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Choices at a Critical Junction:

New York's Mobility and Highway Infrastructure Needs for 2005-2010

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EXECUTIVE SUMMARY

In January, Governor Pataki proposed a $17.4 billion Capital Program for the New York State Department of Transportation (NYSDOT) for 2005 to 2010. Program funding includes a $15.4 billion core capital program that provides for continuation of existing investment levels over the next 5 years, funded through state and federal sources. The Capital Program also includes $2 billion of enhancements in the final two years, funding for which has not been identified.

The proposed $17.4 billion statewide five-year Highway Capital Program would allocate $6.0 billion to the Downstate area, based on historic allocations between Downstate and Upstate areas. These funds will go toward rehabilitation, replacement, maintenance, mobility and safety work on state-owned highways and bridges.

This report reviews the current condition of state-owned highways and bridges in the 14-county Downstate area[1] and future funding needs. Improvements in highway pavement conditions and bridge conditions achieved in the 1990s have slowed, halted or in some cases reversed in the last several years. Mobility on these facilities has steadily worsened under a rising tide of traffic congestion. As anyone who has driven in the region knows first-hand, much work remains to be done to bring these parts of the transportation infrastructure to acceptable conditions and to combat the numbing congestion that plagues state-owned highways.

The $6.0 billion estimated for the Downstate area is insufficient to meet the region's needs. This level of funding would result in deterioration of highway and bridge conditions, continued growth in congestion on the state highway system, or both. Improving the condition of state-owned highways and bridges and combating congestion in the Downstate region will require substantially greater funds than are currently proposed for the Highway Program.

This report develops and analyzes three alternative funding levels based on achieving specified bridge, pavement and congestion conditions by 2010. The most prudent program would make reasonable progress toward a state of good repair for bridges and pavements and would reverse recent increases in highway traffic congestion. This state-of-good repair program would require $13.7 billion for the Downstate area over five years, $7.7 billion more than would be available under the proposed budget.

A more modest program would simply hold the line on further deterioration in current conditions. This program would maintain current bridge and pavement conditions and also prevent further growth in congestion on state highways. This hold-the-line program would require $9.0 billion for the Downstate area over five years, which is $3 billion more than would be available under the proposed budget..

A very minimal program would hold the line on bridge and pavement conditions but allow continued growth in congestion. This alternative, which is not recommended, would maintain current bridge and pavement conditions and slightly increase the drastically inadequate current spending levels on mobility programs. Under this alternative, congestion measured as the cost of traffic delay would increase 16 percent. This program would require $7.3 billion for the Downstate area over five years, or $1.3 billion more than would be available under the proposed budget.

In sum, without major increases in funding, bridge and highway conditions will likely deteriorate significantly in the Downstate region, creating long-term costs for rehabilitation and replacement that will be greater – in the long-term – than adequately funding maintenance and rehabilitation work over the next five years. Likewise, congestion on already-clogged highways will worsen throughout the region, obstructing both person and goods movement and undermining the quality of life and economic vitality of the region. Upcoming decisions on Highway Program funding will thus affect the mobility and economic vitality of the region for years to come.

[1] For purposes of this report, the Downstate area consists of NYSDOT Region 11 (New York City), Region 10 (Long Island) and Region 8 (Columbia, Dutchess, Orange, Putnam, Rockland, Ulster and Westchester counties).

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1. INTRODUCTION

The purpose of this report is to document funding needs for the New York State Highway Program for the 2005-2010 period with a focus on the 14-county Downstate area. The report reviews recent trends in bridge and pavement conditions and mobility levels in the Downstate region. The report develops three alternative programs and funding needs based on achieving specified bridge, pavement and congestion conditions by 2010. The intent of this report is to provide a policy framework for assessment of Highway Program funding needs during the Legislature's consideration of the Governor's proposed Capital Program for 2005-2010.

