

From Rescue to Renaissance:

The Achievements of the MTA Capital Program 1982 - 2004

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Executive Summary

In the late 1970s and early 1980s, New York's transit system neared total collapse. Frequent derailments, car fires, crime, and graffiti plagued the system and ridership plunged. Residents and businesses fled, and suburban commuters stopped taking the train into the city. The system appeared to be out of control and was for many a symbol of the decay into which New York City had fallen.

A quarter of a century later, the crisis has become a dim memory. New cars with working air-conditioning arrive at clean, well-lit stations; derailments and accidents have become a rarity, and on-time performance has improved continuously. Travel times have dropped, and fare discounts have brought millions of new riders into the system. Suburban commuters have returned to the trains and new developments have sprung up along the train lines. New York City's subway has become a source of civic pride and is seen as a powerful tool for leveraging future economic growth.

The turnaround was driven by a capital program that, since its beginning in 1982, has invested \$51 billion (\$68 billion in 2004 dollars) in the region's transit system. This year, the Metropolitan Transportation Authority (MTA) has proposed a plan for the next five years of the capital program, and in this context it is appropriate to review the program's achievements. This report reviews the investments made under the capital program, the accompanying performance improvements, and the resulting economic payoff. These achievements are placed in the context of the evolving goals, funding sources, and leadership of the capital program.

Origins of the Capital Program

The transit crisis of the 1970s and 1980s grew out of years of underfunding and deferred maintenance. In the postwar era, politics, economics, and increasing automobile dependence conspired to weaken the financial condition of the New York City Transit Authority and the commuter railroads. Weaker finances meant less capital investment, and in the City, much of that investment was spent on expansion projects that were never completed, rather than upkeep. The result was that the subway and the commuter lines were depreciating at more than four times the rate of capital replenishment. By some calculations, the subway alone had an estimated value of \$40 billion in 1980, yet it was receiving less than \$140 million annually for capital maintenance (in current dollars).¹

With insufficient funding for maintenance, the MTA's aging infrastructure began to fall apart and approached total collapse. Tracks were not inspected on a regular basis. Stations were left to deteriorate. The subway system suffered repeated derailments – one every 18 days in 1981-82 – caused by crumbling tracks and structures. Trains routinely arrived late, if at all: in 1981, 325 train runs were abandoned on a typical day. Mean Distance Between Failure (MDBF), a standard measure of reliability, fell to a low of 6,640 miles for subway cars in 1981. Graffiti covered every surface; even the doors were broken on more than one-third of all subway cars. Bus performance was hardly better: Manhattan and Bronx buses broke down every 315 miles. On Metro-North and the Long Island Rail Road (LIRR), thousands of riders were forced to stand during their commute due to equipment shortages. In the summers, conditions were worsened by malfunctioning air-conditioning systems; in fact, the LIRR issued wedges to conductors as standard equipment for propping open car doors.²

Evolution of the Capital Program and the Ingredients for its Success

As the transit crisis deepened, a political consensus formed around rebuilding the system. Under Richard Ravitch, appointed as chairman in 1979, the MTA performed a systematic survey of needs and proposed a ten-year, \$14.4 billion (in 1980 dollars) capital investment program. The primary goals of the initial program were to restore the system to a State of Good Repair (SGR) and ensure its long-term survival.

¹ Bear Stearns & Co., *Metropolitan Transportation Authority, Finances of Mass Transit Services in New York City* (New York: Bear Stearns, 1983), p. 22; MTA, *Report to the Governor 1984-1985* (New York: MTA, 1986), p. 19.

² MTA, *No Standing Still: The MTA Capital Program Phase 3, 1992-1996* (New York: MTA, 1991), p. 4; Bear Stearns & Co., p. 22; MTA, *Report to the Governor 1984-1985*, p. 9; Straphangers Campaign, *Subway Performance Measures 1980-1990*, from personal communication with Gene Russianoff, March 29, 2004; MTA, *MTA Capital Needs & Opportunities, 1992-2011* (draft) (New York: MTA, March 9, 1990), p. 15.

For the overcrowded commuter lines, new capacity was also an important goal. In the long-term, Ravitch sought to return all agencies to regular cycles of capital replenishment and maintenance – Normal Replacement in the terminology of the capital program.

A critical element of the capital program, and one indicative of its success, is the continual development of these central goals. It was initially expected that this restoration would take ten years, after which the agencies would be able to resume normal replacement cycles. While the forecast proved optimistic, the program has indeed progressed such that normal replacement now consumes more of the budget than does system restoration, and accounts for the vast majority of the core budget at the commuter lines.

As performance has improved, the MTA has also expanded its vision to include broader mobility goals. With Fare Deal in 1992, the MTA proposed transit improvements that would build on the restored system to attract new riders and help address problems created by increasing automobile use. In 2000, the MTA proposed expansion projects as a further means of addressing regional congestion as well as capacity constraints on both the subway and commuter systems. This growing mission reflects not only the achievement of much of the program's original objectives but also the system's new success in attracting riders.

A second ingredient critical to the success of the capital program has been the steady infusion of dollars. The existence of stable funding sources has allowed the MTA to make long-term commitments, such as multi-year car purchases, and plan long-term projects that would otherwise have been impossible to carry out. In arguing for long-term Federal commitments in 1980, Richard Ravitch stated that,

The ability...to be able to plan a capital program with the knowledge that the money is available in the marketplace, would be of inestimably greater value to us than the current process of waiting year by year for appropriations to come forth.... One cannot reasonably commit to a housing development while waiting each year to find out if there are enough funds to build each successive floor. Our transit system should be viewed in the same way.³

During the capital program's first decade, the MTA received stable support from government at all levels. Federal support has remained fairly steady since then and, in fact, increased in real terms. Beginning in 1991, however, the capital program has seen a decrease in local government support and a significant change in the nature of funds provided by the State. New York City has reduced its annual contribution to less than \$100 million since 2000. Before 1991, the majority of State funding came in the form of capital grants. Since 1991, however, the State has supplied few capital grants, instead contributing dedicated tax funds, which are pledged for the payment of debt service. In the absence of direct capital support, the MTA has relied to an increasing degree on bonding, such that in 2000-2004, roughly two-thirds of the capital program was financed by debt.⁴

Finally, leadership at all levels has been critical to the advancement of the capital program. In the 1980s and early 1990s, the capital program was shepherded through Albany by leaders such as New York State Senator Norm Levy. Richard Ravitch worked in Washington and Albany to develop new funding sources for the program. Robert Kiley and David Gunn overhauled the internal organization and the planning process. Peter Stangl fought for an expansion of the capital program's mission and for new funding from Albany; E. Virgil Conway and Peter Kalikow pushed Governor George Pataki's regional mobility vision. All of these efforts contributed to key elements of today's capital program.

Performance Achievements

With clear goals, secure funding, and strong leadership the MTA has made significant progress toward the capital program's primary goal of restoring the transit system. The achievements at New York City

³ Richard Ravitch, Foreword, *Staff Report of Capital Revitalization for the 1980s and Beyond* (New York: MTA, 1980), pp. 8-9.

⁴ Where no citation is given, spending levels and performance figures given here have been compiled from MTA annual reports, capital plans, twenty-year capital needs assessments, strategic business plans, and documents provided to the authors. The inflation index used for capital costs is the Bureau of Labor Statistics' index for nonresidential construction prices, supplied by the MTA. The index used to deflate operating expenses is the regional Consumer Price Index.

Transit have been particularly striking. The agency made huge strides in restoring the performance and passenger environment of the subway during the 1980s and those changes have persisted with improvements continuing unabated. Reliability, as measured by MDBF, has increased for 18 consecutive years and continues to double every five to seven years; in 2003 it reached nearly 140,000 miles. On-time performance increased dramatically during the 1980s from the low 80% range to more than 97% in 2003, with new highs each of the last six years. The eradication of graffiti in 1989 was a major milestone but further investment has brought a sustained increase in customer satisfaction with the subway environment. On the buses, the passenger environment has also improved, the system has become more accessible with the addition of wheelchair lifts by the early 1990s. Additionally, pollution emissions have dropped as the fleet has been upgraded with clean-fuel technologies.

The commuter lines, which were in somewhat better shape than subway and buses when the capital program began, have come close to achieving system-wide SGR: nearly all of their asset categories are now at 80% or more of SGR. Capital investments at Metro-North have brought reliability and on-time performance to levels well above the lows of the early and mid 1980s, and the system is now viewed by many as a first-rate commuter railroad. Reliability and on-time performance have also increased at the LIRR, though not as dramatically as on the subway or at Metro-North.

The commuter lines have achieved significant success in their second original goal of increasing capacity. Overcrowding on Metro-North has, in general, become much less frequent, although it returned during the winter of 2003-2004 as many older cars were affected by harsh weather. Restoration of Grand Central Terminal to its original splendor, rehabilitation of other stations, expanded parking, and extension of the Harlem line have eased commutes and brought thousands of new riders to the system. On the LIRR, the passenger environment has also improved with more reliable air conditioning, less crowding, and more convenient access at its stations.

Another important goal of the original capital program was to restore a system that provided service “at a reasonable operating cost.” New York City Transit has made significant headway toward that goal. Operating costs on the subway that were once well above those of peer systems have fallen to better than parity, despite rapid growth in ridership. Costs have also fallen at Metro-North and the LIRR, though less dramatically. In part, these falling costs reflect productivity gains from capital program investments in modernized facilities, more reliable rolling stock, and improved management control.

In spite of these capital investments, challenging operating environments at the LIRR and for New York City Transit’s buses have limited the opportunities for performance improvements. In the case of the bus system, traffic congestion has kept a ceiling on bus speeds. Bus reliability has increased significantly but bus performance does not appear to have kept pace and customer satisfaction has remained essentially unchanged since the early 1990s. For the LIRR, lack of control over its terminal at Penn Station and in the East River tunnels, and the absence of free capacity in either facility have given little room for error in its operations and constrained its ability to lift on-time performance.

Economic and Mobility Effects

Beyond performance, the most immediate impact of the capital program has been on regional mobility. Ridership levels generally correlate with employment but during the 1970s, ridership declined as conditions throughout the system worsened. In the 1980s, as reliability began to improve and graffiti was eliminated on the subway, the decline ended and in the early 1990s, subway ridership began to grow faster than employment. Finally, continued improvement in the system and the introduction of fare discounts in the late 1990s brought a surge in subway and bus ridership to levels not seen in decades. Expansion and increased capacity have also brought large ridership gains at Metro-North.

The capital program has brought immediate economic gains through the investment multiplier effect. The \$68 billion investment in regional transit (in 2004 dollars) has had a payoff in jobs and incomes: for every \$1 of capital investment, the program has generated roughly \$1.20 to \$1.70 in immediate economic

activity within New York State, depending on the types of goods and services purchased and the locations of the suppliers.⁵

Broader economic effects of the capital program are difficult to untangle from other factors. New York strongly rebounded during the 1990s as the City's population reached eight million for the first time in 2000, and employment grew to highs not seen in thirty years. Factors such as growing global trade, falling crime, and immigration certainly played important roles in shaping the region's economy. Yet improved transportation, enabled by the capital program, contributed as well.

Studies performed in the 1990s by Cambridge Systematics suggest the magnitude of the effect that the capital program has had on the New York economy. The studies found that the benefits of maintaining the system dwarf the costs: every \$1 invested in maintaining the system returned \$4 in economic benefits over twenty years. The most immediate impact of *not* maintaining the system would be more frequent breakdowns and lower reliability. Transit ridership would drop significantly and automobile travel would increase, resulting in lower air quality. Individuals would spend more time and money traveling, and higher levels of traffic congestion would make the region less competitive for business.⁶

On the other hand, the studies showed – and the capital program has demonstrated – that further investments in extending service can boost the economy. Cambridge Systematics found that every dollar invested in expansion would bring two dollars in business and personal income over twenty years. In fact, network expansion at Metro-North over the last two decades has paved the way for new development in its service area. The capital program's restoration of the subway has changed the transit system's image; the fact that the civic community is debating development of a new business district in Manhattan that depends on the expansion of the subway speaks volumes to new confidence in that system.

Beyond the immediate multiplier effects of capital investment, the capital program's specific contribution to regional economic vitality has been through improved mobility. Increasing ridership – an important measure of mobility and a key goal of the capital program since 1992 – has been seen by many as a sign of a transit renaissance and can be specifically tied in this region to capital investments. The report shows that the capital program brought improvements in reliability and the passenger environment throughout the transit system. These improvements in turn stabilized ridership and set the stage for further growth. The capital program then provided for the fare structure that brought millions of new riders to the system. This new mobility, and the lower costs it signifies, helped set the foundation for New York's economic resurgence.

⁵ Based on Port Authority estimates for the 1982-1991 and 1992-1996 plans. See p. 34.

⁶ Cambridge Systematics, *Lasting Economic Benefits of Public Transit Investment* (Cambridge, MA: Cambridge Systematics, 1996), p. 6-2.

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1. Introduction

In the late 1970s and early 1980s, New York's transit system neared total collapse. Frequent derailments, car fires, crime, and graffiti plagued the system and ridership plunged. Residents and businesses fled the city, and suburban commuters stopped taking the train to the city. The system appeared to be out of control and was for many a symbol of the decay into which the city had fallen.

A quarter of a century later, the crisis has become a dim memory. New cars, with working air-conditioning, arrive at clean, well-lit stations; derailments and accidents have become a rarity, and on-time performance has improved continuously. Travel times have dropped, and fare discounts have brought millions of new riders into the system. Suburban commuters have returned to the trains, and developments have sprung up along the train lines. New York City's subway has become a source of civic pride and is seen as a powerful tool for leveraging future economic growth.

While many might take credit for this transformation, there is little doubt that it began when New York focused attention on its failing transit system and implemented a plan to turn the system around. Until the 1980s, the system had been severely undercapitalized. With the establishment of stable sources of funding in 1982, the MTA launched a capital program to restore the system and return it to a system of regular maintenance and replacement. As progress toward these goals was made, the MTA expanded its focus to improved regional mobility. The capital program relied on a steady infusion of capital but its success depended on management's willingness to innovate, modify the program to changing needs, and learn from mistakes.

The most immediate impact of the capital program has been on the transit system's performance. With new rolling stock and better maintenance facilities and programs, the MTA has been able to provide more reliable service and keep more of its equipment in service at any given time. These changes have had measurable effects on operating performance and customer satisfaction. They have also had important effects on the MTA's own financial performance.

This transformation coincided with an overall rejuvenation of New York's economy, and it may be difficult for some to separate the two. Certainly, a healthier economy has made it possible for the region to invest heavily in its transportation system. At the same time, a stronger transit system has played a role in making New York a more attractive place to live and do business.

This report begins with a review of the crisis that the capital program was designed to address. Section 2 discusses the creation of that program and its evolution in response to changing conditions. Section 3 reviews the performance achievements at the MTA and their relation to the capital program. Section 4 takes a broader look at the impact of the capital program on regional mobility and the economy. The report concludes with a review of the capital program's goals and progress since 1982.

1.1. The Transit Crisis

Before exploring the capital program, it is important to review the conditions that led to the breakdown of transit in the region. For decades, New York's transit system suffered from insufficient investment, and by the early 1980s the symptoms of neglect were widespread. Aging equipment at NYCT and the commuter lines broke down with increasing frequency. The Mean Distance Between Failures (MDBF) for subway cars – the average number of miles between breakdowns, and a key measure of reliability – fell from 26,000 miles in 1971 to a low of 6,640 miles in 1981. Preventive maintenance was nonexistent and even purchases of new cars had little effect on overall reliability. MDBF for new cars should have been at least 40,000 miles, but without regularly scheduled maintenance – cars were only repaired after breakdowns – new cars never performed even close to that level. Until the capital program took off, MDBF for a set of 295 cars placed into service in 1972 had never exceeded 9,600 miles, and MDBF for a set of 754 cars purchased in the mid-1970s had never exceeded 17,000 miles.¹

¹ Bear Stearns & Co., *Metropolitan Transportation Authority, Finances of Mass Transit Services in New York City* (New York: Bear Stearns, 1983), p. 22; MTA, *Report to the Governor 1984-1985* (New York: MTA, 1986), p. 9.

The basic infrastructure was also crumbling. Only one-quarter of subway tracks were receiving mandated twice-weekly inspections. With insufficient track maintenance, the number of derailments soared in the early 1980s, to a rate of one every 18 days in 1981-82. After a succession of derailments in early 1983, red tags were placed at 400 locations with suspect track; these red tags instructed train operators to slow to a crawl.

For subway riders, the result was a system that performed unreliably and unsafely, if at all. At the height of the transit crisis in 1983, on-time performance dropped below 50%.² Hundreds of trains never made it to their destination – in 1981, 325 train runs were abandoned on a typical day. Cars caught fire 2,500 times every year.³

Adding to customers' woes was the poor state of the passenger environment. Graffiti covered "every surface," and the stations were "dark and dingy," in the words of Beverly Dolinsky, Executive Director of the Permanent Citizens Advisory Committee to the MTA.⁴ Doors were broken on more than one-third of all cars in 1983, and nearly as many cars had lighting problems.⁵ Crime had become rampant in the subways, with felonies tripling in the 1970s to more than 15,000 in 1981.⁶

NYCT's bus system was also in shambles. In 1980, 837 new buses that were placed into service were then quickly taken out of service for up to two years to replace structural manufacturing defects discovered in the frames. Those buses and service had miserable performance, with Manhattan and Bronx buses breaking down every 315 miles.⁷

Faced with declining conditions and performance, riders fled both the subway and buses during the 1970s. Subway ridership fell below one billion in 1977, half the postwar peak, and bus ridership plummeted 38% in the 1970s. While New York City's weak economy contributed to the declines, the transit system's poor reliability forced riders to use other travel alternatives, in particular the automobile, and pushed many residents and businesses out of the City to the suburbs or outside the region. (Section 4 gives a more complete discussion of the economic impact of the system's decline.) New York City itself was seen as past its prime, and the decaying subway was the chief emblem of its decline.

The commuter lines were also in dire condition. Metro-North approached "total collapse," according to the US Railway Association, due to "virtually nonexistent maintenance."⁸ Poorly maintained fleets at both Metro-North and the Long Island Rail Road (LIRR) meant that cars broke down frequently and had to be kept out of service. Onboard, faulty air-conditioning systems resulted in conductors being issued wedges as standard equipment to prop open car doors for ventilation.⁹

For commuter rail customers, fewer cars in service meant that an average of 4,100 riders were forced to stand every day on Metro-North in 1983, and more than 14,000 every day on the LIRR. During summers these riders additionally endured stifling heat due to faulty air-conditioning systems. A study of LIRR commuters found that "very large percentages suffered additional stress, anxiety, and tiredness as a result of their commuting experience."¹⁰ Such factors contributed to the flight of business from the City to the suburbs or beyond.

