbursing unit, thus avoiding the problem of double counting that would occur if intergovernmental expenditures of the state were counted as both state and local expenditures. On the other hand, from the perspective of the state, the non-federal portion of the spending recorded on its audited books ($938 million) is the amount that matters. This is the amount of money it had to raise through bond issuance, and it is the debt service on this figure which appears in the operating budget.

Reconciliation of Census Bureau and Commonwealth of Massachusetts Capital Spending Data, Fiscal Year 1989, Thousands of Dollars

Census Bureau	
State government capital spending	$1,092,748
Off-budget entities	(394,655)
	698,093

Commonwealth of Massachusetts	Fund Type				
	General	Highway	Federal	Other	Total
Annual Report Capital Spending	680,234	118,970	291,409	139,206	1,229,819
Census classifies as state aid/ intergovern-mental expenditure	(322,409)	(16,034)	(3,108)	(72,889)	(414,440)
Census classifies as operating expenditure	(53,869)	(622)	0	(12,592)	(67,083)
Census classifies as transfer/ other expenditure	(17,401)	0	0	(2,688)	(20,089)
Total	286,555	102,314	288,301	51,037	728,207
Difference from Census Bureau Total					30,114
Difference as Percent of Census Bureau Total					4.3

[8] According to Section 17 of Chapter 581 of the Acts of 1980, the MBTA is supposed to have been submitting a prospective budget coinciding with the state's fiscal year since July 1, 1983. While the MBTA now keeps its books on a fiscal year corresponding to the Commonwealth's, it continues to calculate its net cost of service on a calendar-year basis to be appropriated retrospectively.

[9] The MBTA is descended from Massachusetts' first public authority, the Boston Transit Commission, which was created in 1894 and built the subway tunnels. In 1918, the Boston Transit Department replaced the Commission and inherited the unpaid tunnel bills. The Metropolitan Transit Authority replaced the Boston Transit Department in 1949 and inherited the tunnel bills and other unpaid bills. These were all transferred to the MBTA when it was created in 1964.

[10] In 1989 only 2.5 percent of Massachusetts' interstate highway mileage, which includes the Mass Turnpike, was rated deficient, compared to 9.3 percent nationwide. At Logan, only 20 of every 1000 takeoffs and landings were delayed in 1989, compared to an average of 31 for the nation's 22 major airports.

[11] Some movement appears already to have been made in this direction. *The Boston Globe* (10/13/90) reported that $4.5 million of operating expenses for the existing central artery was transferred from the Department of Public Works to the Turnpike Authority, after the Authority's counsel offered help during the latest round of budget cuts.

[12] Most documents cite the cost for the Central Artery project as $4.4 billion, which is measured in constant 1987 dollars. The Central Artery Project's Public Information Office provided annual cost estimates in 1989 dollars. The figure commonly cited as the price tag for the Harbor Cleanup project is $6.1 billion. This is the cost inflated to 1999 dollars. In constant 1990 dollars the cost is estimated at $2.8 billion, according to the MWRA. Converting this to 1989 dollars results in a cost estimate of $2.7 billion.

[13] The Lazard Frères approach and the methodology used in this study differ, and these differences are summarized below. First, the annual expenditures used in the Lazard Frères report represent incurred obligations, rather than cash expenditures, which produce larger costs for the early years of the project in the Lazard calculations.

Second, Lazard Frères assume somewhat different federal matching rates. For the approved portion of the project, they assumed a 90-percent federal match on 97 percent of project costs, while this study assumed a 90-percent match on all costs. For the unapproved 20 percent of the project, the Lazard assumption was an 85-percent match of 97 percent of the costs up to and including 1992, with the match dropping to 82.5 percent on 97 percent of total costs after 1992. This study assumed no expenditures on the unapproved portion prior to 1992, and a federal match of only 75 percent when expenditures began after 1992. The following table shows costs by project section, broken down into federal and state shares before and after 1992.

Reconciliation of Federal Funding Estimates for the Central Artery Project
Millions of 1989 Dollars

	FY1990–FY1999		
	Total	Federal	State
Lazard Frères:			
Unapproved	958	771	187
Approved	4,014	3,504	510
Total	4,972	4,275	697
Munnell & Cook:			
Unapproved	994	745	249
Approved	3,978	3,580	398
Total	4,972	4,325	648

	FY1990–FY1992			FY1993–FY1999		
	Total	Federal	State	Total	Federal	State
Lazard Frères:						
Unapproved	178	147	31	780	624	156
Approved	1,605	1,401	204	2,409	2,103	306
Total	1,783	1,548	235	3,189	2,727	462
Munnell & Cook:						
Unapproved	0	0	0	994	745	249
Approved	789	710	79	3,189	2,870	319
Total	789	710	79	4,183	3,615	568

Source: Lazard Frères and Co., 1990, *Financing Plan for the Central Artery/Third Harbor Tunnel*, Chapter 2.

[14] The initial problems leading to this federal court order developed because the treatment plants and the sewer system are very old and have been consistently operating beyond their capacity. In the early 1900s, the system was recognized as one of the best in the country, though all it did was collect wastewater which was then released into the harbor. The Nut Island primary treatment plant was completed in 1952, providing wastewater treatment for the first time, and by 1968 the Deer Island primary treatment plant was also operational.

Over the next decade, growth among the communities served, combined with neglect of maintenance due to inadequate funding, resulted in treatment far below federal requirements. The two current primary treatment plants remove only 50 percent of bacterial pollution from wastewater, while the federal government requires that 90 percent be removed.

By the early 1980s, the situation had substantially deteriorated. Boston's treatment plants on Deer and Nut Islands experienced several instances of pump problems and capacity constraints, which resulted in the dumping of billions of gallons of untreated sewage into the harbor. Several lawsuits were filed against the Metropolitan District Commission (MDC), which culminated in the July 1985 finding that the MDC and the Massachusetts Water Resources Authority (MWRA) as its successor agency were liable for violating federal water pollution laws and responsible for remedying the intolerable situation. Thus years of neglect, substantial undercapacity, and outdated treatment technologies have created one of the most polluted waterways in the nation.

[15] An analysis by Cambridge Systematics indicates that, in its peak year, the Central Artery/Tunnel project will require 4,600 construction workers and will create another 10,500 jobs indirectly through the multiplier effects. A similar study performed by Cape Ann Economics for Associated Industries of Massachusetts produced more conservative estimates of 7,000 total jobs in the average year and 10,000 total jobs in the peak year. Cambridge Systematics also performed a similar analysis of the Harbor Cleanup project which estimated that, in its peak year, the project will generate 3,600 construction jobs and 6,200 other jobs for a total of 9,800 jobs.

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