The next Highway Program represents a critical juncture for the Downstate area. The level of funding for capital spending on highways and bridges will determine whether bridge and pavement conditions and congestion improve – or deteriorate. This report shows that without major increases in funding, bridge and pavement conditions will worsen. Deterioration of bridge and pavement conditions would create long-term costs for major rehabilitation or replacement of these facilities that would be greater – in the long-term – than the cost of adequately funding maintenance and rehabilitation work. In addition, without very substantial increases in funding for mobility projects, congestion on the already-congested state highway system will grow even worse throughout the region, impeding both person and goods movement and undermining the quality of life and economic vitality of the region.

In the Downstate region (defined as New York City, Long Island, and Westchester, Rockland, Orange, Columbia, Dutchess, Putnam and Ulster counties), the New York State Department of Transportation (NYSDOT) is responsible for 2,254 highway bridges and 8,827 lane miles on the state highway system. During the 1990s, highway and bridge repairs led to improvements in the conditions of these facilities. That progress has slowed, halted and in some areas reversed in the last several years as a result of budgetary belt-tightening.

Further, highway traffic congestion has only worsened over the past 15 years. The revitalization and growth of New York City and growth in population and employment throughout the region have served to add cars and trucks to the region's highways. This trend is certain to continue at proposed funding levels.

This report reviews recent trends in bridge and pavement conditions and congestion levels and develops goals for moving toward a state of good repair for bridges and pavements and for reversing the trend toward ever-greater traffic congestion. The report discusses how traffic congestion affects mobility and economic vitality of the region, and estimates the financial benefits of an expanded mobility program.

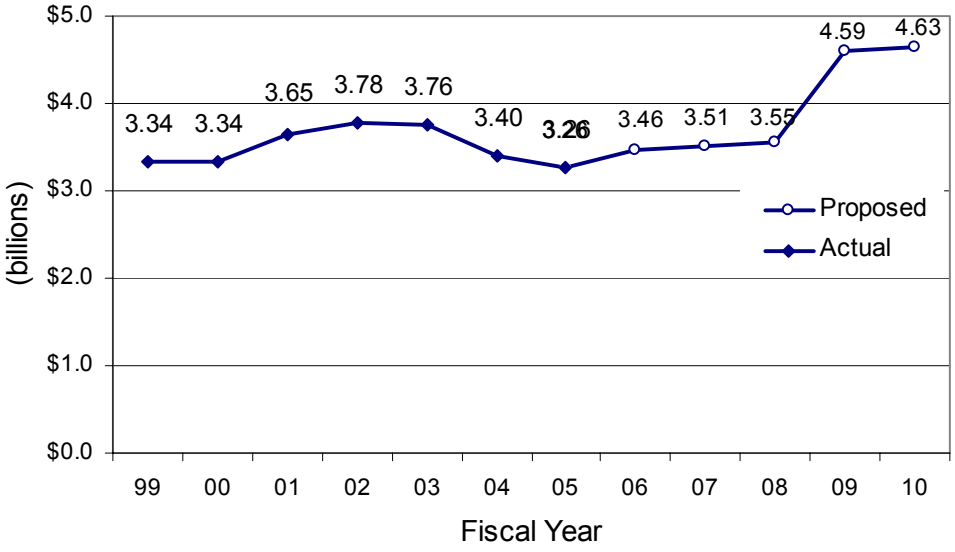
Funding trends and proposed 2005-2010 Capital Program

Appropriations for state spending on highways and bridges and other elements of NYSDOT's Capital Program have declined over the last three years. New York State Executive Budgets published for each year show that appropriations for Highway Facilities peaked at $3.78 billion in fiscal year 2002 and then declined each year since 2002, reaching $3.26 billion in fiscal year 2005, which ends on March 31. (See Figure 1.)

Under the Governor's budget proposed in January 2005, appropriations for Highway Facilities would increase to $3.46 billion in fiscal year 2005-06 (which starts on April 1) and to slightly more than $3.5 billion in each of the following two years. Appropriations would then jump to $4.6 billion in the final two years of the plan (FY'08-09 and FY'09-10), although the financing source for the additional $1 billion in each of these years has not been identified.