² MTA, *Report to the Governor, 1984-1985* (New York: MTA, 1986), p. 18.

³ On-time performance was 70%, but this measure only considers arrivals at terminal points, not the intermediate points that are typically more heavily used. Sources: MTA, *No Standing Still: The MTA Capital Program Phase 3, 1992-1996* (New York: MTA, 1991), p. 4; Bear Stearns & Co., p. 22.

⁴ MTA, *No Standing Still*, p. 4; personal communication with Beverly Dolinsky, Executive Director, Permanent Citizens Advisory Committee to the MTA.

⁵ Straphangers Campaign, *Subway Performance Measures 1980-1990*, from personal communication with Gene Russianoff, Senior Staff Attorney, Straphangers, March 29, 2004.

⁶ Bear Stearns & Co., p. 23.

⁷ *Ibid.*, p. 22.

⁸ MTA, *No Standing Still*, p. 4.

⁹ MTA, *MTA Capital Needs & Opportunities, 1992-2011* (draft) (New York: MTA, March 9, 1990), p. 15.

¹⁰ Wolfgang Quante, *The Exodus of Corporate Headquarters from New York City* (New York: Praeger, 1976), p. 105.

1.2. Origins of the Transit Crisis

The origins of the transit crisis of the 1970s and 1980s can be traced to policies and trends from previous decades. The first two lines of the current subway system were created by a public-private venture. They were financed and owned by the public sector but built and operated by private companies (the Interborough Rapid Transit Company – IRT – and the Brooklyn Manhattan Transit Company – BMT). However, their ability to maintain the capital infrastructure was constrained by public policies, most notably those governing fares. By 1940, the City had taken control of the IRT and BMT, adding them to its own publicly-operated service, the Independent Rapid Transit Railroad (IND), which had begun service in 1932. However, competition for public funds continually left insufficient funds for capital maintenance. On the commuter lines, economic and demographic trends eventually crippled the private companies that owned the lines and prevented them from properly maintaining the systems.

When the IRT opened for service in 1904, it reaped profits from the initial nickel fare, but after World War I, spiraling inflation quickly eroded the profits of the IRT and the BMT (which began operations in 1918-1920) and forced both companies to cut maintenance. The companies lobbied for a fare increase, but by the 1920s, the City was antagonistic toward the companies that had built and operated the system.¹¹ Raising the fare or subsidizing the “plutocrats” of the IRT and BMT was anathema to the City’s political leadership, and the nickel fare became a cornerstone of John Hylan’s mayoral campaign in 1921.¹²

Holding the fare at a nickel as the companies teetered on the edge of bankruptcy, and even after they were sold to the City, resulted in deteriorating service and deferral of new car purchases. The burst of economic activity engendered by World War II brought operating surpluses for a few years, but after the war, inflation drove up costs and the system sank into deficit again. In 1948, the City finally increased the fare to 10¢ and restored the system to solvency. A second fare increase, to 15¢, came five years later with the creation of the independent New York City Transit Authority. While increasing the fare would always be politically difficult, it had become possible, and low fares were no longer such an overwhelming threat to the system’s viability.

However, in the postwar period, maintenance continued to suffer as system expansion took priority. Discussing the Westway project that would have built an underground highway along Manhattan’s West Side, Phillip Lopate writes, “there has always been more money in the city budget to build than to maintain infrastructure;” the same has often been true for transit.¹³ From the 1950s through the 1970s, the Transit Authority repeatedly promised construction of a Second Avenue subway to replace the elevated lines on Second and Third Avenues that had been razed in the 1940s and 1950s. State voters approved bond issues in 1951 and 1967 to fund the new line. In a rare move to put capital upkeep ahead of expansion, the Transit Authority diverted the proceeds of the 1951 issue to purchase replacements for its aging rolling stock, some of which then dated to 1904. Construction of the new line finally began in the 1970s, and the Transit Authority began work on a number of other major capital expansions, as well. In the 1970s, these projects consumed 45% of the Transit Authority’s capital budget and left a decreasing share for upkeep of the existing system.

The history of New York’s commuter lines parallels that of the subway. Metro-North and the LIRR were originally built by private companies, with parts of the New Haven Line dating from 1831, and the LIRR from 1834. With competition from the automobile in the 20th century, commuter lines across the country began a long decline, and after World War II suffered continuous financial problems. The LIRR went bankrupt (for the first time) in 1949, and Penn Central, the owner of what is now Metro-North, failed in 1970. In their weak financial state, the commuter lines reduced capital reinvestment and maintenance. When the lines failed and were finally absorbed by the Metropolitan Transportation Authority (MTA) – the LIRR in 1966, Metro-North in 1983 – there was much room for improvement.

¹¹ Clifton Hood, *722 Miles: The Building of the Subways and How They Transformed New York* (Baltimore: Johns Hopkins University Press, 1993), p. 220.

¹² *Ibid.*, pp. 188-197.

¹³ Phillip Lopate, *Waterfront* (New York: Crown, 2004), p. 81.

2. Evolution of the Capital Program

With both transit and commuter operations in disarray and the region's economic future apparently at stake, the political will to remedy the situation gradually developed. In 1978, the New York City Department of City Planning and the Natural Resources Defense Council released a report that identified the urgent needs in NYCT's infrastructure and rolling stock and argued for a dramatic increase in capital spending.¹⁴ Rider advocates organized the Straphangers Campaign in 1979 and publicized the effects of underinvestment through regular surveys of transit conditions. A Booz-Allen & Hamilton study in 1978 concluded that "it should be clear to all MTA observers and managers that the needs of the MTA and its operating units are overwhelmingly large."¹⁵

These reports highlighted the importance of rehabilitating the transit system and restoring sustainable replacement cycles. They also paved the way for development of an ongoing capital program that has proven vital to the system's rescue.

An important step in developing the capital program was securing new funding. Once this was in place, the MTA developed procedures for investing the funds productively. Needs assessments were developed, line departments were reorganized, and as experience was gained with the capital program, procedures were refined. Finally, as the capital program began to bear fruit, its goals were extended and broadened. This section looks at the creation of the capital program and its transformation in response to changing conditions.

2.1. Securing New Funding

As with other categories of capital equipment, a transit system needs regular replacement and maintenance to operate properly. Tracks need frequent inspection to ensure proper alignment and need to be replaced before they fail; sharply curved segments may need to be replaced as frequently as every nine months.¹⁶ Subway cars have a useful life of 35 to 40 years and commuter rail cars 30 years; both require periodic maintenance and overhauls in order to sustain high performance levels. Buses need replacement after 12 years; passenger stations are thought to require rehabilitation every 35 years; rail bridges and tunnels have useful lives of 100 years or more but require ongoing maintenance. This maintenance, without which the system will deteriorate and eventually fail, requires a continual injection of capital dollars.

A sustained capital program also involves periodic assessment of needs on which to base the funding. It requires an inventory of the system's capital assets, determination of the useful life of each asset and an assessment of the replacement costs and the cost of maintaining the asset over its life cycle. Such evaluations do not appear to have been made on a regular basis until the early 1980s but have become an integral part of the MTA's capital planning process.

Before that, unreliable funding meant that NYCT and the commuter lines were unable to meet their capital replenishment needs. Calculations by Bear, Stearns and Company using a conservative 60-year straight-line depreciation schedule found that in the 1970s, the Transit Authority needed to spend \$1.46 billion per year (in 2004 dollars) to maintain its capital stock. At the time, the agency was investing only \$301 million annually on such upkeep.¹⁷ Similarly, the Conrail lines that became Metro-North needed \$283 million annually for capital replenishment but received only \$65 million per year.¹⁸ With funding levels "so far below any objective estimate of maintenance costs...eventually no one felt the need to make such

¹⁴ Wagner, Robert F. Jr., *A New Direction in Transit* (New York: New York City Department of City Planning [NYC DCP], 1978).

¹⁵ Booz-Allen & Hamilton Inc., Transportation Consulting Division, *New York MTA Management Study* (New York: Booz-Allen & Hamilton, 1980), p. 6.

¹⁶ MTA, *MTA Capital Program 1982-1991* (New York: MTA, May 1992), p. IIA-29.

¹⁷ Bear, Stearns & Co., p. 19.

¹⁸ Howard Permut, "Implementing Change Successfully: MTA Metro-North Railroad Case Study," lecture notes for National Transit Institute class, 2004; and Richard Ravitch, "Foreword," *Staff Report of Capital Revitalization for the 1980s and Beyond* (New York: MTA, 1980), p. I-2.

estimates,” according to one observer.¹⁹ The result was a gradual aging and deterioration of the transit system that led to its near collapse.

For New York City Transit, the funding that existed was largely from Federal sources. Although the City was legally responsible for the upkeep of the subway, by the late 1970s it was providing only 5% of the agency’s capital funds. The largest contributor by far to the capital program was the Federal government: grants from the Urban Mass Transportation Administration and the Federal Aid to Urban Systems program provided 78% of NYCT’s capital funding. State bond issues accounted for 14% of the capital budget, and direct state subsidies made up the remaining 3% (Figure 1).²⁰

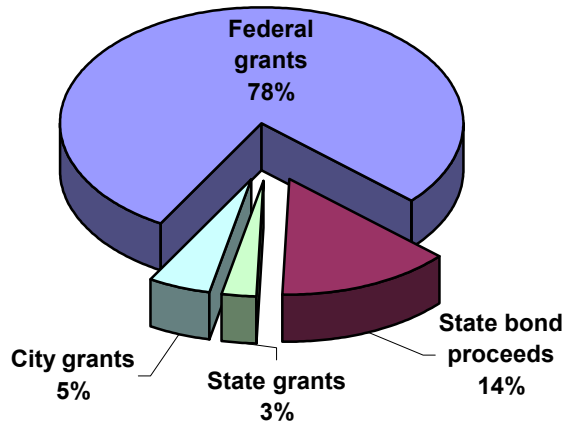


Figure 1. New York City Transit Capital Funding Sources, 1975-1978

Source: compiled from MTA annual reports, capital plans, twenty-year capital needs assessments, strategic business plans and authors’ calculations

On the commuter lines, the State began providing capital subsidies in 1974 to the LIRR and to Metro-North’s predecessors. For the subway and the commuter lines, the level of capital investment was far too low to maintain the existing infrastructure; even so, at NYCT, 45% of these funds were spent not on upkeep but on system expansion.

In 1979, Governor Hugh Carey asked Richard Ravitch to lead the agency. Ravitch, an accomplished builder and developer, had “no illusions that it would be

anything less than a full-time commitment.”²¹ Within months, he initiated a system-wide survey of capital needs. The survey, completed by the end of 1980, proposed a 10-year capital program of \$14.4 billion to restore the system to a State of Good Repair (SGR), and an additional \$3 billion program of system expansion and improvements.

Ravitch took his case to local, state, and federal officials, and after intense lobbying and strenuous negotiations, won large funding commitments at all levels. The federal government agreed to extend “safe harbor leasing” to the public sector, a tax break that led to \$754 million for the MTA over the next decade. Ravitch negotiated favorable financing terms from subway car manufacturers overseas and fought for a large share of increased federal transit funding in 1982. From New York State, he obtained a 10-year commitment for transit subsidies against which the MTA could write bonds, and the MTA received the authority to issue bonds backed by the fare box. The MTA also secured \$1.5 billion in Federal highway funds that had been previously designated for the (canceled) Westway highway project.

At the same time, New York City increased its commitment to NYCT, from \$40 million annually in the late 1970s to \$245 million in 1982-1986 and \$305 million in 1987-1991. New York State provided \$87 million per year in direct appropriations for the capital program in its first decade, in addition to the State service contract bonds and the new taxes. With these new funding sources, support for the capital program was distributed broadly, as shown in Figure 2, and the MTA was able to dramatically increase the level of capital spending. At New York City Transit, capital investment rose from \$776 million per year in the late 1970s to \$1.9 billion between 1982 and 1991. Similarly, capital investment at Metro-North rose from

¹⁹ James Lardner, “Painting the Elephant,” *The New Yorker* (June 25, 1984): 42-43.

²⁰ Wagner, p. XII-4.

²¹ Lardner, p. 42.

approximately \$60 million per year to \$260 million, and at the LIRR from \$72 million to \$301 million (all figures in 2004 dollars).²²

Ravitch was also successful in modifying the capital planning process. In the 1970s, each capital project needed to be approved by a myriad of agencies at all levels of government. In part to streamline the process, the Legislature authorized a five-year planning process and created a Capital Program Review Board (CPRB) to approve changes.²³ The State's approval was thereby limited to an all-or-nothing vote on the entire plan. The City's involvement was similarly restricted; it was given a seat on the CPRB and could veto the overall plan as it related to New York City Transit.

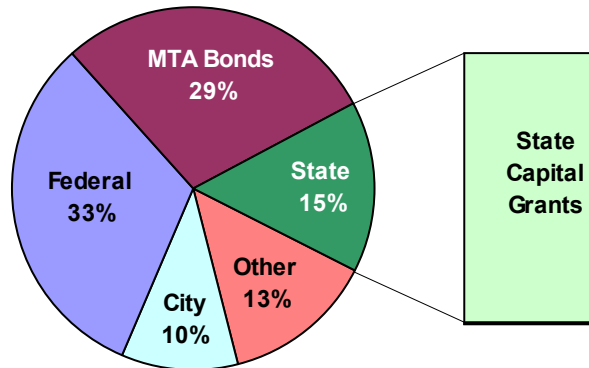


Figure 2. MTA Capital Program Funding Sources, 1982-1991

Source: compiled from MTA annual reports, capital plans, twenty-year capital needs assessments, strategic business plans and authors' calculations

2.2. Renewing the Organization

In initiating the MTA's capital program, Richard Ravitch's signature achievement was assembling the financial resources to support the system's revitalization. More was needed than just dollars, however; as James Lardner wrote in *The New Yorker*, the MTA needed "someone who would concentrate his energies on the inner workings of the institution."²⁴ A new Governor, Mario Cuomo, appointed Robert Kiley to replace Ravitch in 1983. Along with David Gunn, the new NYCT president, Kiley introduced managerial and operational changes that would allow the MTA to effectively execute the capital program.

In his first Report to the Governor, Kiley reported that "the root of the problem, along with years of disinvestment, was the absence of real management: hardly anyone could be held accountable for the performance of some 51,000 employees."²⁵ He and Gunn found that there were only 100 managers in the field supervising day-to-day operations, and a total of 600 managers in all of NYCT. There were an additional 5,000 supervisors, but these were insulated from accountability by both union and civil-service protections.

The Track and Structures Department exemplified this weak organization. With 5,000 employees, it had only 11 line managers who could be held accountable for maintaining the 830 miles of track, 73 miles of elevated structures, 465 stations, and 133 miles of tunnels. With such an organization, the department had "foundered." Deteriorating track conditions contributed to as many as 20 derailments in 1983 and 15 in 1984. On-time performance plummeted as the agency slowed trains to a crawl at 400 locations with suspect track.²⁶

Kiley temporarily suspended nearly all capital work in 1984 and set about reforming the MTA internally. Gunn and Kiley went to the Legislature in 1984 and received approval to hire an additional 1,200 non-

²² Where no citation is given, spending levels and performance figures given here have been compiled from MTA annual reports, capital plans, twenty-year capital needs assessments, strategic business plans, and documents provided to the authors. The inflation index used for capital costs is the Bureau of Labor Statistics' index for nonresidential construction prices, supplied by the MTA. The index used to deflate operating expenses is the regional Consumer Price Index.

²³ The CPRB has four members, and approval of the Capital Plan requires unanimous consent. The Governor, the State Senate, and the State Assembly each have one representative, and New York City has a representative who votes on City transit plans.

²⁴ Lardner, p. 72.

²⁵ Robert Kiley, Foreword, *Report to the Governor, 1984-1985*, p. 2.

²⁶ MTA, *Report to the Governor, 1984-1985*, p. 18.

civil-service managers. They placed managers in every shop, yard, and depot. The Track and Structures Department was reconstituted, and the number of managers increased to 165. Union rules were amended, and senior management set specific performance and financial goals. Gunn also established a program to eliminate graffiti from the subway cars and buses.

2.3. Identifying Needs

At the heart of the capital program is a needs assessment. Along with its five-year capital plans, the MTA has periodically released a twenty-year needs assessment that identifies goals for the program and the investments required to achieve those goals. In 1981, the MTA defined the program's initial goals and prioritized them as follows:²⁷

1. Reestablish and maintain reliable operations.
2. Ensure the long-term survival of the system and its safe, reliable operation at a reasonable operating cost.
3. Make other improvements to the existing system, such as greater commuter rail system capacity and passenger environment improvements.
4. Complete existing subway expansion projects.

In this first needs assessment, each MTA agency identified the specific work necessary to achieve these goals. The work was grouped by both the type of asset upon which it would be performed – rolling stock, track, passenger stations, signals, and so on – and the class of need it addressed. The needs classifications were refined over the years but essentially are the following:²⁸

- State of Good Repair (SGR): projects that correct for previously deferred maintenance or replace aging equipment and facilities that are already beyond their useful lives.
- Normal Replacement (NR): projects that maintain good repair by replacing components as they reach the ends of their useful lives.
- System Improvement (SI): improvements that add track and train service to the existing configuration of the MTA network; reduce congestion by eliminating bottlenecks and other constraints; make service more reliable, pleasant, and comfortable; reduce travel time; and provide increased information for customers and employees.
- Network Expansion (NE): projects that expand the current system in order to serve increasing travel demand in regional corridors. Includes new rail lines or additional tracks and service extensions beyond existing terminals, and projects that strengthen market share and capture new markets.

These classifications roughly correspond to the original goals but the definitions have shifted over time in response to changing conditions. The definition of State of Good Repair in particular has been implicitly redefined to accommodate technological advances and rising customer expectations.²⁹

Successive assessments have looked at needs over a twenty-year period and identified objectives in the context of the region's critical transportation issues and economic and demographic trends. The initial assessment in 1981 estimated that the MTA would restore the transit system within ten years, after which it would transition to cyclical replacement cycles for all asset categories. As the capital program commenced, this forecast proved optimistic and was updated after a more thorough assessment in 1986. With the experience of the capital program to date, this new assessment stated that while many components of the system would reach a State of Good Repair by 1991, some would not achieve that goal until after 2006, the horizon date for the report. Target dates for each asset category have been updated in each capital plan and assessment since, and while progress has continued, some assets are now forecast to reach SGR as late as 2028.

²⁷ The initial needs assessment covered a ten-year period. Source: MTA, *Submission to the MTA Capital Program Review Board* (New York: MTA, 1981), p. II.A.1.2-3.

²⁸ MTA, *MTA Capital Needs & Opportunities, 1992-2011*, pp. 28 and 47.