The Highway Facilities budget category includes about one-half million dollars for snow and ice control and state forces preventive maintenance. Subtracting these appropriations leaves about $3.0 billion for the NYSDOT Capital Program in FY'05-06 and $17.4 billion over the 5-year life of the NYSDOT

Figure 1. New York State Capital Appropriations for Highway Facilities



Source: New York State Executive Budget, Capital Program and Financing Plan issued for each fiscal year, FY'98-99 through FY'05-06.

Capital Program. The NYSDOT Capital Program, also known as the Highway Program, funds work on state highways and bridges and, through various programs for local assistance, on local highways and bridges.

As shown in Table 1, $15.4 billion of the NYSDOT Capital Program would be allocated to the Highway and Bridge Capital Program funding that is allocated to each of NYSDOT's 11 regions using several different formulas specified by law. (The balance of the $17.4 billion Capital Program is allocated to local highway and bridge capital programs and several smaller rail freight and passenger categories.) The bulk of the $15.4 billion Highway and Bridge Capital Program funding is devoted to work on state-owned bridges and the state highway system, although a portion is budgeted in each region for work on local highways and bridges that are not part of the state system.

This report focuses on the Highway and Bridge Capital Program for the Downstate area (NYSDOT Regions 8, 10 and 11). As shown in Table 2, $1.0 billion would be available in FY'05-06 for projects on the state highway system and on state-owned bridges located in the Downstate area, based on the historic allocation between Downstate and Upstate areas.[2] These projects include rehabilitation, replacement and maintenance of bridges and highway pavement and mobility-related and safety projects.

The $1.0 billion in funding for state highway and bridge projects in the Downstate area is allocated by each region to several program areas: bridge preventive maintenance, rehabilitation and replacement, pavement rehabilitation and replacement, mobility and safety. Based on allocations in recent years, the $1.0 billion in FY'05-06 is likely to be allocated as follows: approximately $390 million a year to bridge and pavement maintenance, rehabilitation and replacement contracts; $190 million to mobility contracts; and $60 million a year for safety programs.[3] In addition, $360 million is likely to be allocated

[2] An additional $0.20 billion is allocated to work on local highways and bridges that are not part of the state system.
[3] It should be noted many projects serve multiple purposes and thus this classification is not exact. For example, highway rehabilitation and replacement projects sometimes include components to improve mobility and safety.

for in-house and consultant design and consultant support, construction inspection, right-of-way easements and acquisitions and preventive maintenance non-let work. (See Table 2.)

The fundamental issue addressed by this report concerns the adequacy of these funding levels for the Downstate area. The next two sections of the report address recent trends and future funding needs for state-owned bridges and pavements on the state highway system. Section 4 discusses the significance of traffic congestion for residents and businesses in the Downstate area, the impacts of rising congestion levels on mobility and economic vitality, and funding needs. Section 5 pulls together the funding needs identified in sections 2-4 in the context of projected funding levels.

Table 1. New York State Department of Transportation Proposed Capital Program, 2005-2010 (billions)

	FY'05-06	FY'06-07	FY'07-08	FY'08-09	FY'09-10	Total
Highway and bridge capital program	$2.6	$2.7	$2.7	$3.7	$3.8	$15.4
Other programs*	0.4	0.4	0.4	0.4	0.4	2.0
Total - NYSDOT Capital Program	$3.0	$3.1	$3.1	$4.1	$4.2	$17.4

*Includes local highway and bridge capital programs known as CHIPS and Marchiselli programs, rail freight and passenger projects and certain public transit funding.

Note that this table does not include snow and ice control and state forces preventive maintenance expenses that are included in Figure 1.

Source: New York State Executive Budget Finance Plan. Annual figures estimated based on information in Finance Plan.