²⁹ Mysore Nagaraja, President of MTA Capital Construction, Department of Capital Program Management, MTA New York City Transit, personal communication, March 22, 2004.

2.4. Investments 1982-1991

At NYCT, the focus of the program in its first decade was on restoring reliable operations and establishing normal replacement cycles. The agency set specific performance targets for reliability, on-time performance, abandonments, and passenger environment improvements. System expansion projects were to be advanced “only after the more basic needs to reestablish operations and ensure long term survival are satisfied.”³⁰ Expansion projects already under construction were brought to an orderly conclusion.

The agency’s first significant investment was in new and upgraded rolling stock. In the first ten years of the capital program, NYCT purchased 1,775 new cars and overhauled nearly 3,900 others. It also purchased 2,500 new buses during that period. Ninety-nine percent of the buses had air-conditioning, and NYCT’s bus system was the first in the country to be handicapped-accessible: by 1991, 90% of the fleet was equipped with wheelchair lifts.

Billions of dollars also went to the “invisible” infrastructure, the parts of the system not necessarily visible to customers but critical to its smooth operation. For example, 472 miles of fiber-optic cable were laid in the late 1980s to replace much of the existing telephone system. Older manually-operated power substations, with hard to find replacement parts and hazardous components, were replaced and upgraded with solid-state electronics and remote controls. Seven of 16 subway car service shops were overhauled, and for buses, the agency rehabilitated seven depots and replaced five others. A track geometry car was purchased in 1982 to verify track alignment and ensure the safety of the cars and riding on those rails. A second car purchased in 1987 checked tunnel clearances and wear and tear of the rails.

As with the subway, neglect of the commuter lines had led to poor reliability, but insufficient funding had also meant that fleets had not been expanded to accommodate the growing number of suburban commuters. In the first decade of the program, therefore, the MTA sought not only to restore the existing system but to add new capacity. The LIRR, for example, built a new storage yard at Penn Station to allow for increased peak-period service and more frequent cleaning and inspection. Electrification of the Ronkonkoma line from Hicksville reduced travel times and allowed direct service to Penn Station. Metro-North, which had seen significant ridership growth during the 1970s, added capacity with new car purchases and electrified the Upper Harlem line to decrease commute times by as much as 30 minutes.

2.5. Emerging from the Crisis 1992-1999

As the second five-year capital plan neared completion in 1991, the MTA found it more difficult to rally support for the program. When the first capital plan was proposed in 1981, the system’s poor condition was obvious, and when that plan came up for renewal five years later, it was not difficult to argue for continued funding of the system’s restoration. Beyond the purchases of new rolling stock, there was little in the way of visible improvement. By 1991, however, significant progress had been achieved throughout the system: graffiti had been eradicated; the entire subway fleet had been replaced or rehabilitated; the subway track was in a State of Good Repair; and the commuter lines had received new rolling stock. The remaining problems were far less visible and it became more difficult to persuade policymakers to maintain a high level of funding.³¹

In the changed environment, the MTA saw the need to make a “strategic” case for continued funding from all levels of government. As part of this effort, the MTA released a twenty-year needs assessment, tellingly titled, “MTA Capital Needs *and Opportunities*, 1992-2011” [italics added]. Moving beyond restoration of the existing system, the report argued that the purpose of the capital program should be to “keep the region moving by getting people out of cars and onto transit.” It explored trends of increasing automobile dependence and the costs of growing congestion throughout the region, including traffic delays, air pollution, and lower overall quality of life.

To address these issues, the MTA proposed not only to continue rebuilding the transit system to maintain the hard-won gains, but to embark anew on a program of upgrading the system to remove barriers to

³⁰ MTA, *Submission to the MTA Capital Program Review Board* (New York: MTA, 1981), p. II.A.1.2-3.

³¹ MTA publications treat the 1982-1986 and 1987-1991 plans as one ten-year plan.

ridership growth and provide transit to underserved corridors, particularly those facing severe traffic congestion. The centerpiece of the program was a new Automated Fare Collection (AFC) system (eventually branded as MetroCard) that allowed the MTA to offer fare products such as monthly and weekly passes and free transfers between the subway and buses.³²

The MTA's new chairman, Peter Stangl, sought public support for the program, but in Albany he found himself in a protracted struggle over funding with then-Governor Mario Cuomo. Stangl proposed a \$9.6 billion plan (in 1992 dollars); Cuomo wanted an \$8.1 billion plan. Much of the debate was over the way an increase in the Petroleum Business Tax (PBT) would be divided between transit and highways. In the end, the MTA was awarded the higher level of funding and a 34% share of the PBT.³³

The new plan marked a turning point in the financing of the capital program. The PBT provided a solid foundation for the issuance of additional bonds; yet State subsidies fell. The State continued paying the debt service on the service contract bonds issued under the first two capital plans, but in the late 1980s it ended nearly all grants to the capital program, fundamentally changing the nature of the State's financial contribution to the MTA capital program. Furthermore, the City reduced its support by \$150 million annually in 1992 (in 2004 dollars). (Five years later, the City later restored some funding so the annual contribution was only reduced to \$243 million in 1992-1999 from \$277 million in 1982-1991.³⁴)

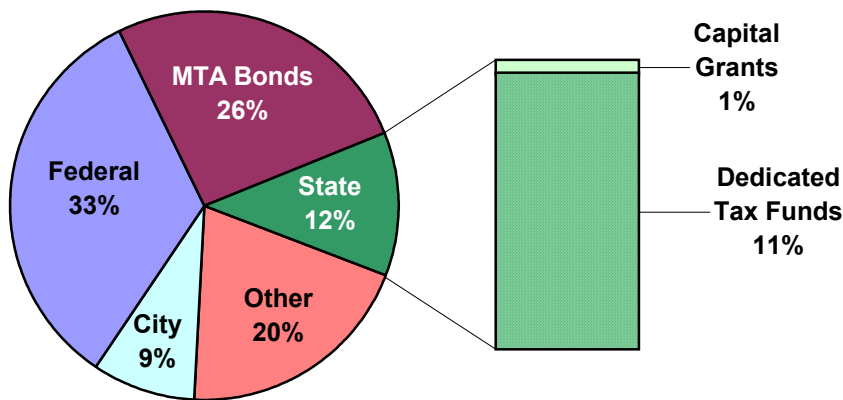


Figure 3. MTA Capital Program Funding Sources, 1992-1999

Source: compiled from MTA annual reports, capital plans, twenty-year capital needs assessments, strategic business plans and authors' calculations

There is much debate surrounding this change in the nature of the State's financial contribution. The State perspective is that its contribution to the MTA capital program has remained relatively constant, with 15% of the program's support coming from State funds in 1982-1991; 12% in 1992-1999; and 18% in 2000-2004. (See Figures 2, 3, and 6.)

The State contends that although direct subsidies ended in the 2000-2004 capital plan, it continues to authorize funding for the

MTA Dedicated Trust Fund (DTF), which is used for debt service. The State believes that this demonstrates its continued commitment to the MTA and allows for more flexibility in how the monies are used. However, the picture is more complex since the benefits and risks have shifted with the use of monies for the DTF in place of direct subsidies. In fact, an October 2004 report from the Office of the State Comptroller notes that the State's contribution is now "markedly different from a capital grant, because the MTA and not the State is responsible for the cost of borrowing. Moreover, the burden that these bonds place on the MTA operating budget is not fixed, but rises and falls with economically sensitive tax revenues, which are subject to business cycles."³⁵

³² Jay Walder, Managing Director, Finance and Planning, Transport for London, personal communication, March 25, 2004.

³³ New York State Department of Transportation, "State Transportation Operating Assistance (STOA)," www.dot.state.ny.us/pubtrans/stoa.html (referenced October 11, 2004).

³⁴ The 1992-1996 plan was extended to 1999 with a fourth five-year plan for 1995-1999. MTA publications generally treat the two plans as one covering the 1992-1999 period.

³⁵ New York State, Office of the State Comptroller, *Review of the Proposed Financial Plan and Capital Program for the Metropolitan Transportation Authority*, Report 7-2005 (NY: Office of the State Comptroller, October 2004), p. 31.

Monies for the DTF are derived from several taxes collected by the State: the petroleum business tax; the motor fuel tax; motor vehicle fees; a 1/4% district sales tax; a franchise tax and temporary franchise surcharges that are imposed on certain transportation and transmission companies.³⁶ It is important to point out that payment of dedicated tax fund revenues to the DTF “is subject to and dependent upon annual appropriations being made by the State Legislature.”³⁷ Further, “the State Legislature is not obligated to make appropriations to fund the MTA Dedicated Tax Fund, and there can be no assurance that the State Legislature will make any such appropriation.”³⁸ Thus, the MTA bears the risk on the bonds that are issued.

Regardless of how one tallies the funds for the DTF (i.e., as State-authorized dedicated taxes or as MTA bonds), there is no question that the MTA’s overall reliance on debt has increased significantly (Figure 4). The result, according to the State Comptroller report, is a “heavy burden” on the MTA’s operating budget.

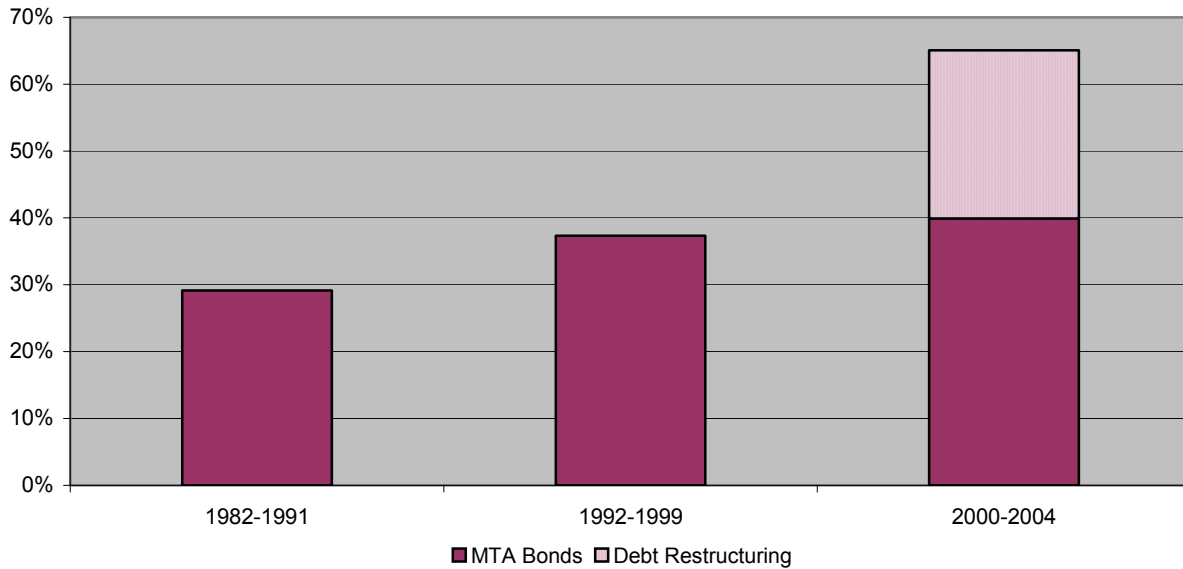


Figure 4. Percent of MTA Capital Program Financed by Debt

Source: compiled from MTA annual reports, capital plans, twenty-year capital needs assessments, strategic business plans and authors' calculations

Despite concerns over its increasing reliance on debt, the MTA continued its ambitious program. At NYCT, 19% of the funds went to System Improvement, up from 13% in the first decade. The agency invested \$736 million (in 2004 dollars) to install thousands of subway turnstiles, vending machines, and MetroCard readers on buses, as well as the necessary supporting infrastructure such as power systems.³⁹ When MetroCard was finally in place system-wide in 1997, it allowed the MTA to introduce fare discounts and free bus-subway transfers.

The MTA also expanded service to new markets. Metro-North extended its Harlem line to Wassaic and added to its fleet to support rapidly growing ridership. NYCT continued construction of the 63rd Street connector to the Queens Boulevard line to relieve overcrowding on one of the most congested subway corridors, and it revived consideration of the Second Avenue Subway to provide congestion relief and new capacity on Manhattan’s East Side. The LIRR began planning a link to Grand Central Terminal with the aim of providing additional capacity and a greater range of travel options.

³⁶ MTA, *Combined Continuing Disclosure Findings 2004*, pg A-101.

³⁷ *Ibid.*, p. A-104

³⁸ *Ibid.*

³⁹ In 1989-1991, the agency had spent \$363 million developing and beginning installation of the AFC system.

At the same time, the MTA continued its primary focus on restoring the transit system: nearly 80% of the capital program went to SGR and NR projects.⁴⁰ One quarter of the entire program was for purchases of new rolling stock, including clean-fuel buses, new-technology subway cars, and new electric and bi-level diesel coaches on the commuter lines to replace 35- and 40-year old equipment.⁴¹ The LIRR introduced dual-mode locomotives to provide a one-seat ride for commuters from diesel territory into the City, where the tunnels are electrified. Station rehabilitation was also a major focus of 1992-1999, accounting for another 22% of the total program. Major projects included the restoration of Grand Central Terminal to its historic grandeur, new retail developments in the station, and new access points at the north end of the station. On the LIRR, key stations including Jamaica, Bayside, Manhasset, Hicksville, and Babylon were rehabilitated, while for the subway, NYCT embarked on projects at Times Square, Atlantic Avenue, 72nd Street/Broadway, Main Street/Flushing, and 161st Street/Yankee Stadium.

The MTA continued restoring the “invisible” infrastructure as well. Among other projects, NYCT rebuilt the Lenox Avenue tunnel and the Franklin Avenue shuttle; ordered a second vacuum train to remove debris from subway tracks; and began replacing its antiquated signal system with a centralized control center and electronic signaling. The LIRR began installing a new fiber optic communications network, while Metro-North rehabilitated its deteriorating Park Avenue viaduct.

Overall, the MTA made progress toward achieving SGR: at the LIRR, all categories except bridges and viaducts achieved SGR by 1999, while at Metro-North, only four categories had not yet achieved SGR and those were all above 80% of SGR. NYCT, which had begun the capital program in much worse condition than the commuter lines, brought all but three categories to above 50% of SGR. The steady progress toward SGR meant that in many categories, the MTA could finally begin normal replacement cycles. As a result, the share of the core (non-expansion) program directed to Normal Replacement increased from 5% in 1982-1991 to 39% in 1992-1999, and to 46% in the 2000-2004 capital plan (Figure 5).

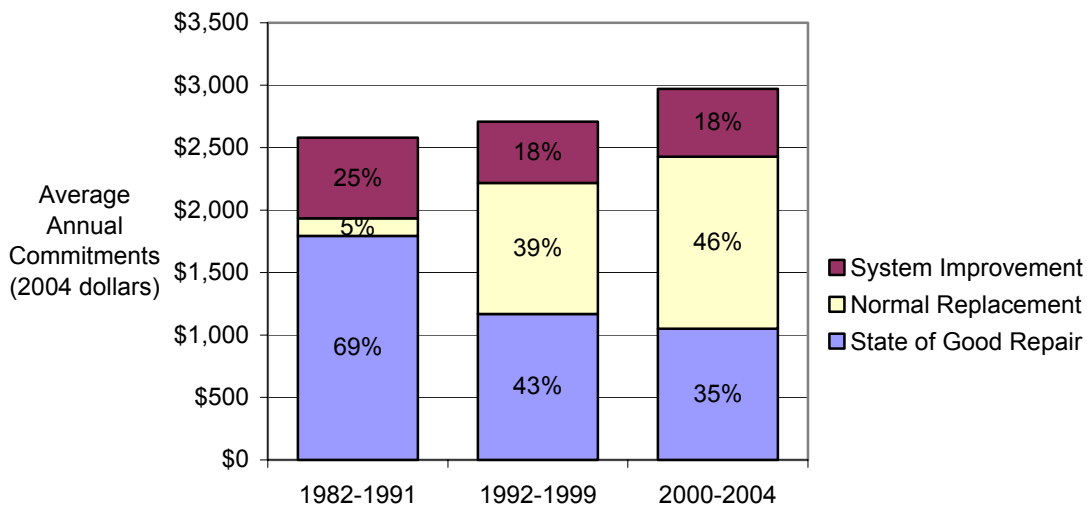


Figure 5. Composition of the Core Program

Source: compiled from MTA annual reports, capital plans, twenty-year capital needs assessments, strategic business plans and authors' calculations

⁴⁰ Capital Program 2000-2004. New York: MTA, 2000.

⁴¹ Some rolling stock purchases were not part of the SGR or NR classifications but represented capacity improvements and were classified under System Improvement.

2.6. Toward Expansion 2000-2004

The 2000-2004 Plan saw continued evolution of the capital program from an almost single-minded focus on reviving the system to a broader focus on regional mobility. Having made progress toward restoring the system, and with a dramatic surge in ridership straining the subway's capacity, the MTA was "now poised for the next step," according to its five-year plan.⁴² Governor George Pataki had put forward a Master Links proposal in 1996 that included LIRR access to Grand Central and new links to JFK and LaGuardia airports; his appointees as chairmen, E. Virgil Conway (1995-2000) and Peter Kalikow (2001-present) now incorporated these projects into the capital program. The plan also revived consideration of a Second Avenue Subway. These projects, and Federally-funded projects directed at the restoration of Lower Manhattan after September 11, 2001, accounted for \$4.4 billion of the total \$19.1 billion program. Still, nearly three-quarters of the program was directed to the core program of system restoration, cyclical replacement, and improvement projects such as new elevators to provide access for the disabled.⁴³

From the 1992-1999 plan to the 2000-2004 plan, MTA yearly spending increased by \$1 billion, from an average of \$2.78 billion to \$3.78 billion. While the total amount of federal transit funding grew from \$927 million per year to \$1.03 billion annually, the share of the MTA capital program's funding represented by federal contributions decreased from 33% to 27%. The City's contribution dropped from an average of \$243 million per year in 1992-1999 (9%) to just \$95 million (3%). The amount of dedicated tax funds that the State provided more than doubled, from \$315 million per year to \$686 million, increasing from 11% in 1992-1999 to 18% in 2000-2004 (Figure 6).