Table 2. Estimated Highway and Bridge Capital Program, FY'05-06 (in billions)

Downstate area (Regions 8, 10 and 11)	
State highways and bridges	$ 1.00
Bridge and pavement contract lettings	0.39
Mobility contract lettings	0.19
Safety contract lettings	0.06
In-house and consultant design and consultant support*	0.36
Local highways and bridges	0.20
Total, Downstate region	$ 1.20
Upstate program	1.44
Statewide highway and bridge capital program	$ 2.64

Source: Based on Executive Budget Funding Level, historic Upstate/Downstate allocations and allocation of funds based on lettings history.

2. BRIDGE CONDITIONS

NYSDOT is responsible for 2,254 highway bridges in the Downstate area, encompassing over 32 million square feet of bridge area. A span is classified as a bridge if it clears more than 20 feet,[4] and includes bridges that span water, other highways and railways. (Note that there are an almost equal number of bridges owned by local governments and other governmental entities.)

One of the central challenges for Highway Program funding is to bring the state's highway bridges to acceptable conditions. The condition of state-owned bridges in the New York region shows impressive improvements over the past decade, but progress has slowed in recent years and much remains to be done.

Bridge condition ratings

Bridges must be maintained on a regular basis to prevent deterioration that can quickly accelerate once it reaches a certain point. If left unchecked, bridge deterioration can produce disastrous collapses. The main cause of the 1987 failure of the Schoharie Creek Bridge on the New York State Thruway that killed 10 vehicle occupants was erosion (or "scour") of sediment under pier three and the resultant failure to maintain the wall of stones along the foundation. Over several decades, the Schoharie Creek eroded enough material to produce a loss of support for the foundation and the bridge collapsed.[5]

NYSDOT inspects each highway bridge on a biannual basis or more often if needed. Inspectors rate each component of each bridge span on a scale of "1" (poor condition) to "7" (new condition). Ratings of 5 to 7 indicate acceptable conditions; lower ratings indicate deterioration.

Inspectors follow a very detailed Bridge Inspection Manual that includes photographs for each condition rating. Figures 2 and 3 on the following pages illustrate how the ratings system corresponds to actual physical conditions for scour and paintings – two of many conditions rated on bridges. As shown in Figure 2, minor scour (erosion) of footings is rated a 5; serious scour or erosion is rated a 3 or below. For the condition of superstructure paint, moderate paint deterioration with no corrosion is rated 5, while paint "in poor condition with minor corrosion in isolated areas" is rated 4. (See Figure 3.)

Condition ratings for individual bridge elements are combined by formula to compute an overall or "average" bridge condition rating. Bridges with overall ratings of 5 to 7 are in acceptable condition, although bridges with a 5 rating need some corrective action. Bridges rated less than 5 are classified as "deficient." Deficient bridges are not necessarily unsafe but do need major work, such as replacing a deck or a total rehabilitation. Bridges rated 3.0 to 4.99 need some rehabilitation while bridges with ratings under 3 show serious deterioration.

Bridges start to deteriorate from the moment that they are opened to traffic. Regular maintenance, however, substantially extends the useful life of bridges. NYSDOT has developed statistical models of bridge deterioration for program management and budgeting purposes. These models show the effect of corrective maintenance treatments on bridge service life based on bridge deterioration and maintenance records for the state's highway bridges. Figure 4 illustrates schematically how bridges subject to corrective maintenance deteriorate less quickly and have a longer life than bridges lacking corrective maintenance treatments.

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[4] New York State Department of Transportation, "Bridge Inventory Manual," Amended November 1, 1991, p. 3.
[5] Chris Storey and Norbert Delatte, "Lessons from the Collapse of the Schoharie Creek Bridge," *Proceedings of the 3rd ASCE Forensics Congress*, October 19 - 21, 2003, San Diego, California

Figure 2. Bridge Ratings for Scour

Figure 4D.8.2
Rate 5
minor erosion at the base of a column. Most of the paving bricks have been removed, but the underlying embankment material is largely undisturbed.