New bond issues and a restructuring of existing debt supplied a large portion of the MTA's funding in the 2000-2004 program. The MTA issued an annual average of \$1.5 billion in new debt, nearly double the \$780 million of the 1982-1991 plan (in 2004 dollars). The MTA had planned additionally to raise funds through a bond act that would also have supported highway projects throughout the State, but voters defeated the proposal at the polls in 2000, leaving a \$1.6 billion deficit in the capital budget. The MTA addressed this shortfall and raised additional funds – a total of \$4.5 billion – by taking advantage of favorable interest rates and restructuring its existing debt. The restructuring was not without cost, since it committed the MTA to high levels of debt service far into the future, with the average bond maturity increasing from 13 to 20 years. In fact, debt service is expected to more than double over the next four years, from \$797 million in 2003 to \$1.7 billion in 2007.⁴⁴

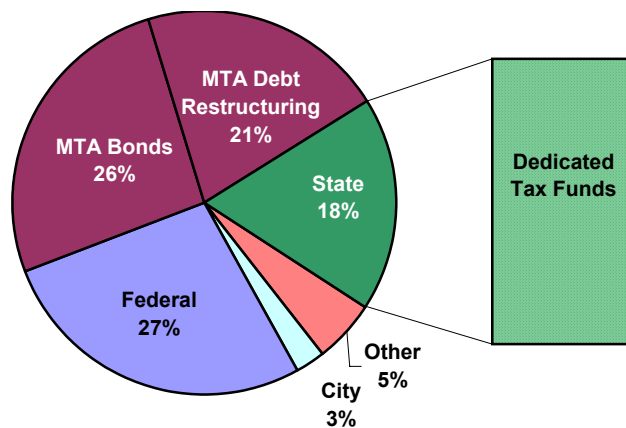


Figure 6. MTA Capital Program Funding Sources, 2000-2004

Source: compiled from MTA annual reports, capital plans, twenty-year capital needs assessments, strategic business plans and authors' calculations

⁴² MTA, *MTA Capital Program, 2000-2004* (New York: MTA, 2000), p. 1.

⁴³ The \$4.4 billion includes \$619 million for security enhancements and \$1.15 billion for Federally-funded projects at Fulton Street and South Ferry, part of the September 11 recovery effort. Not included is \$217 million for repair of the 1/9 line that ran under the World Trade Center.

⁴⁴ Included in the debt restructuring were state service contract bonds issued in the 1980s. Restructuring these bonds extended the State's debt service commitment to 2031 and released \$776 million in debt service reserves for the MTA. This amount is included in the \$4.5 billion debt restructuring. Source: Katherine Lapp, Executive Director & Chief Operating Officer, MTA, "The MTA: Progress Made and Challenges Ahead," Breakfast Series, NYU-Rudin Center, The Kimmel Center, New York, December 10, 2003.

The 2000-2004 period was characterized by continued investment toward achieving a state of good repair; SGR and NR accounted for 82% of the core program. Much of this was for rolling stock to replace equipment or support burgeoning ridership: the MTA purchased 1,210 new subway cars, 1,065 buses including hundreds of higher-capacity articulated buses and high-capacity express buses, and 698 commuter rail coaches.⁴⁵ NYCT made major investments in the invisible infrastructure, replacing fifty miles of tunnel lighting, reconstructing or building new car yards and bus depots, and advancing a major modernization of its signal system. The LIRR began rolling out a new fleet of electric trains and invested in improved and expanded parking facilities and station upgrades. Metro-North also upgraded its fleet, rehabilitated passenger stations, and invested in new or replacement yards and shops.

With the broadening of the capital program to include network expansion, the MTA created a Capital Construction Company to oversee new projects. The MTA began construction of a new link between the LIRR and Grand Central Terminal that would cut travel times for thousands of riders and give the LIRR more operational flexibility. The Second Avenue Subway – a new line in Manhattan from 125th Street to Hanover Square that would serve more than half a million riders daily – progressed beyond preliminary engineering and the Federal environmental review process. The Agency also developed plans for a westward extension of the #7 line and began exploring a link between Lower Manhattan and JFK Airport. Together, these reflected the first significant expansion efforts in half a century.

2.7. Summary

With this ambitious expansion program, the MTA has made significant progress from the early 1980s when Richard Ravitch was forced to close down or conclude existing projects. The evolution of the program has demonstrated the critical role of key aspects of the capital program, each of which has proven integral to the program's success.

First, an important trend of the capital program, and one indicative of its success, is the continual development of its central goals. As indicated earlier, the program began with the mission of restoring the system to a condition of good repair. It was initially expected that this restoration would take ten years, after which the agencies would be able to resume normal replacement cycles. While the forecast proved optimistic, the program has indeed progressed such that normal replacement now consumes more of the budget than does system restoration, and accounts for the vast majority of the core budget at the commuter lines.

At the same time, as performance improved, the MTA expanded its vision to include broader mobility goals. In 1992, the MTA proposed transit improvements that built on the restored system and would attract new riders. In 2000, the MTA proposed expansion projects as a means for addressing regional congestion as well as capacity constraints on both the subway and commuter systems. This broadening of the vision reflects not only the achievement of much of the program's original objectives but also the system's success in attracting new riders. (Section 4 looks more closely at the relationship between the program and the increase in ridership.)

Internally, the capital program has also been shaped by the MTA's responses to changing conditions. Most notably, the station renovation program was transformed several times, as the MTA learned more about the costs of rehabilitating its stations. At first, many stations were slated only to receive a new contemporary-style façade; the redbrick walls at 49th Street on the Broadway line exemplify this work. While carrying out these surface renovations in the 1980s, however, engineers often uncovered more fundamental problems that needed to be addressed, and the program was changed to include more complete rehabilitation. In more recent years, the MTA has saved monies by simultaneously scheduling rehabilitation work at adjacent stations.

⁴⁵ Includes 65 coaches for the Port Jervis and Pascack Valley Lines operated by New Jersey Transit.

The second ingredient critical to the success of the capital program is the steady infusion of dollars. The existence of stable funding sources has allowed the MTA to make long-term commitments, such as multi-year car purchases, and plan long-term projects that would otherwise have been impossible to carry out. In arguing for long-term Federal commitments in 1980, Richard Ravitch stated that,

The ability...to be able to plan a capital program with the knowledge that the money is available in the marketplace, would be of inestimably greater value to us than the current process of waiting year by year for appropriations to come forth...One cannot reasonably commit to a housing development while waiting each year to find out if there are enough funds to build each successive floor. Our transit system should be viewed in the same way.⁴⁶

During the capital program's first decade, the MTA received stable support from government at all levels. Federal support has remained fairly steady since then and, in fact, increased in real terms. Beginning in 1991, however, the capital program has seen a decrease in local government support and a significant change in the nature of funds provided by the State. New York City has reduced its annual contribution to less than \$100 million since 2000. Before 1991, the majority of State funding came in the form of capital grants. Since 1991, however, the State has supplied few capital grants, instead contributing dedicated tax funds, which are pledged for the payment of debt service. In the absence of direct capital support, the MTA has relied to an increasing degree on bonding, such that in 2000-2004, roughly two-thirds of the capital program was financed by debt.⁴⁷ This increase in reliance on debt and restructuring of existing debt has allowed the MTA to continue its ambitious capital program, but has greatly increased the MTA's yearly debt service burden through 2031.

⁴⁶ Richard Ravitch, Foreword, *Staff Report of Capital Revitalization for the 1980s and Beyond* (New York: MTA, 1980), pp. 8-9.

⁴⁷ Where no citation is given, spending levels and performance figures given here have been compiled from MTA annual reports, capital plans, twenty-year capital needs assessments, strategic business plans, and documents provided to the authors. The inflation index used for capital costs is the Bureau of Labor Statistics' index for nonresidential construction prices, supplied by the MTA. The index used to deflate operating expenses is the regional Consumer Price Index.

3. Achievements of the Capital Program

The process of capital programming has been integral to the huge strides made by the MTA in restoring the region's transit system. For the most part, these achievements are the result of sustained investment since 1982 – a total of \$68 billion in 2004 dollars – in restoring the system to a State of Good Repair. In some cases, such as improved reliability, the connection is clear: new cars and maintenance facilities, and new maintenance practices, have resulted in fewer breakdowns. In the case of other measures, such as customer satisfaction, the connection is harder to make, but inferences can be drawn. This section reviews the investments and performance achievements of the MTA since 1982 and the relationship between the capital program and those achievements. It also looks at gains in operating efficiency at the MTA over the last two decades and the impact of the capital program on that performance.

3.1. Physical Investments

While the MTA classifies its capital program by needs, it is instructive to look at the actual investments by agency and by category of infrastructure. Including projected commitments for 2004, the following are highlights of the major investments since 1982 (all figures are in 2004 dollars):

New York City Transit

- Subway cars (\$11.3 billion): since 1982, NYCT has purchased 4,277 new subway cars and overhauled 4,174 cars. The cars reached a State of Good Repair in 1992. The latest cars feature computerized announcements and digital displays of the next station.
- Buses (\$2.8 billion): the agency has turned over nearly all of its fleet two times, and increased the size of the fleet from a low of 3,659 in 1992 to over 4,600 in 2000 toward a target size of over 5,000. The fleet reached SGR in 1986. By 1993, all of the buses were air-conditioned, and the fleet was the first large system in the country to have wheelchair lifts on all of its buses. Since 2000, all new buses purchased use clean-fuel technologies.
- Passenger stations (\$6.9 billion): of 468 stations, the agency has renovated almost one-half. Major renovations completed or underway include Flushing Main Street, Times Square, Union Square, Grand Central, Atlantic Avenue, 72nd St./Broadway, and 161st St./Yankee Stadium. Elevators have been added to more than 30 stations as part of a program to make 100 stations wheelchair-accessible by 2020.
- Track (\$4.6 billion): the 628 miles of track reached SGR in 1991. In the first 10 years of the capital program, NYCT replaced or reconstructed 594 miles.
- Infrastructure⁴⁸ (\$5.16 billion): of the 417 track miles of tunnel lighting, more than half had reached SGR by 2004; almost two-thirds of the 202 ventilation plants had reached SGR; and over 90% of the 289 pump rooms had reached SGR. Major structures include 14 under-river tunnels and 70 miles of elevated track. Significant line structures have been rebuilt, including the Lenox Avenue tunnel and the Franklin Avenue shuttle.
- Signals and Communications: (\$4.9 billion): roughly 100% of A division signals are in good repair. Signals have been consolidated into a central command center and automated train supervision (ATS) has been introduced. Along with Communication-Based Train Control (CBTC), ATS will allow centralized train control and improve reliability and flexibility. Future plans call for ATS to be installed on the BMT and CBTC to be installed on the IND lines. Other upgrades include hundreds of miles of fiber-optic cable to replace antiquated communications wiring, and modernization of manually operated power stations with remotely controlled equipment.

⁴⁸ Here, infrastructure refers to the categories of line equipment and line structures.

- Shops, yards, and bus depots (\$4.3 billion): by 2004, 80% of the tracks and signals in the 23 train yards operated by NYCT were in SGR. The agency built 5 new depots for servicing its buses and rebuilt or rehabilitated most of the rest. It added support for a diversified fleet including articulated buses and clean fuel buses. By 2000, all but two of the 20 depots were at SGR.
- MetroCard (\$1.1 billion): NYCT installed thousands of turnstiles, vending machines, and MetroCard readers on buses, as well as a supporting infrastructure. MetroCard allowed NYCT to introduce fare discounts and free bus-subway transfers.
- 63rd St. Connector (\$870 million): the agency completed a new subway connection between Queens and Manhattan, relieving conditions on the overcrowded Queens Boulevard line.
- Second Avenue Subway: construction is slated to begin early in 2005 on the first segment of a line that is projected to carry 220,000 riders daily and relieve chronic overcrowding on the Lexington Avenue line.

Long Island Rail Road

- Rolling stock (\$2.7 billion): the LIRR has replaced or overhauled its entire fleet of 914 electric and 134 diesel coaches. Dual-mode locomotives introduced in the 1990s have allowed the LIRR to provide one-seat rides into Penn Station from diesel lines.
- Passenger stations (\$1.4 billion): Penn Station received major improvements in the 1980s, including a direct connection to the Eighth Avenue subway and better access to the main concourse from train platforms. Major renovations have been completed at Woodside, Huntington, Ronkonkoma, and Jamaica.
- New service: electrification of the Main Line to Ronkonkoma in 1987 allowed the LIRR to increase peak hour service by 67%, and cut commute times by 26 minutes.
- West Side Storage Yard: a new storage yard west of Penn Station increased peak hour capacity by 15%.
- East Side Access: construction has begun on a project to bring LIRR trains into Grand Central Terminal, shortening and simplifying the commutes of tens of thousands of commuters who work in East Midtown.

Metro-North

- Rolling stock (\$1.4 billion): Metro-North's fleet includes 563 electric and 176 diesel coaches. Under the capital program, it has purchased 544 new cars, to reduce the number of standees and accommodate growing ridership.
- Passenger stations (\$1.5 billion): at Grand Central Terminal, new entrances opened at the north end of the station, cutting several minutes out of the commute for thousands of riders. Metro-North renovated the entire station and restored the main hall to its original splendor. Dozens of line stations were rehabilitated or received major upgrades, including high-level platforms, platform canopies and heated shelters, and new information systems. Expanded parking at a number of stations provided for growth in ridership.

- Infrastructure: the antiquated catenary on the New Haven line (dating from 1907) and substandard third rails were replaced in the 1980s. Along with modernized power substations on the Harlem and Hudson lines, these changes increased system reliability and resulted in improved on-time performance.
- New service: electrification of the Harlem line north of Brewster and the extension of the line to Wassauc shortened commute times by up to 30 minutes for thousands of riders.

The effect on the infrastructure of this huge investment has been to bring the entire system closer to a State of Good Repair. The LIRR has achieved SGR in every asset category except line structures, which includes bridges, viaducts, and the East River tunnels. At Metro-North, line structures, shops and yards, power, and passenger stations are the only original asset categories not yet at SGR, and they will likely be priorities in the 2005-2009 plan.⁴⁹ As a result, these agencies have been able to move towards cyclical replacement cycles for most assets and focus resources on other capital needs, such as System Improvement and Network Expansion.

NYCT has made huge strides but has further to go than the commuter rail agencies to achieve system-wide SGR. The agency replaced or overhauled all of its subway cars and buses by 1991 and brought its track and switches to a State of Good Repair by 1997. Elevators and escalators in passenger stations reached SGR in 2003. Of the remaining ten asset categories, four are above 80% of SGR and the remainder are above or near 50% of SGR. This represents significant progress since the early 1990s, when only the rolling stock and track had achieved SGR and no categories other than switches were at 80% of SGR. As indicated in Section 1, this achievement has allowed the agency to focus more resources on Normal Replacement.

The fact that New York City Transit has more SGR work remaining than the commuter lines reflects differences in the size, operation, and history of the systems. The subway system is much larger and more complex than the commuter lines and is used far more intensively. For example, the subway has more than three times as many cars as do the commuter lines combined, and nine times as many riders. Maintenance and upgrades are hampered by difficult working conditions: most of the passenger stations and line structures are underground, and work crews must accommodate trains that operate 24 hours a day. Furthermore, the subway system began the capital program in worse condition than the commuter lines.

3.2. Performance Benefits

With these physical investments, the capital program has brought dramatic improvements in reliability and on-time performance to riders. Restoration of the passenger environment has brought cleaner cars and stations. Investment in an automated fare collection (AFC) system has made fare discounts possible. And there is some evidence the MTA has reaped internal benefits in terms of lower operating costs and lower maintenance costs. These results can be used to measure the effectiveness of the capital program.

3.2.1. Reliability

The most significant aspect of transit system performance is the ability to meet a schedule. If trains or buses fail to pick up riders when they expect, or take longer than expected to reach their destination, riders will conclude the system is undependable and may seek alternatives. By the same token, increased adherence to a schedule means customers can better predict their time, and they spend less time waiting at stations or onboard delayed trains or buses, and more frequently choose transit.

While the operating environment plays an important part in determining schedules, and issues such as the effectiveness of the labor force affect on-time performance, the condition of the rolling stock and infrastructure sets a baseline for the performance. A measure that isolates capital conditions from

⁴⁹ In 2003, Metro-North assumed maintenance responsibility for the Port Jervis (west of Hudson) line infrastructure. This new asset category is at just under 50% of SGR.

operating issues is Mean Distance Between Failure (MDBF). For trains and subway cars, this measures the frequency with which a vehicle breaks down. While it does not reflect changes in all aspects of capital upkeep, such as tunnel lighting or fan plants, it is affected by the age of the rolling stock and the quality of maintenance. Maintenance, in turn, is affected by conditions at yards, shops, and depots where crews repair and upgrade the rolling stock.

On the subway, this basic measure of reliability had plummeted during the 1970s. MDBF for subway cars fell from 26,000 miles in 1971 to 6,640 in 1981. New cars were quickly falling into disrepair, with MDBF dropping 6%-11% per year.

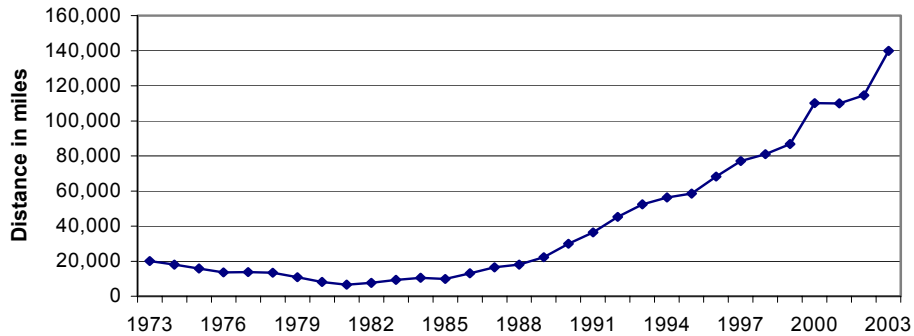


Figure 7. Mean Distance Between Failure, NYCT Subway

Source: compiled from MTA annual reports, capital plans, twenty-year capital needs assessments, strategic business plans and authors' calculations

With the beginning of the capital program in 1982, subway car MDBF began to turn around, and it has increased almost continuously since, with only a small decrease in 1985. Furthermore, the rate of increase has not slowed, as MDBF has been doubling every five to seven years, to its 2003 level of nearly 140,000 miles (Figure 7) – a more than twenty-fold increase since 1981. MDBF for New York City Transit's buses, which are subject to a much less controlled environment, has gradually increased from 1,394 miles in 1986 to 3,554 miles in 2003 (Figure 8).

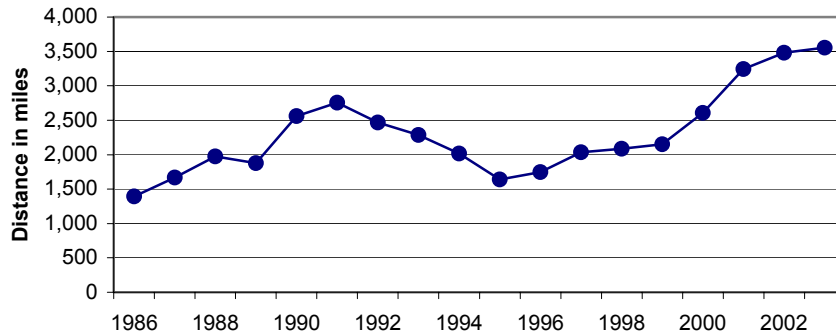


Figure 8. Mean Distance Between Failure, NYCT Bus

Source: compiled from MTA annual reports, capital plans, twenty-year capital needs assessments, strategic business plans and authors' calculations

These improvements reflect both capital investments and managerial changes. With David Gunn’s overhaul of the line departments in the mid-1980s, and the replacement of aging rolling stock, the capital program began to achieve significant results. In 1985, the number of derailments dropped to three, and nearly all of the red tags (serious conditions) were resolved by the end of that year. By 1991, 593 of 709 miles of mainline track had been replaced or rehabilitated and the track had achieved SGR. Nearly 3,900 cars were overhauled by 1991, and 1,775 new cars had been put into service. These investments helped bring average MDBF for the entire fleet to 36,413 miles by 1991, and greater than 140,000 miles today.

These new cars account for much of the increased reliability. New train cars have consistently had higher MDBF than older cars; this was true even before NYCT implemented a scheduled preventive maintenance system. A program in the 1980s to overhaul thousands of cars also contributed to improved reliability and extended the lives of these cars. Similarly, performance at NYCT’s bus fleet dropped in the early 1990s as the average age increased, but a new wave of bus purchases beginning in 1995 lowered the average age and resulted in increased reliability.

In addition to the gains provided by new and overhauled cars, the MTA took steps to protect its investments. NYCT moved to improve working conditions and maintenance procedures for the new and overhauled equipment. Investments in shops at yards brought better working conditions and greater productivity. For example, maintenance crews had formerly had to crawl under train cars to work on them. The capital program funded improvements that involved elevating the maintenance tracks so workers could stand underneath the cars. Mort Downey, Chief Financial Officer and then Executive Director of the MTA from 1981 to 1992, noted that these improved working conditions enabled higher performance from the MTA’s labor force; this contributed to improved reliability.⁵⁰

A standardized maintenance system also brought dramatic gains. During the 1970s, preventive maintenance simply was not performed; crews only worked on trains after they had failed. With a new Scheduled Maintenance System, introduced in 1989, NYCT put subway cars on a cycle of regularly scheduled overhauls. This program increased the fleet’s reliability by taking cars out of service for regular maintenance *before* they failed.

On the commuter lines, reliability has also improved, though not nearly as rapidly as for the subway. At Metro-North, MDBF is up 205% since 1989 (the first year for which figures are available), from 18,520 miles to 56,578 miles. At the LIRR, MDBF nearly doubled from 1982 to 1987. During the 1990s, however, MDBF leveled off and is now at only 39,579, just two-thirds that of Metro-North (Figure 9).

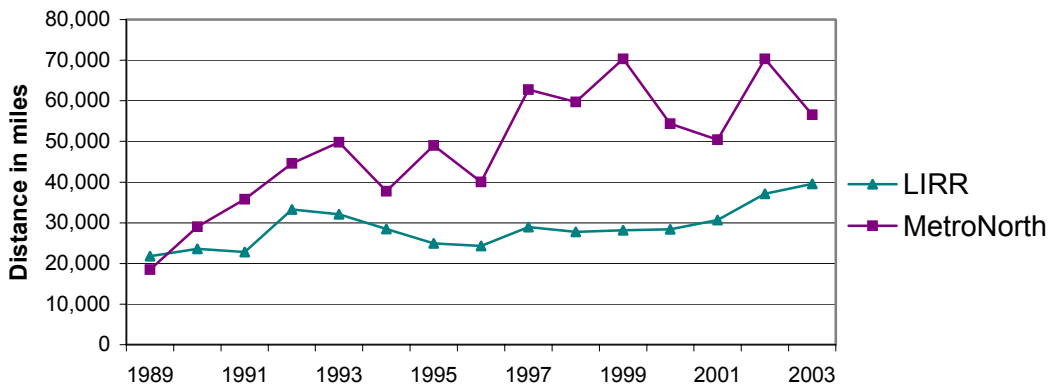


Figure 9. Mean Distance Between Failure, Commuter Lines

Source: compiled from MTA annual reports, capital plans, twenty-year capital needs assessments, strategic business plans and authors’ calculations

⁵⁰ Mortimer Downey, President, PB Consult, personal communication, March 22, 2004

Growth in MDBF at the LIRR has been slower than at Metro-North for a number of reasons; most notably, the LIRR's fleet has not been continuously renewed, as Metro-North's was during the 1980s and 1990s. New M7 cars that have been added to the LIRR's fleet since 2002 may begin to address this issue: the new cars recorded an MDBF of 225,000 miles for the first four months of 2004. Both Metro-North and the LIRR are phasing in preventive (scheduled) maintenance programs for new or remanufactured cars; these may help prevent long-term degradation of performance.

3.2.2. On-Time Performance

For riders, increased reliability has meant that trains adhere more closely to their schedules and are less frequently canceled.⁵⁰ At NYCT, the change in on-time performance has been fairly dramatic, as shown by Figure 10. The percentage of trains reaching their terminal within five minutes of schedule has increased from the low 80% range for most of the 1980s to above 90% since 1995 and above 95% since 2000.⁵² Similarly, on-time performance has steadily increased at the commuter lines, from the high 80% range in the mid-1980s to 96%-97% at Metro-North in the last three years, and to 93%-94% at the LIRR (Figure 10). These changes mirror the gradual improvement in MDBF. In fact, the agencies with the greatest improvements in MDBF have had the most significant increases in on-time performance, suggesting that improving the condition of the capital equipment significantly impacts reliability as seen by riders.

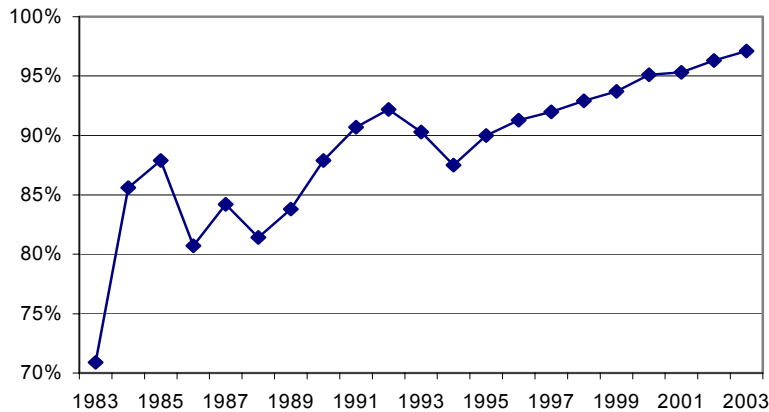


Figure 10. Terminal On-Time Performance, NYCT Subway

Source: compiled from MTA annual reports, capital plans, twenty-year capital needs assessments, strategic business plans and authors' calculations

Operating conditions can also affect on-time performance and likely explain much of the difference between Metro-North and the LIRR. Metro-North owns its New York City terminal and is able to keep its cars at the platform for an extended period, meaning departing trains can be brought in well ahead of schedule. In this environment, improvements in the rolling stock have been key to increasing reliability and schedule performance.

⁵¹ On-time performance for buses is a less useful indicator of the capital program's effectiveness, since schedule adherence is strongly affected by external conditions such as traffic congestion.

⁵² On-time performance hit a low of 70.9% in 1983 when trains were slowed system-wide after a series of derailments.

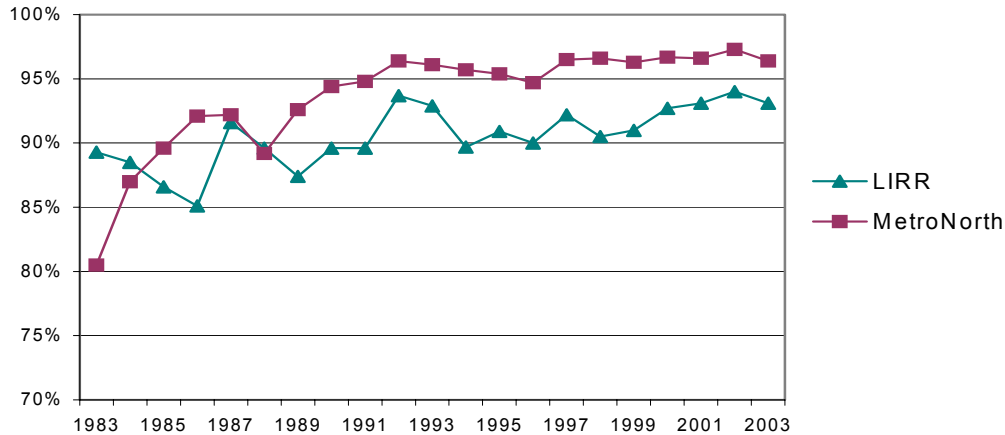


Figure 11. Terminal On-Time Performance, Commuter Lines

Source: compiled from MTA annual reports, capital plans, twenty-year capital needs assessments, strategic business plans and authors' calculations

The LIRR, on the other hand, owns neither Penn Station nor the East River tunnels leading to the terminal and depends on Amtrak for much of the maintenance of and access to these structures. As a result, the LIRR is not able to fully control its own operations. During peak hours, Penn Station and the East River tunnels run at capacity, such that the LIRR is not able to bring trains in before their schedule departure. Regardless of the condition of the rolling stock, these conditions have made it difficult for the LIRR to bring its on-time performance to the same level as Metro-North. The MTA began to address these constraints with development of the West Side Storage Yard in the 1980s, which allowed trains to be cleaned between runs without running them under the East River again. The planned link to Grand Central would further increase capacity under the East River and relieve scheduling constraints at Penn Station, potentially allowing for longer station dwell times and improved on-time performance.

For NYCT's buses, on-time performance measures may be less meaningful than for the rail systems as an indicator of capital performance. However, calculations by the Straphangers Campaign suggest that buses on many routes are hardly faster than pedestrians.⁵³ Again, as with the LIRR, this may be explained at least in part by a difficult operating environment: congested city streets. The MTA's proposed bus rapid transit pilot project in the 2005-2009 capital program may address these problems in some areas.

3.2.3. Passenger Environment

Huge strides have also been made in the physical environment experienced by train and bus riders. When the capital program began, conditions in the subway were "abominable," in the words of Jeffrey Zupan, Senior Fellow at the Regional Plan Association.⁵⁴ In addition to the graffiti that covered every surface of every car and station, the cars were poorly lit, mislabeled, lacked readable maps, and commonly had broken door panels. NYCT did not even measure these problems until the 1990s, when conditions had dramatically improved. However, the Straphangers Campaign, a riders advocacy group, found that in 1983, 37% of all subway cars had a broken door panel, 29% had lighting problems, 22% were labeled with the wrong subway line number or letter, and 29% did not have even one readable subway map.⁵⁵

⁵³ Straphangers Campaign and Transportation Alternatives, "Third Annual 'Pokey' Awards for Slowest City Buses," September 23, 2004, <http://www.straphangers.org/pokeyaward/release04.html>.

⁵⁴ Jeffrey Zupan, Senior Fellow, Regional Plan Association, personal communication, April 19, 2004

⁵⁵ Straphangers Campaign, *Subway Performance Measures, 1980-1990*.

By 1990, the passenger environment had improved so dramatically that “the Straphangers Campaign stopped rating [several of] these aspects of service because improvements made the ratings no longer necessary,” in the Straphangers' words.⁵⁶ By then, only 6% of the cars surveyed had broken door panels. Defective lighting was found on 22% of the cars, less than 5% of the surveyed cars were mislabeled, and less than 1% had unreadable maps. This last was undoubtedly affected by the eradication of graffiti, a victory that was achieved May 12, 1989.⁵⁷

On the commuter lines, the passenger environment had never reached the dire state of the subway cars; nevertheless, malfunctioning air-conditioning and chronically overcrowded trains created miserable conditions for passengers. The capital program and new operational procedures made for rapid improvements. At Metro-North, only 80% of air conditioners functioned properly in 1981; with changes in hiring practices, operating procedures, and new cleaning and safety equipment, these air conditioners reached a 99% success rate by 1985. Poorly maintained fleets at Metro-North and the LIRR meant that cars broke down frequently and had to be kept out of service; with fewer cars running, an average of 4,100 riders were forced to stand every day on Metro-North in 1983, and more than 14,000 every day on the LIRR. By 2003, the number of standees at Metro-North averaged about 200 when weather was not a factor, and at the LIRR the number of standees during the AM peak had been brought down to about 160.⁵⁸ New car purchases, improved reliability, and capacity increases allowed the commuter lines to provide more seats on a regular basis.

3.2.4. Customer Ratings

As conditions improved, the MTA began regular studies of customer satisfaction. Beginning in 1988, NYCT has conducted annual telephone surveys, asking riders to rate various aspects of service on a scale of 0 to 10. The commuter lines have performed similar surveys since at least 1996.

According to these surveys, NYCT subway riders' overall satisfaction increased fairly continuously during the 1980s and 1990s (Figure 12).

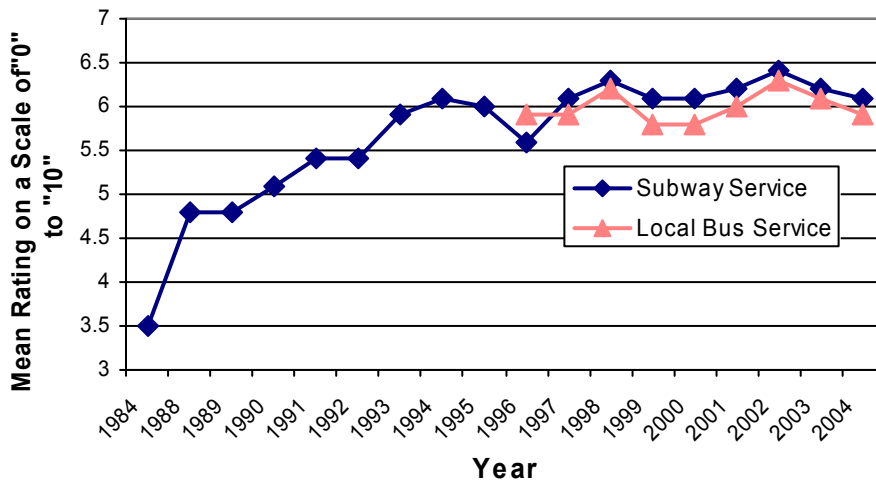


Figure 12. NYC Transit Customer Ratings, 2004
 Source: Lieberman Research Group, 2004 Citywide Survey Topline Results

⁵⁶ Straphangers Campaign, *Subway Performance Measures, 1980-1990*.

⁵⁷ “Whitewash,” *The Economist*, May 20, 1989, p. 34, referenced on LEXIS-NEXIS Academic.

⁵⁸ MTA, *Report to the Governor 1984-1985*, p. 75; MTA, *Metro-North Committee Agenda*, (New York: MTA, December 2003), pp. 9-11; MTA, *Report to the Governor 1991* (New York: MTA, 1992), p. 45; Elisa Picca, Chief Planning Officer, MTA Long Island Rail Road, personal communication, October 5, 2004. These figures do not account for the winter of 2003-2004, when problems with Metro-North's train fleet resulted in numerous cancellations and short trains.

In rating individual categories of service, subway riders have given NYCT gradually higher scores for on-time performance, reflecting the improvements described above. (It should be noted that, according to a 2003 survey by the Lieberman Research Group, fare increases tend to depress customer satisfaction ratings.⁵⁹) Ratings for the overall station environment have also increased significantly since they were first measured in 1991. The latter reflect the continuing program of station renovation; the agency's early focus on the most heavily-used stations means that a high percentage of customers have experienced the improvements. As for buses, service ratings since 1996 have ranged minimally. Although there have been capital investments in bus service, such as purchase of new vehicles, ratings may also reflect conditions beyond the capital program such as traffic congestion.

Survey data for Metro-North and the LIRR from 1996-2002 show strong overall customer satisfaction ratings for both railroads, with a slight improvement trend over that period. In most specific ratings categories, Metro-North riders are somewhat more satisfied than LIRR riders. The higher overall satisfaction ratings by Metro-North customers may reflect the differences in reliability and on-time performance described above.

3.3. Financial Benefits

Beyond performance improvements, one might anticipate that attainment of a State of Good Repair would bring lower operating costs. Investments in new equipment should result in fewer repair calls, as the equipment breaks down less frequently. With more reliable equipment, agencies can afford to keep less spare equipment on hand. Throughout the economy, investments in technology have allowed corporations to improve operating efficiency and cut labor costs. Investments in employee facilities can contribute to improved morale and higher productivity. This section explores the effect that the capital program may have had on operating costs.

During the period of the capital program, each of the three operating agencies has seen gains in operating efficiency. A standard measure of financial efficiency for transit systems is operating cost per vehicle revenue mile. When adjusted for inflation, these costs have dropped at all of the agencies since 1984, the earliest year for which comparative data is available. Operating costs (in 2000 dollars) on the subway have fallen from \$12.22 per vehicle revenue mile to \$7.21 in 2000, while costs on the buses edged lower, from \$15.35 in 1984 to \$14.91 in 2000. At Metro-North, costs fell from \$24.62 to \$12.47, while at the LIRR they dropped from \$17.01 to \$13.67. Most of the decrease at Metro-North took place in the 1980s; since then, the commuter lines' operating expenses have been very similar.⁶⁰

The MTA has at times documented links between the capital program and gains in operating efficiency. For example, an analysis in 1989 reported that "improved management control, combined with the infusion of new and reconstructed facilities and equipment, has permitted a reduction of over 5,000 positions" at NYCT in the preceding five years.⁶¹ For 1989, the agency expected that productivity gains would result in the elimination of another 608 positions, with some of the savings directly attributable to the capital program. With the rolling stock becoming more reliable, the agency was planning to cut 91 maintenance positions. Modernization and automation of signal and power systems would result in the elimination of another 65 positions. Better scheduling of service, new labor agreements, better materials management, and new organizational arrangements also accounted for a large portion – possibly most – of the savings.

⁵⁹ Lieberman Research Group, *2003 Citywide Survey Report*, Prepared for MTA New York City Transit (March 2004), p. 27.

⁶⁰ US Department of Transportation, Federal Transit Administration, *National Transit Database*, in *Florida Transit Information Systems* (computer program), compiled by Florida Department of Transportation, 2003.

⁶¹ MTA, *Strategic Business Plan, 1990-1994* (New York: MTA, 1989), Volume 1, pp. 1-37 through 1-40, and Volume 2, pp. 3-21 through 3-24.