Figure 4D.8.3
Rate 2
pier scour that has exposed the end of the footing founded on rock.

Source: NYSDOT Bridge Inspection Manual, 1997

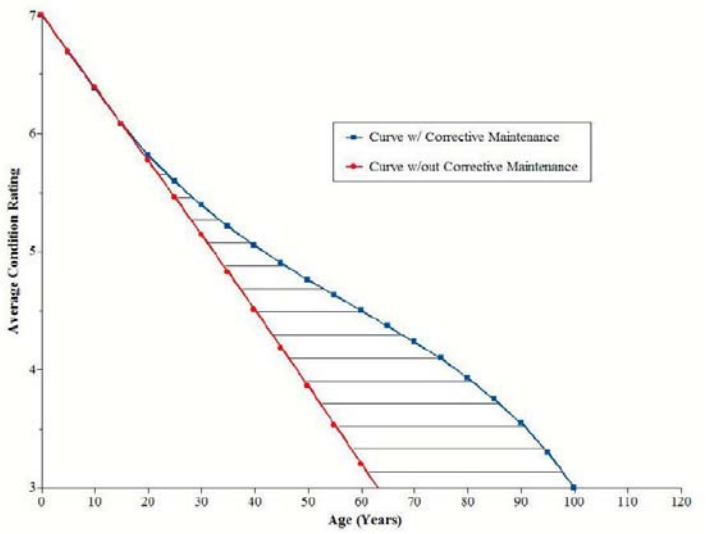
Figure 3. Bridge Ratings for Paint Conditions

Figure 7.4.4
Rate 5
paint that is faded and chalked with isolated minor steel corrosion. Rate paint 5.

Figure 7.4.5
Rate 4
weathering steel with corrosion along the bottom of the web exceeding the expected oxidation that would form a protective coating. Rate paint 4.

Source: NYSDOT Bridge Inspection Manual, 1997

Figure 4. Bridge Deterioration Curves With and Without Corrective Maintenance



Bridge conditions in the Downstate area

Bridge conditions vary in different parts of the Downstate area. State highway bridges in New York City are in much worse condition than bridges in the suburbs. The condition of bridges in the city has improved until the last two years, whereas trends are mixed in the suburbs.

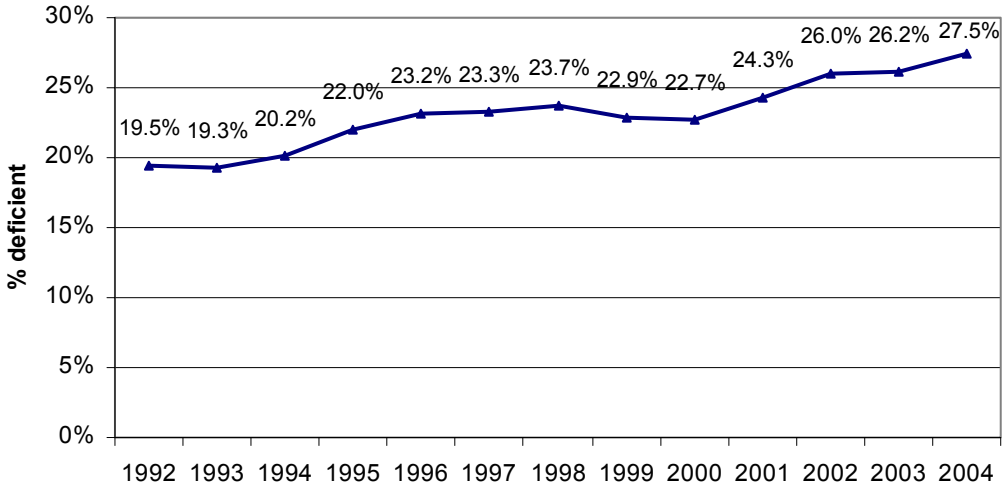
- The Mid-Hudson region (NYSDOT Region 8) shows a slight worsening in bridge conditions from 1993 to 1996, a leveling off in the mid to late-90s, and worsening since 2000. The proportion of deficient bridges increased from 22.7 percent in 2000 to 27.5 percent in 2004.