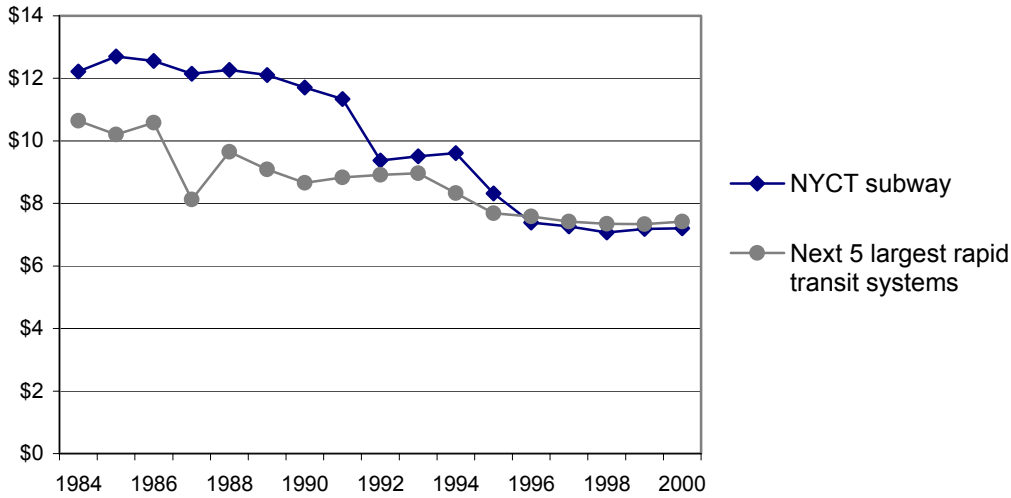


Figure 13. Operating Costs Per Vehicle Revenue Mile, Rapid Transit Systems

Source: compiled from MTA annual reports, capital plans, twenty-year capital needs assessments, strategic business plans and authors' calculations

A comparison with other large transit systems shows that the MTA was not alone when it came to cutting costs in the 1980s and 1990s. However, NYCT has cut operating costs on the subway much more dramatically than its peers at the next five largest rapid transit systems. Average costs on the other systems dropped 30% from \$10.64 in 1984 to \$7.42 in 2000, while NYCT's costs fell 41%. Given the challenging operating environment in New York, including intensive use, 24-hour operation, and harsh weather, it is notable that the subway's operating costs per vehicle revenue mile have dropped to slightly below that of the peer group average (Figure 13).

Relative trends at the commuter lines in comparison with their peers are more difficult to identify. Over the last two decades, costs have fallen at the LIRR, at Metro-North, and at the next four largest commuter lines. Since the early 1990s, costs at the MTA's commuter lines have been higher than at the peer systems (Figure 14). Again, however, the MTA operates in a unique environment: its commuter lines make extensive use of electric and dual-mode locomotives that are inherently more costly to maintain than the diesel locomotives employed by other large systems. As for buses, costs at all large systems have stagnated; increased traffic congestion may be preventing significant reductions.⁶²

⁶² For the subway, the peer systems were the rapid transit systems in Boston, Washington, Atlanta, Chicago, and San Francisco (BART). The commuter lines' peers were the systems in Boston, New Jersey (NJ Transit), Philadelphia, and Chicago. The bus peers were NJ Transit and the bus systems in Philadelphia, Chicago, Houston, and Los Angeles.

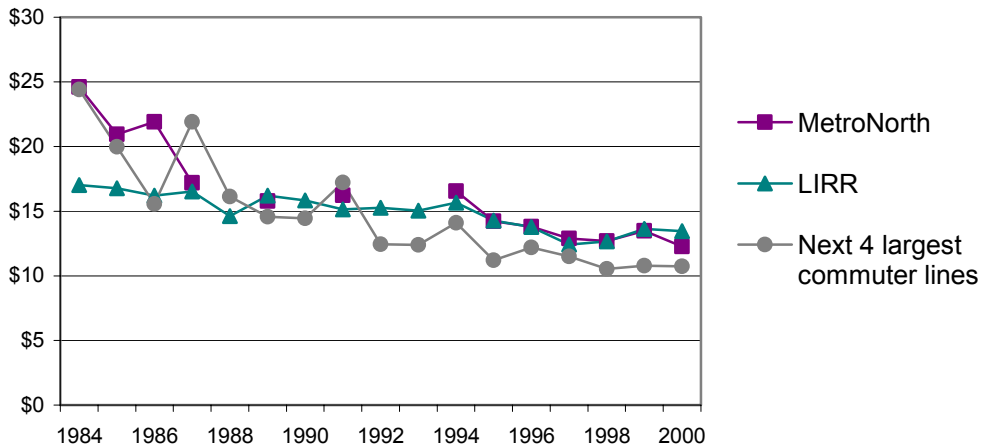


Figure 14. Operating Costs Per Vehicle Revenue Mile, Commuter Railroads

Source: compiled from MTA annual reports, capital plans, twenty-year capital needs assessments, strategic business plans and authors' calculations

An important effect of improved capital conditions is that when equipment breaks down less frequently, more of it can be kept in service and less needs to be held in reserve. At NYCT, increased reliability appears to have had exactly that effect. Figure 15 shows that since 1981, the fraction of the subway car fleet that is considered spare reserve has dropped from 28.3% to 18.7% in 2004. With fewer cars in reserve, fewer cars need to be purchased to provide additional service; in fact, since 1981, the number of cars in service during peak hours has increased by 292 while the total fleet has shrunk by 122 cars. With the current generation of subway cars carrying price tags ranging from \$1.5 to \$2 million, the agency has realized a significant financial benefit from improved reliability.

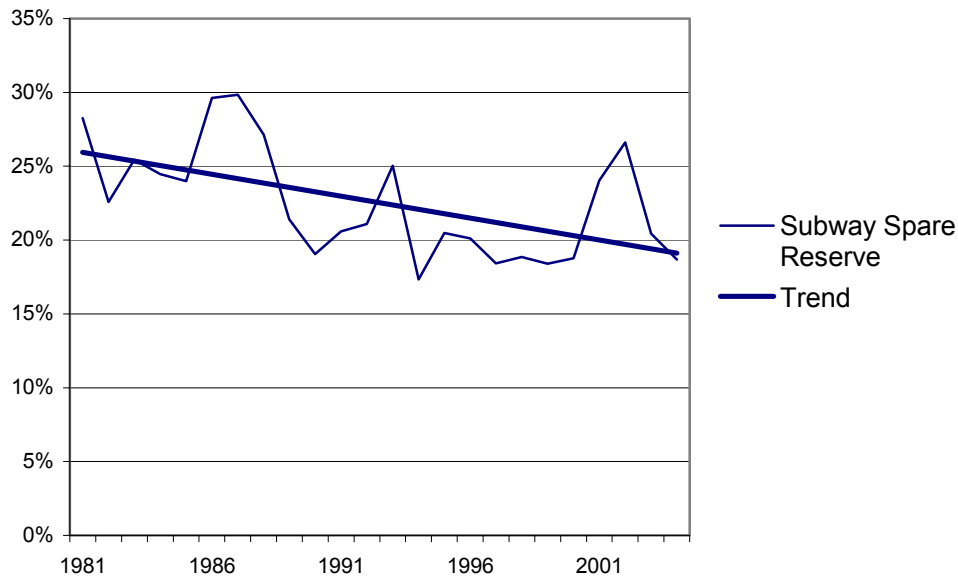


Figure 15. Fraction of NYCT Subway Fleet in Spare Reserve

Source: compiled from MTA annual reports, capital plans, twenty-year capital needs assessments and strategic business plans

3.4. Summary of Goals and Achievements

In examining the relationship of the MTA's capital program to its record of achievement, several themes stand out:

First, the investments aimed at restoring a State of Good Repair have brought major improvements in performance and in the passenger environment. The progress at NYCT has been particularly striking. While the agency made huge strides in restoring the performance and passenger environment of the subway during the 1980s, those changes have persisted and improvement has continued unabated. Reliability, as measured by MDBF, has increased for 18 consecutive years and continues to double every five to seven years. On-time performance increased dramatically during the 1980s and has continued to increase, with new highs each of the last six years. The eradication of graffiti in 1989 was a major milestone but further investment has brought a continued increase in customer satisfaction with the subway environment. On the buses, the passenger environment has also improved, especially with the addition of wheelchair lifts by the early 1990s, and the fleet contributes less to City air pollution than it once did.

The commuter lines have also made important strides towards restoring SGR, with nearly all of their asset categories at 80% or more of SGR. At Metro-North, now viewed by many as a first-rate commuter railroad, capital investments have brought reliability and on-time performance to levels well above the lows of the early and mid 1980s. At the LIRR, reliability and on-time performance have also increased, though not as dramatically as on the subway or at Metro-North.

Second, the commuter lines have achieved significant success in their second original goal of increasing capacity. Overcrowding on Metro-North has, in general, become much less frequent, although it returned during the winter of 2003-2004 as many older cars were impacted by harsh weather. Passenger station rehabilitations, expanded parking, and extension of the Harlem line have eased the commute for thousands and brought new riders to the system. On the LIRR, the passenger environment has also improved with more reliable air conditioning and far less crowding, and with improved accessibility at its stations.

Third, despite significant capital investments, challenging operating environments for the LIRR and for NYCT's buses have limited the opportunities for performance improvements. In the case of the bus system, traffic congestion has kept a ceiling on bus speeds. Bus reliability has increased significantly but bus performance does not appear to have kept pace and customer satisfaction has remained essentially unchanged since the early 1990s. For the LIRR, lack of control over its terminal at Penn Station and in the East River tunnels, and the absence of free capacity in either facility has given little room for error in its operations and constrained its ability to improve on-time performance.

Finally, an important goal of the capital program as originally defined was to restore a system that provided service "at a reasonable operating cost." NYCT has again made significant headway toward that goal. Operating costs on the subway that were once well above those of peer systems have fallen to better than parity, despite rapid growth in ridership. Costs have also fallen at Metro-North and the LIRR, though less dramatically. In part, these falling costs reflect productivity gains from capital program investments in modernized facilities, more reliable rolling stock, and improved management control.

4. Mobility and Economic Effects

Beyond the kind of performance improvements discussed in the previous section, investments in transportation infrastructure can have significant economic impact. Some of these are short-term effects related to the economic activity of constructing the infrastructure. Once the project is put into service, there are immediate impacts in terms of reduced travel times and costs. Over a longer time frame, the investment affects land use, as improved accessibility impels firms and individuals to relocate to take advantage of time saving travel. These changes in turn can drive up real estate values.⁶³

The long-range effects derive from changes in accessibility that the investment creates, and since the early 1990s, improved regional mobility has been a prime goal of the MTA's capital program. Therefore, this section begins by reviewing the trends in MTA ridership – a key measure of mobility – in the context of the capital program. It then explores the link between the MTA's investments under the capital program and the regional economy.

4.1. Mobility

In the realm of transportation, mobility refers to the movement of people and goods; for a transit system, the most significant measurement of mobility is ridership. In New York and especially in Manhattan, changes in transit ridership have historically been closely tied to the level of employment. As jobs are created or lost, ridership changes as the number of commuting trips fluctuates. However, a number of other factors related to the transit system also affect mobility. Changes in the fare can bring changes in ridership. The quality of service, including both performance and the passenger environment, may attract or deter riders. Expansion of the transit system into new areas can bring increased mobility in the form of new riders. While it is hard to isolate individual influences on ridership, the MTA's capital program has brought significant changes to all of these areas. This section explores the effect that improved performance, restoration of the passenger environment, expansion and improvement of the commuter rail lines, and a new fare structure have had on transit mobility.

4.1.1. *The Impact of Employment*

Before discussing the impact of the capital program on mobility, it is important to review the strongest influence on ridership: employment. Using regional ridership data from the 1970s, a pair of studies by Charles River Associates (CRA) in the early 1980s found that changes in ridership were strongly tied to changes in employment. For every 1% increase in Manhattan employment, subway ridership increased 0.95%. The effect on Metro-North and LIRR was even stronger: the same change in employment resulted in changes of as much as 2.2% in commuter rail ridership. CRA explained this by pointing out that suburban commuters primarily held white-collar jobs in sectors such as finance that were growing faster than the overall economy.⁶⁴

These relationships persisted over the last quarter-century (Figure 16). During the 1980s, annual subway ridership, as predicted, rose and fell with employment and ended the decade at just over one billion. In the early 1990s, however, ridership grew much faster than employment. In the late 1990s, as the local economy heated up, ridership growth far outpaced job growth and was up 22% during 1997-2000. With the weaker economy of the last three years, ridership fell in 2003 for the first time in 12 years. The strong growth of the 1990s, however, suggests that factors beyond the economy were at work.

⁶³ David Banister and Joseph Berechman, *Transport Investment and Economic Development* (London: University College, 2000), p. 173.

⁶⁴ Charles River Associates (CRA), *New York City Transit Authority Revenue Feasibility Study: Economic Analyses and Projections*, (New York: CRA, 1982), pp. 5-12 through 5-23; and CRA, *Long Island Rail Road and Metro-North Commuter Rail Revenue Feasibility Study: Economic Analyses and Projections*, (New York: CRA, 1984), pp. 5-13 through 5-23.

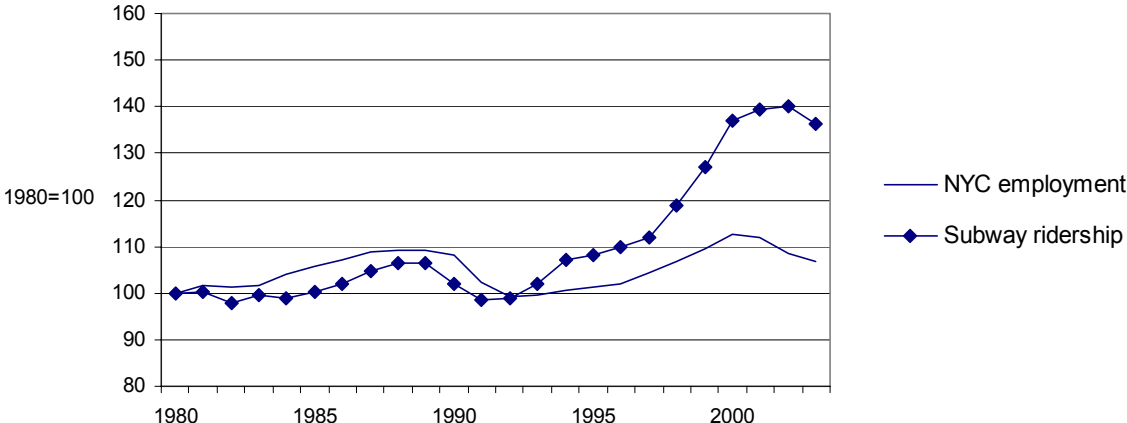


Figure 16. Employment and Transit Ridership

Source: compiled from MTA annual reports, capital plans, twenty-year capital needs assessments, strategic business plans and authors' calculations

As with the subway, ridership on the commuter rail lines has fluctuated with changes in the economy, but other factors are clearly at work as well. Since 1983, LIRR ridership has risen and fallen in lockstep with the economy, growing during most of the 1980s, falling during the recession at the end of that decade, and climbing again during the 1990s until the recession of 2001-2003. At Metro-North, ridership has climbed steadily since the strike in 1983 and is up 46% since 1981. While ridership there has dipped during recessions, the strong overall growth clearly reflects influences beyond City employment, such as improved performance and network expansion.⁶⁵

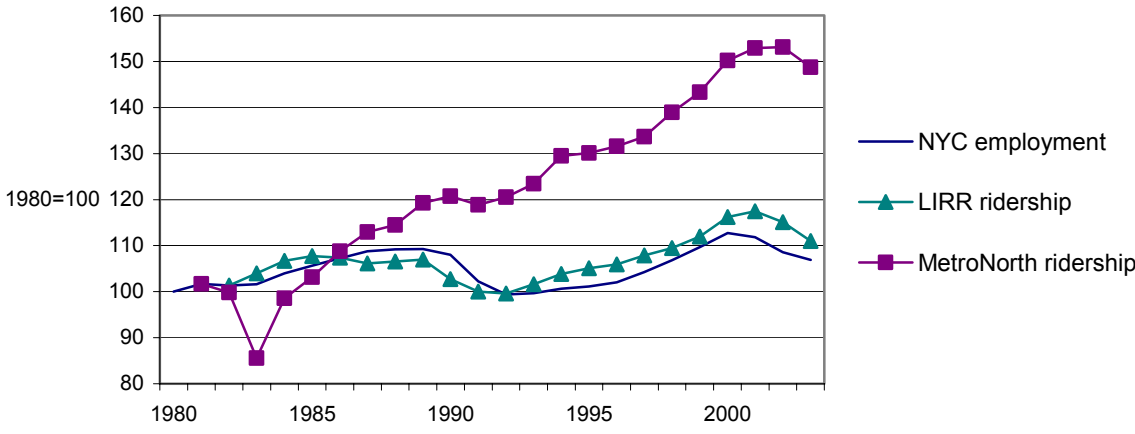


Figure 17. Employment and Commuter Rail Ridership

Source: compiled from MTA annual reports, capital plans, twenty-year capital needs assessments, strategic business plans and authors' calculations

⁶⁵ In 1998, LIRR changed method for counting ridership and provided adjusted numbers for 1994-1997. For this chart, ridership numbers before 1994 were adjusted by the same factor as the 1994 adjustment. The sharp dip in ridership at Metro-North in 1983 reflects a strike that year.

CRA found that New York City Transit bus ridership did not correlate strongly with employment, and suggested that buses were more heavily used for discretionary (non-commute) purposes. Ridership fell dramatically during the 1970s, from 947 million at the start of the decade to 648 million in 1980. It continued to fall for the next decade, reaching a low of 492 million in 1996. In the next six years, as a result of a combination of new rolling stock and a favorable fare policy, ridership exploded, jumping 55% to 762 million, and fell only as the recession deepened in 2003.

4.1.2. Performance

Beyond employment, the improved reliability brought by the capital program appears to have had a dramatic effect on regional mobility. For riders, an increase in reliability means that the time cost of travel drops and transit becomes an increasingly attractive mode of travel. In fact, CRA found in its studies that while changes in employment have the strongest effect on ridership, changes in Mean Distance Between Failure (MDBF) also have a statistically significant effect on ridership. This suggests that capital investments that improve performance can result in increased ridership.