- On Long Island (NYSDOT Region 10), the proportion of deficient bridges declined somewhat in the 1990s, from 23.7 percent in 1994 to 18.2 percent in 2001. This figure has been stable since 2001.

- In New York City (Region 11), bridge conditions improved steadily in the 1990s but leveled off in the past two years. The proportion of bridges rated deficient declined from 72.4 percent in 1993 to about 51 percent in both 2003 and 2004.

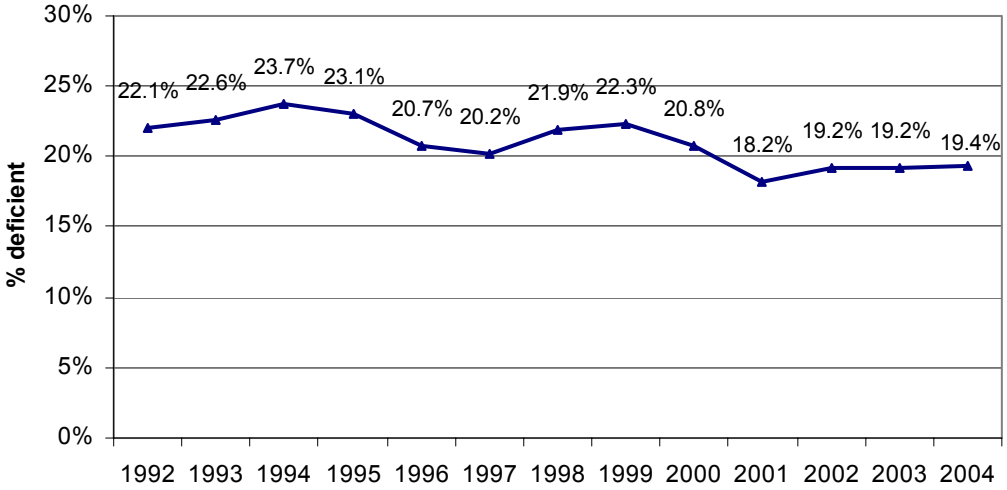
See Figures 5-7 on the following pages.

Figure 5. State Highway Bridges – Percent Deficient in Region 8 (Mid-Hudson)



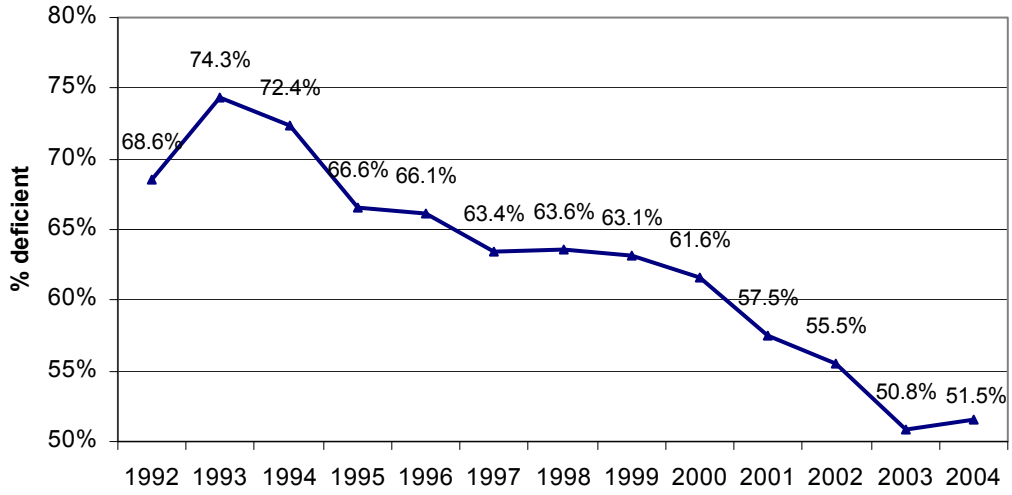
Region 8 encompasses Columbia, Dutchess, Orange, Putnam, Rockland, Ulster, Westchester counties.