Indeed, there has been a striking correlation between reliability and growth in ridership. From 1989 through 2003, ridership at the LIRR has increased 7%, while Metro-North ridership is up 25%. Population growth alone does not explain why Metro-North has been so much more successful in attracting new riders: Long Island's population grew 5.5% during the 1990s, while the upstate counties of Dutchess, Orange, Putnam, Rockland, and Westchester grew only slightly faster to 7.6%. Relative changes in performance at the two agencies are, however, suggestive. Metro-North's MDBF has increased much faster than the LIRR's and is now 50% higher (Figure 17). Metro-North has also expanded its service into new areas, while track limitations have made it difficult for the LIRR to add new services such as reverse commutes. While systematic differences make it hard to separate relative influences of expansion from improved reliability on ridership, however, the large increase in reliability at Metro-North, as compared with more modest increase at the LIRR, may explain part of the difference in ridership growth.⁶⁶

On the subways, ridership had dropped faster than employment for decades. In 1947, annual ridership on the subways and elevated trains had peaked at 2 billion riders; but with competition from the automobile and continuous disinvestment, ridership had fallen to 1.3 billion in 1960, and to just below one billion in 1982.⁶⁷ Reliability, as measured by MDBF, had also fallen for decades, but in 1982 it turned around and began a long climb upward. In the same year, the long-term trend in ridership ended, and it stopped falling faster than employment. Then in 1990, improvements that had only been seen on the numbered lines (the IRT) finally made their way to the rest of the system. In the same year, ridership finally began to grow faster than employment, a trend that has continued since. While it is hard to distinguish various influences on ridership, the relationship between improved performance and stable or increasing ridership is striking.

4.1.3. Passenger Environment

The passenger environment seems to have a particularly strong impact on discretionary travel. During the 1970s, as the number of felonies in the subway tripled, off-peak ridership at Times Square plummeted 40% even as rush-hour traffic increased slightly.⁶⁸ Increasing graffiti and poorer performance also contributed to the sense that nobody was in control of the subway and deterred riders from taking the system. By the same token, the eradication of graffiti on the subway cars in 1989 likely contributed to the strong growth in ridership that began the following year.

⁶⁶ The population of Dutchess, Orange, Putnam, Rockland, and Westchester counties grew by 7.6% from 1990-2000, while that of Nassau and Suffolk grew by 5.5%. Source: US Census Bureau, Census 2000 Redistricting Data (P.L. 94-171) Summary File and 1990 Census, www.census.gov.

⁶⁷ Hood, pp. 240-241; Bear Stearns & Co., p. 18.

⁶⁸ Bear Stearns & Co., p. 23.

4.1.4. Network Expansion

Beyond improved reliability, expansions and upgrades on the commuter lines have also brought new riders. In the Metro-North service area, electrification of the Harlem Line beyond Brewster enabled a huge increase in ridership to Manhattan from Dutchess County: weekday ridership on the Dover Plains line increased 370% between 1980 and 1990. A six-mile extension of the line in 2000 spurred additional growth and supported growing outbound travel from Manhattan.⁷¹

4.1.5. Fare Discounts

The price paid by riders would seem at first glance to be a significant influence on ridership, but this was not the case in the 1970s, according to the CRA studies. For every 1% increase in the fare, subway ridership dropped by 0.10%, bus ridership dropped by 0.26%, Long Island Railroad ridership dropped by 0.19%, and Metro-North ridership dropped by between 0.26% and 0.33%, depending on the line.⁷² Subway ridership had the lowest elasticity because of a lack of viable alternatives. Bus trips were more sensitive to fare increases, because more of them were discretionary in nature and could be substituted by taxis or walking. Similarly, rail commuters were more likely than city transit commuters to own a car and could replace a rail trip with an automobile trip.

The new fare structure at NYCT appears to have changed these relationships. The introduction of free MetroCard transfers between buses and subways in 1997 and the rollout of monthly and weekly unlimited ride passes the next year spurred the most dramatic surge in subway and bus ridership in decades. With free transfers, the marginal cost of taking the bus to the subway dropped to zero, and commuters who once walked long distances to the subway could now get there by bus for free. Monthly and weekly passes cut the marginal cost of trips by either mode to zero, and had the greatest effect on off-peak travel. Ridership increased most on Sundays, Saturdays, and off-peak hours during the week, suggesting that discretionary trips accounted for the largest portion of the increase.

Some long-time observers argue that the dramatic increase in subway and bus ridership brought on by fare discounts would not have occurred without the major performance and passenger environment improvements

Mode Shift or More Travel?

The dramatic increase in transit ridership of the late 1990s raises the possibility that some travelers may have switched from automobiles to transit. Evidence of such a shift is mixed.

*While transit ridership increased dramatically in the last decade, it does not appear that automobile drivers abandoned their vehicles and switched to transit for the **commute** trip. Between 1990 and 2000, the share of commuters in the New York-New Jersey metropolitan area who drove alone or carpoled remained essentially unchanged at 65.7%. Bus and light rail ridership slipped from 7.2% to 6.8%, while subway and rail ridership edged up from 16.7% to 17.1%, so that the fraction of commuters taking transit was unchanged.⁶⁹ For commute trips, then, there has been very little mode shift. However, this stability still meant that the region went against a national trend, as transit's share of commute trips declined in 28 of the 49 largest metropolitan areas in the United States.*

*For all travel, including **discretionary** trips, there is some evidence that the dramatic increase in ridership resulted in a modal shift. First, the rate of increase in automobile ownership slowed in the City, from 21% in the 1980s to only 6% in the 1990s and closer to the rate of population growth.⁷⁰ Second, during most of the last two decades, growth in total vehicle miles traveled (VMT) by all vehicles on highways and streets in the downstate region roughly paralleled growth in the rest of the United States. However, in 1998 and 1999, when the economy was, if anything, stronger locally than in the rest of the country, VMT growth slowed. This coincides with the years of greatest growth in City transit ridership, so it is possible that some automobile traffic was replaced by transit ridership. This pattern is not seen at the state level and warrants further investigation.*

Another possibility is that transit riders have not replaced one mode of travel with another but are actually taking more trips. This also warrants further investigation as there could be significant implications if this increased travel results in increased economic activity.

⁶⁹ Nancy McGuckin and Nanda Srinivasan, "Journey to Work Trends in the United States and its Major Metropolitan Areas, 1960 - 2000," Publication No. FHWA -EP-03-058 (Washington: US DOT, FHWA, 2003), Chapter 4, www.fhwa.dot.gov/ctpp/jtw/jtw4.htm.

⁷⁰ Bruce Schaller, *Mode Shift in the 1990s* (Brooklyn: Schaller Consulting, 2001), p. 8; New York State Department of Transportation (NYSDOT) Planning and Strategy Group, *Travel Trends in New York State* (Albany: NYSDOT, 2003), p. 2; downstate figures are for the NYMTC region and were supplied by Nathan Erlbaum, NYSDOT.

⁷¹ Joel Russell, Robert Lane, and John Shapiro, *Community Planning for the Wassaic Rail Extension* (New York: Regional Plan Association, 1999), Chapter 2.

⁷² CRA, *New York City Transit Authority Revenue Feasibility Study: Economic Analyses and Projections*, pp. 5-12 through 5-23; and CRA, *Long Island Rail Road and Metro-North Commuter Rail Revenue Feasibility Study: Economic Analyses and Projections*, pp. 5-13 through 5-23.

that had already taken place. Jeffrey Zupan, Senior Fellow at the Regional Plan Association, argues that when subway cars and stations were covered with graffiti and service was not reliable, riders had the feeling that nobody was in control of the system. As subway reliability improved and cars and stations were cleaned up, riders were reassured that the MTA was in fact in control. This kind of reassurance made it possible for riders to return to the system when fare discounts were finally implemented.⁷³

While system improvements and extensions of existing lines have brought readily identifiable increases in ridership, the overall improvements in service appear to have halted the decline in ridership and made possible the dramatic gains that have been seen at NYCT and Metro-North. These two types of improvements – network extensions or upgrades, and restoration of a State of Good Repair – have also had different kinds of economic effects, discussed below.

4.2. Economic Impact of Disinvestment in Transit

The economic effects of transportation investment have been studied by economists for decades, yet there is little agreement on the magnitude of any impacts, particularly in well-developed economies. Recent research suggests, in fact, that transportation investments by themselves do not *create* economic activity, but they do *enable* it: transportation is a necessary but not sufficient condition for economic growth. Other conditions that must exist are a strong economy and a skilled labor force.⁷⁴ This implies that a deteriorating transportation system can inhibit economic activity – a phenomenon experienced by New York in the 1960s and 1970s.

New York's economic travails in those years have been well-documented and parallel similar declines in large cities throughout the country. Between 1968 and 1974, nearly one-third of the City's Fortune 500 headquarters moved to the suburbs or outside the region. Manufacturing jobs left for the suburbs or to overseas, such that during the 1970s, the City lost a half-million jobs and its population dropped by more than 10%.

New York's decline in this period was the result of a complex web of cultural, demographic, and technological factors affecting the entire country. Certainly, mobility brought on by the popularity of the automobile and development of the interstate highway system made suburban life possible and increasingly attractive. For New York, however, the poor state of its transit infrastructure appears to have been a unique factor driving jobs and growth out of the City and into the suburbs or beyond the region.

A 1976 study on the corporate relocation decisions of companies leaving New York found that "the most important consideration in headquarter relocation is usually an interest in reducing the commuting burden of senior executives.... More than two-thirds of the companies interviewed in the suburbs stated that the factor of commuting was a 'primary' or 'important' reason in their decision to relocate from New York City." Commuting takes time – time that could be spent on other, more profitable and enjoyable activities, and restricts executives' work schedule. The study noted, in relation to the increasing frequency of delays on the transit system, that "a very serious problem is the growing uncertainty whether a commuting executive will be able to maintain his schedule."⁷⁵ Another survey confirmed that a concern of companies leaving the City was that "frequent equipment breakdowns...cause substantial losses in paid work time."⁷⁶ Both studies cited the unreliability of New York's transportation system as a drag on worker productivity.

More generally, unreliable transit drives up costs for individuals as it forces riders to devote more of their time to travel. A single breakdown costs riders the time they lose in that delay as well as the costs associated with not keeping on schedule. If breakdowns are frequent, individuals budget extra time into their travel schedule on a regular basis to account for the chance of a delay, adding to the burden.

⁷³ Jeffrey Zupan, personal communication, April 19, 2004.

⁷⁴ Robert Paaswell, *New Jersey's Links to the 21st Century: Maximizing the Impact of Infrastructure Investment* (New York: University Transportation Research Center, City College of New York, 2002), p. 44.

⁷⁵ Wolfgang Quante, *The Exodus of Corporate Headquarters from New York City* (New York: Praeger, 1976), pp. 104-105.

⁷⁶ J. Roger O'Meara, "Executive Suites in Suburbs," *Conference Board Record* 9, 8 (August 1972): 12.

The costs of a poor transit system go beyond the value of lost time. In a 1995 study for Chicago's Regional Transportation Authority, Cambridge Systematics identified a few of the immediate effects of disinvestment in transit.⁷⁷

- Air quality would suffer as riders switched to automobiles for commuting or other trips.
- Individuals switching from transit to automobiles for their travel would face higher personal expenses. (In the New York metropolitan region, residents spend 14.5% of their household income on transportation, much less than the national average of 17.9%. New Yorkers save on transportation because they own and drive fewer automobiles than other Americans and save on the high costs of purchasing and maintaining an automobile.⁷⁸)
- Certain segments of the population that are particularly dependent on public transit would suffer disproportionately. The disabled and elderly would have less access to essential services; some individuals would no longer be able to live on their own and would have to be placed in institutions or with other caregivers. For low-income residents, disinvestment could mean a loss of employment opportunities. Schoolchildren would be affected and the study argued that in Chicago, "many of the marginal students in the system may drop out of school if transportation [becomes] difficult or inconvenient."⁷⁹

For businesses, an unreliable transit system makes them less competitive and reduces the attractiveness of the region as a place to live or to do business.⁸⁰ If transit performance were allowed to deteriorate, highway congestion would intensify, as riders switched to automobiles for commuting or other trips. The increased congestion would affect freight delivery costs. Poor transportation, or increased highway congestion, would make it more difficult for businesses in the central business districts to attract specialized workers, and deter recreational visitors and tourists. Cambridge Systematics estimated that for Chicago, 50% of day-trippers using mass transit would be sensitive to changes in the quality of the transit system.⁸¹

In a similar study for the MTA in 1996, Cambridge Systematics quantified the long-term economic impacts of such disinvestment. The study posited scenarios in which the MTA cut its capital program by 50% from the then-current (baseline) level, or \$1.2 billion annually; and by 25%, or \$600 million annually. The most direct effects would be on the reliability of travel. After twenty years of 50% disinvestment, breakdowns would occur four times as frequently as under the baseline; with 25% disinvestment, breakdowns would double in frequency. Transit ridership would drop significantly under either scenario and highway congestion and other negative effects of automobile use would increase. Transit riders would bear a cost of nearly \$2 billion annually (1996 dollars) in additional delays in the 50% scenario and \$730 million in the 25% scenario, outweighing the savings to the MTA. The impact of additional automobile travel, including the costs of increased congestion, would more than double these costs.⁸²

When the impact on the entire economy is considered, the effects of transit disinvestment were shown to be quite large and to far outweigh the financial savings. As transit performance deteriorates and highway congestion worsens, firms and workers may leave the region, taking jobs and tax revenues with them. Other firms may relocate to the suburban fringes of the region; growth in these regions entails large public costs in terms of new public infrastructure. Over twenty years, 50% and 25% cuts in MTA capital spending would cost the region *four* times as much as the savings, in terms of business and personal income. Or, as the study put it, "each dollar spent on achieving and maintaining a state of good repair returns over \$4 to the region in benefits over 20 years."⁸³

⁷⁷ Cambridge Systematics, *The Economic Impacts of the RTA System on the Regional and State Economies* (Cambridge, MA: Cambridge Systematics, Inc., 1995), pp. 4.1-5.6.

⁷⁸ Surface Transportation Policy Project (STPP), *Driven to Spend: The Impact of Sprawl on Household Transportation Expenses* (Washington: STPP, 2000), chapter 1, <http://www.transact.org/report.asp?id=41>.

⁷⁹ Cambridge Systematics, *Lasting Economic Benefits of Public Transit Investment* (Cambridge, MA: Cambridge Systematics, 1996), p. 4.8.

⁸⁰ *Ibid.*, pp. 1.2-1.3.

⁸¹ *Ibid.*, p. 5.9.

⁸² *Ibid.*, p. 4.4.

⁸³ *Ibid.*, p. 6.2.

4.3. Potential Benefits of Transit Investment

Cambridge Systematics also looked at the potential effect of investing in additional capacity. The study explored an expansion scenario, in which the MTA continued to fund the core program at the same level but also made additions to the regional network. The additions, which were estimated at approximately \$9.9 billion in 1996 dollars, included the LIRR link to Grand Central, a Second Avenue Subway from 63rd Street to 125th Street, and extension of Metro-North's Upper Harlem line. The same transportation and economic effects were evaluated as for the disinvestment scenario.

Under the expansion scenario, the study found positive effects on highway congestion, benefits to individuals in the form of reduced travel times, somewhat lower shipping costs, and a mode switch from automobiles to transit. Improved travel would make the region a more attractive place to live and more competitive for businesses. The effects would be more localized, however, since expansion would affect some parts of the region more than others. The payback would be significant but somewhat less than that for maintaining a State of Good Repair: for each dollar invested in expansion over twenty years, the region would see \$2 in business and personal income.⁸⁴

The positive effects of investment in transit can be explored empirically by looking at changes in New York's economy since the capital program began. As Section 2 indicated, the 1980s and 1990s marked the end of a long period of disinvestment in New York's transit system. During this period, the region's economy rebounded and for several years – before the events of September 11th – grew faster than the national economy. Untangling the effects of the MTA's \$68 billion capital investment from all other influences on the regional economy would be a daunting task, but there is clearly a correlation in time between the mobility gains provided by the region's improved transit system and a stronger economy. These trends support the idea that transportation is a necessary pre-condition for economic growth.

This relationship is seen most clearly in New York's northern suburbs, where Metro-North has extended service to new communities and dramatically improved overall performance. Companies throughout Metro-North's service area have chosen to locate near stations in order to provide convenient access for their employees as well as a quick connection to Manhattan's Midtown. According to Howard Permut, Vice President of Planning and Development at Metro-North, Swiss Re specifically chose to build its new trading floor in Stamford, Connecticut across from the Metro-North station for the accessibility benefits such a location provided. Large new transit-oriented projects are under way or have been completed in New Rochelle, Bronxville, White Plains, and Yonkers. In Rockland County, a major real estate developer is building a parking lot for Metro-North at the Haverstraw terminus of the railroad's Ossining Ferry. The ferry connection, which was introduced by Metro-North in 2000 and cut 30 minutes off the one-way commute, is a major feature of the development and has been "integral to the revitalization" of Haverstraw, in the words of the developer.⁸⁵

In the City, the relationship is more difficult to pinpoint. Improved transit may have played a part in some development decisions, such as the Citicorp tower in Long Island City that is located near a major nexus of transit lines including the new 63rd Street connection. Queens West and proposed developments at Atlantic Avenue in Brooklyn also depend on a strong transit system. On an even larger scale, a project such as the proposed business district in Far West Midtown would be hard to contemplate without the solid foundation of a restored transit system.

Numerous studies have looked at the impact of transit on real estate values.⁸⁶ While the MTA has not completed such a study in recent years, results along New Jersey Transit's Midtown Direct line are suggestive. New Jersey Transit began this direct service to Manhattan along the Morris and Essex line in 1996, saving commuters a transfer and from 20 to 40 minutes per day in travel time. The impact on land prices has been dramatic and well-documented. A Columbia University study found that the value of

⁸⁴ Cambridge Systematics, *Lasting Economic Benefits*, p. 6.2.

⁸⁵ Tri-State Transportation Campaign, "Haverstraw-Ossining Ferry Will Start This Summer," *Mobilizing the Region*, Issue 276 (July 3, 2000), <http://www.tstc.org/bulletin/20000703/mtr27609.htm>; Ginsburg Development Companies, "Harbors at Haverstraw: a Model for Revitalization" (Haverstraw, 2002), http://www.gdc-homes.com/about_showfullarticle.asp?item_id=14.

⁸⁶ Victor Ochieng et al, "The Residential Relocation Impacts of Midtown Direct: A Descriptive Analysis," New Jersey's Link to the 21st Century Working Paper No. 10 (New York: University Transportation Research Center, City College of New York, 2002), p.3.

being within walking distance of a Midtown Direct station increased dramatically after the service began. Holding everything else constant, the relative value of being within walking distance of one of the stations increased from \$17,000 in 1993 to \$90,000 a decade later (in 2003 dollars), while the relative value of being two to five miles from the station dropped from \$30,000 in 1993 to -\$17,000 in 2003. These communities had had commuter rail service for decades; it was an *improvement* in service that had such a dramatic economic effect.⁸⁷ It is quite likely that improved service and shorter commute times on Metro-North's Harlem line and the LIRR's Ronkonkoma line have had similar effects.

4.4. The Multiplier Effect and Future Capital Spending

While investment in transportation infrastructure may foster long-term economic growth, it also brings economic benefits in the short term. When the MTA spends capital dollars, it creates jobs for those who carry out the work. Money also goes to suppliers of goods and services, and this also creates jobs. The money cascades through these suppliers who in turn purchase goods and services from other vendors. The wages paid along the way also have a ripple effect, as they support other jobs and spending – the so-called “induced” impact. The ripple of economic activity generated by a single investment is known as the multiplier effect.

The magnitude of the multiplier effect depends greatly on the particular goods and services that are purchased. The size of the economy to be considered also matters. Manufactured goods tend to have higher multipliers than raw materials, for example, since an increase in production at one level will require the purchase of additional goods and services as inputs and induce an increase in their respective production. Furthermore, if the benefits to a particular region are to be considered, then the multiplier depends on the extent to which the purchased goods (and their inputs) are manufactured within the region.

For the MTA, rolling stock has been a significant part of its capital program. The MTA built support in Albany for the capital program in the 1980s in part by putting New York content quotas into its new car contracts and requiring that rehabilitation work be performed in-state. In response, rolling stock manufacturers established plants in New York State, so that much of the economic benefits of car rehabilitation and purchase contracts have accrued locally and thus augmented the multiplier effect of the capital program.⁸⁸

In 1989 and 1991, the Port Authority estimated the multiplier effect of the MTA's 1982-1991 and 1992-1996 plans, respectively. It found that for the first plan, every \$1 spent by the MTA would generate \$1.19 in economic activity within the state (including the original \$1). However, 29% of this capital program went to out-of-state suppliers and workers. For the remaining portion that was spent within New York State, the effect on the state economy was much stronger: every \$1 spent within the state was expected to generate \$1.68 in economic activity. For the 1992-1996 plan, the Port Authority estimated that every \$1 from the capital program would generate \$1.29 in economic activity within the state.⁸⁹

These studies provide a rough guide to the economic activity that would be generated by future MTA capital spending. Assuming that future spending patterns resemble those of previous plans, the state should see a multiplier effect of between approximately \$1.20 and \$1.70, depending on the types of goods and services purchased and the locations of the suppliers.

4.5. Summary

It is difficult to gauge the precise economic effects of the capital program's investments on an economy as large as New York's. New York strongly rebounded during the 1990s as the City's population reached eight million for the first time in 2000 and employment grew to highs not seen in thirty years. Factors such

⁸⁷ Juliette Dellecker Michaelson, *Walk-and-Ride: How MidTOWN DIRECT has affected residential property values within walking distance of train stations* (draft), Master's thesis (New York: Columbia University, 2004), p. 3.

⁸⁸ Mortimer Downey, personal communication, December 11, 2004.

⁸⁹ The MTA's summary of the 1992-1996 estimates does not indicate the fraction of the capital program that would be spent in-state. Sources: The Port Authority of New York and New Jersey, “The Economic Impact of the MTA 10-Year Capital Program,” 1989; MTA, *Economic Impact of the 1992-96 MTA Capital Program on New York State* (New York: MTA, 1995).

as growing global trade, falling crime, and immigration certainly played important roles in shaping the regional economy. Yet improved transportation, enabled by the capital program, contributed as well. The \$68 billion investment in regional transit has had immediate payoff in jobs and incomes. Network expansion at Metro-North has paved the way for new development in its service area. Restoration of the subway has changed the transit system's image; the fact that the civic community is debating development of a new business district in Manhattan that depends on the expansion of the subway speaks volumes to new confidence in that system.

The Cambridge Systematics studies indicate the magnitude of the effect that the capital program has had on the New York economy. In the long run, the benefits of maintaining the system dwarf the costs. Further investments in extending service can boost local markets, as well. These effects have likely contributed to the economy's strength since the early 1990s and will determine the impact of further investment.

Such long-term effects derive primarily from the lower costs brought by improved mobility. Increasing ridership – an important measure of mobility and a key goal of the capital program since 1992 – has been seen by many as a sign of a transit renaissance, but it can be specifically tied in this region to capital investments. As the previous section showed, the capital program has brought improvements in reliability and the passenger environment throughout the transit system that in turn stabilized ridership and set the stage for further growth. The capital program then provided for the fare system that brought millions of new riders to the system. This new mobility, and the lower costs it signifies, helped set the foundation for New York's economic resurgence.

5. Conclusion

In reviewing the effects of the MTA capital program since 1982, one major conclusion stands out: the capital program has had a transformative effect on the region's transit system. The subway and commuter lines have recovered from the brink of collapse and raised their performance to levels not seen in decades, if ever. Billions of dollars invested in restoring the City's transit system, and a new fare structure made possible by those investments, have dramatically increased mobility; while investments on the commuter lines have improved the quality of travel, and at Metro-North brought new accessibility to thousands of riders. These achievements represent a turnaround hardly imaginable in the early 1980s.

This success can be analyzed in terms of the goals of the capital program. The primary goal of the original capital program was to restore the system to a State of Good Repair, at which point the MTA would establish a program of Normal Replacement based on needs assessments.

At the commuter lines, this goal has been nearly achieved: at the LIRR, only one asset category is not at SGR, while only five remain at Metro-North. At NYCT, where the backlog of deferred maintenance was much greater, huge strides have been made, as the rolling stock has been renewed and most categories of the infrastructure are at least at 80% of SGR. Much work remains to be done: signal modernization and rehabilitation of all passenger stations, for example, are projected to take decades more. Yet the shift to Normal Replacement cycles is underway at all three agencies, and the share of funding for restoring SGR is now less than that for Normal Replacement in the proposed 2005-2009 Plan.

In 1992, the MTA broadened the capital program's goals to include improved regional mobility. The new plan sought to transform the region's network with innovative pricing and improved service. Its success can be seen in the surge in ridership at NYCT. That plan (and the 1995-1999 plan) brought to fruition the new fare system that improved mobility for millions of riders. The success of that plan can also be seen in improved service throughout the system and new accessibility for thousands of riders in the Metro-North service area.

The 2000 Plan built on the achievements of the previous decades and proposed expanding service to new markets. It is too early to judge the results of this plan; however, the MTA is making headway on a number of expansion projects – the first such work in decades.

Yet important obstacles have prevented full realization of the capital program's goals. At the LIRR, improved mobility has been stymied by capacity constraints. In New York City, bus performance has been limited by traffic congestion. New investments by the MTA – the LIRR-Grand Central link, and a bus rapid transit pilot – may address these constraints.

The ability of the MTA to continue making progress towards these goals depends on the availability of funding. As Richard Ravitch made clear, consistent and dependable funding is key to making long-term investments. New York State and New York City injected billions of dollars into the capital program in the 1980s and early 1990s, but the City portion has been greatly reduced, and the State portion is significantly changed in nature. Further, a major source of funds for the 2000-2004 Plan will not be available in the future: the debt restructuring that yielded \$4.5 billion, or 25% of all funds.

In any case, continued support from government will be essential to maintaining the system and preventing a return to the crisis conditions of the 1970s and early 1980s. NYCT faces a backlog of catch-up work from decades of deferred maintenance that it is not scheduled to complete until 2027. Normal Replacement will likely continue to be the largest category of expenses at all agencies, and it needs to be adequately funded to prevent any slippage in performance. Underfunding these programs carries a huge cost, since (as Section 4 showed) the losses from disinvestment are so large relative to the savings.

The potential gains provided by improving and expanding the transit system are harder to quantify, but the record of the capital program to date is instructive. In 1991, after ten years of investment, the long decline in subway ridership had stopped. NYCT had succeeded in eradicating graffiti in the subway, and

riders were benefiting from major performance improvements throughout the regional transit system. Some might have asked, what more could be done? Nonetheless, progress continued: Grand Central Terminal was restored to its original glory, travel times dropped for thousands of commuters, and customer satisfaction with the subway passed that of the buses. Most dramatically, subway, bus, and Metro-North ridership soared to levels not seen in decades (if ever, in the latter case). In 1999 few might have imagined further advances; indeed, voters rejected new bond funding for the capital program. Yet over the next four years, with continued performance improvements, the transit system became the platform for major economic development initiatives throughout the region.

For 2005-2009 the MTA has proposed to continue restoring and maintaining the existing system, to expand the network, and to improve security in the wake of September 11th. What payoffs might this capital plan bring? Direct benefits potentially include improved mobility, shorter commutes, lower air pollution, and a better regional quality of life. Beyond these, further investment in the region's transit system may be an important pre-condition to continued economic vitality. These outcomes depend on the strategic choices the MTA makes in the next capital plan. They also depend on the MTA receiving sufficient funding and maintaining the leadership necessary to make those choices.

Bibliography

- Banister, David, and Joseph Berechman. *Transport Investment and Economic Development*. London: University College, 2000.
- Bear, Stearns & Co. *Metropolitan Transportation Authority, Finances of Commuter Rail Services in the New York Region*. New York: Bear Stearns, 1985.
- Bear, Stearns & Co. *Metropolitan Transportation Authority, Finances of Mass Transit Services in New York City*. New York: Bear Stearns, 1983.
- Booz-Allen & Hamilton Inc., Transportation Consulting Division. *New York MTA Management Study*. New York: Booz-Allen & Hamilton, Transportation Consulting Division, 1980.
- Cambridge Systematics, Inc. *Public Transportation and the Nation's Economy, A Quantitative Analysis of Public Transportation's Economic Impact*. Cambridge, MA: Cambridge Systematics, Inc., 1999.
- _____. *The Economic Impacts of the RTA System on the Regional and State Economies*. Cambridge, MA: Cambridge Systematics, Inc., 1995.
- _____. *Lasting Economic Benefits of Public Transit Investment, Final Report*. Cambridge, MA: Cambridge Systematics, Inc., 1996.
- Charles River Associated Incorporated (CRA). *New York City Transit Authority Revenue Feasibility Study: Economic Analyses and Projections*. New York: CRA, 1982.
- _____. *Long Island Rail Road and Metro-North Commuter Rail Revenue Feasibility Study: Economic Analyses and Projections*. New York: CRA, 1984.
- Citizens Advisory Committee. *Financing the Operating Deficit and Reorganizing the Executive Structure of the MTA*. New York: MTA, 1979.
- Citizens Budget Commission. *Financing Transportation Services in the New York Region*. New York: Citizens Budget Commission, 2004.
- _____. *Transportation Infrastructure and New York's Competitiveness*. New York: Citizens Budget Commission, 1999.
- DeLeuw Cather & Company, Engineers and Planners. *Engineering Audit for New York MTA Bond Feasibility Study*. New York: DeLeuw, Cather, 1982.
- Ginsburg Development Companies. "Harbors at Haverstraw: A Model for Revitalization." Haverstraw, 2002. http://www.gdc-homes.com/about_showfullarticle.asp?item_id=14
- Hood, Clifton. *722 Miles: The Building of the Subways and How They Transformed New York*. Baltimore: Johns Hopkins University Press, 1993.
- Lapp, Katherine. "The MTA: Progress Made and Challenges Ahead." Breakfast Series, NYU-Rudin Center, The Kimmel Center, New York. December 10, 2003.
- Lardner, James. "Painting the Elephant." *The New Yorker* (June 25, 1984): 41-72.

Lieberman Research Group. *2003 Citywide Survey Report*. Prepared for MTA New York City Transit (March 2004).

_____. *2004 Citywide Survey Topline Results*. Results of a Random Telephone Survey conducted April 14-28, 2004.

McCall, H. Carl. *A Guide for Evaluating the Metropolitan Transportation Authority's Proposed Capital Program for 2000 Through 2004*. New York: Office of the State Deputy Comptroller for the City of New York, 1999.

McGuckin, Nancy, and Nanda Srinivasan. "Journey to Work Trends in the United States and its Major Metropolitan Areas, 1960 – 2000." Publication No. FHWA -EP-03-058 (Washington: US Department of Transportation, Federal Highway Administration, 2003.
<http://www.fhwa.dot.gov/ctpp/jtw/jtw4.htm>.

Metropolitan Transportation Authority (MTA). *Amendment: MTA 2000-2004 Capital Program*. New York: MTA, 2003.

_____. *An Amendment to the Capital Programs of the Metropolitan Transportation Authority*. New York: MTA, 1986.

_____. *Annual Reports, 1980-1982, 1985-1987, 1992-1995*. New York: MTA, 1981-1996.

_____. *Capital Needs Assessment 2000-2019*. New York: MTA, 2000.

_____. *Capital Program 1995-1999*. New York: MTA, 1997.

_____. *Capital Program 2000-2004*. New York: MTA, 2000.

_____. *The Capital Programs of the Metropolitan Transportation Authority*. New York: MTA, 1987.

_____. *Comprehensive Annual Financial Reports, 1997-2002*. New York: MTA, 1998-2003.

_____. *Combined Continuing Disclosure Filings 2004*. New York: MTA, 2004.

_____. *Economic Impact of the 1992-96 MTA Capital Program on New York State*. New York: MTA, 1995.

_____. *Second Avenue Subway Final Environmental Impact Statement*. New York: MTA, 2004.

_____. *Final Review of 1997 Operating Budget Results*. New York: MTA Finance Committee, 1998.

_____. *Metro-North Committee Meeting*. New York: MTA, December 10, 2003.

_____. *MTA Capital Needs & Opportunities 1992-2011*. New York: MTA, 1994.

_____. *The MTA Capital Program*. New York: MTA, 1986.

_____. *MTA Capital Program 1992-1996*. New York: MTA, 1992.

_____. *MTA Capital Program 1982-1991*. New York: MTA, 1992.

_____. *MTA Proposed Capital Program 2005-2009*. New York: MTA, September 29, 2004.

_____. *Report to the Governor 1984-1985*. New York: MTA, 1986.

- _____. *Report to the Governor 1990*. New York: MTA, 1991.
- _____. *Report to the Governor 1991*. New York: MTA, 1992.
- _____. *Staff Report of Capital Revitalization for the 1980's and Beyond*. New York: MTA, 1980.
- _____. *Strategic Business Plan 1990-1994*. 2 vols. New York: MTA, 1989.
- _____. *Strategic Business Plan 1994-1998*. 2 vols. New York: MTA, 1993.
- _____. *Strategic Operation Plans*. New York: MTA, 1984.
- _____. *Strategic Planning Initiative*. New York: MTA, 1988.
- _____. *Submission to the MTA Capital Program Review Board*. New York: MTA, 1981.
- _____. *Subway and Bus Ridership Report 1998/1999*. New York: MTA, 2000.
- _____. *Twenty-Year Capital Needs Assessment 1987-2006*. New York: MTA, 1986.
- Michaelson, Juliette Dellecker. *Walk-and-Ride: How Midtown Direct Has Affected Residential Property Values Within Walking Distance of Train Stations*. Master's thesis (draft). New York: Columbia University, 2004.
- New York State. Department of Transportation. "State Transportation Operating Assistance (STOA)." <http://www.dot.state.ny.us/pubtrans/stoa.html> (referenced October 11, 2004).
- New York State. Office of the State Comptroller. *Review of the Proposed Financial Plan and Capital Program for the Metropolitan Transportation Authority*. Report 7-2005. NY: Office of the State Comptroller, October 2004.
- Ochieng, Victor, et al. "The Residential Relocation Impacts of Midtown Direct: A Descriptive Analysis." New Jersey's Link to the 21st Century Working Paper No. 10. New York: University Transportation Research Center, City College of New York, 2002.
- O'Meara, J. Roger. "Executive Suites in Suburbs." *Conference Board Record* 9, 8 (August 1972).
- Paaswell, Robert. *New Jersey's Links to the 21st Century: Maximizing the Impact of Infrastructure Investment*. New York: University Transportation Research Center, City College of New York, 2002.
- Permut, Howard. "Implementing Change Successfully: MTA Metro North Railroad Case Study." Lecture notes for National Transportation Institute class, 2004.
- Port Authority of New York and New Jersey (PANYNJ). "The Economic Impact of the MTA 10-Year Capital Program." New York: PANYNJ, 1989.
- Quante, Wolfgang. *The Exodus of Corporate Headquarters from New York City*. New York: Praeger, 1976.
- Rappaport, Joseph, and Gene Russianoff. *The Good, the Bad and the Ugly, A Straphangers Campaign Report*. New York: New York Public Interest Research Center, Inc. (NYPIRC), 1987.
- Rappaport, Joseph G., Eddie Mark and Gene Russianoff. *Slow Motion, A Straphangers Campaign Report*. New York: NYPIRC, 1988.

- Rappaport Joseph G., et al. *\$1.25 for What?, A Survey of Subway Service, A Straphangers Campaign Report*. New York: NYPIRC, 1989.
- Russell, Joel, Robert Lane, and John Shapiro. *Community Planning for the Wassaic Rail Extension*. New York: Regional Plan Association, 1999.
- _____. *Investing in New York's Transit Future: An Assessment of the Capital Needs of the Metropolitan Transportation Authority*. New York: Empire State Transportation Alliance, 1999.
- Ryan, Herbert F. *New York City Politics, A Study of Delivery Systems*. New York: Vantage Press, 1989.
- Schaller Consulting. *Mode Shift in the 1990s, How Subway and Bus Ridership Outpaced the Auto in Market Share Gains in New York City*. New York: Schaller Consulting, 2001.
- Sigall, Jonathan. *A Comparative Study of Financing for the MTA and Other Transit Properties*. New York: Permanent Citizens Advisory Committee to the MTA, 1997.
- Sisk, Richard. "Rap-hangers hit majority of lines." *Daily News*. December 17, 1987.
- Straphangers Campaign. *Subway Performance Measures, 1980-1990*. From Personal Communication with Gene Russianoff.
- Straphangers Campaign and Transportation Alternatives. "Third Annual 'Pokey' Awards for Slowest City Buses." September 23, 2004. <http://www.straphangers.org/pokeyaward/release04.html>.
- Surface Transportation Policy Project (STPP). *Driven to Spend: The Impact of Sprawl on Household Transportation Expenses*. Washington: STPP, 2000. <http://www.transact.org/report.asp?id=41>.
- Tri-State Transportation Campaign. "Haverstraw-Ossining Ferry Will Start This Summer." *Mobilizing the Region 276* (July 3, 2000). <http://www.tstc.org/bulletin/20000703/mtr27609.htm>.
- US Census Bureau. *Census 2000 Redistricting Data (P.L. 94-171) Summary File and 1990 Census*. <http://www.census.gov>.
- US Department of Transportation, Federal Highway Administration. *National Transit Database*. In *Florida Transit Information System* (computer program). Compiled by Florida Department of Transportation, 2003.
- Wagner, Robert F. Jr. *A New Direction in Transit*. New York: New York City Department of City Planning, 1978.
- "Whitewash." *The Economist*. May 20, 1989, p. 34. Referenced on LEXIS-NEXIS Academic.