Figure 6. State Highway Bridges – Percent Deficient in Region 10 (Long Island)



Region 10 encompasses Nassau and Suffolk counties.

Figure 7. State Highway Bridges – Percent Deficient in Region 11 (New York City)



Region 11 encompasses the five boroughs of New York City.
Source: Official Bridge Data. Issued annually by NYSDOT.

Goals for 2005 to 2010 Highway Program

While it might be expected that no bridges should be classified as deficient, as a practical matter, reaching zero percent deficient bridges would be an exorbitantly expensive and ultimately unnecessary endeavor. It is desirable, however, to reach a manageable level of deficient bridges and then maintain that level. Thus, setting bridge condition goals requires making a judgment as to what constitutes a reasonable percentage of deficient bridges and assessing expenditures required to reach and subsequently maintain that goal.

Based on previous national and state goals, 20 percent deficient bridges appears to be prudent. The Federal Highway Administration set a goal of 20 percent of bridges on the National Highway System being classified as deficient by 2008.[6] The memorandum of understanding (MOU) signed by the Governor and Legislative leaders for the 2000 Bond Act set goals of 16-20 percent deficient bridges for Long Island and the Hudson Valley by 2005. For state highway bridges in New York City, which had (and still have) a much higher deficiency level, the MOU goal was 45-50 percent by 2005.

For purposes of assessing needs for the next Highway Program, the following goals are used as defining achievement of or (in the case of New York City) reasonable progress toward a state of good repair for state highway bridges:

- Continued progress in bridge conditions in New York City, based on the rate of progress achieved from 1994 to 2004. To achieve this goal, the percentage of deficient bridges should continue to decline at the same rate, 2 percent per year, as occurred during the past 10 years. The result would be to reach 39.5 percent of bridges rated deficient in 2010, down from 51.5 percent in 2004.

- Preventing deterioration in bridge conditions in the Mid-Hudson region based on achieved levels in the 2000-04 period the percentage of deficient bridges. This means that the

[6] Federal Highway Administration, *1998 National Strategic Plan.* Available: http://www.fhwa.dot.gov/policy/fhplan.html. Accessed Dec. 13, 2004.

percentage of deficient bridges should be reduced to 22.7 percent – the percentage achieved in 2000.

- Likewise, to prevent deterioration in bridge conditions on Long Island, the percentage of deficient bridges should be maintained at the 2004 level of 19.4 percent.

Costs of state-of-good repair bridge program

Table 3 shows the estimated annual cost of this program. Achieving the deficiency ratings listed above would cost $567 million annually for the period of the next Highway Program, 2005-2010.

For comparative purposes, Table 3 also shows estimated costs of simply maintaining current conditions, i.e., the current percentage of bridges rated as deficient. The cost of this option for state bridges in the Downstate area is $382 million annually.

Table 3. Cost of Bridge Program in the Downstate Area, 2005-2010

	State of Good Repair Program (Achieve 2000-01 percent deficient in Regions 8 and 10 and continue previous rate of improvement in Region 11)	**Maintenance of Current Conditions** (Maintain current percent deficient bridges)
	Percent Deficient	
Region 8	22.7%	27.5%
Region 10	19.4%	19.4%
Region 11	39.5%	51.5%
Annual cost	$567 m	$382 m

Source: Estimates based on costs per bridge needing rehabilitation and replacement work.

3. PAVEMENT CONDITIONS

NYSDOT is responsible for 8,827 lane miles on the state highway system in the Downstate area. The state highway system includes Interstates, state highways, certain parkways and state-owned service roads. Not included in the state highway system is non-DOT parkways and local and institutional roads, and the New York State Thruway.

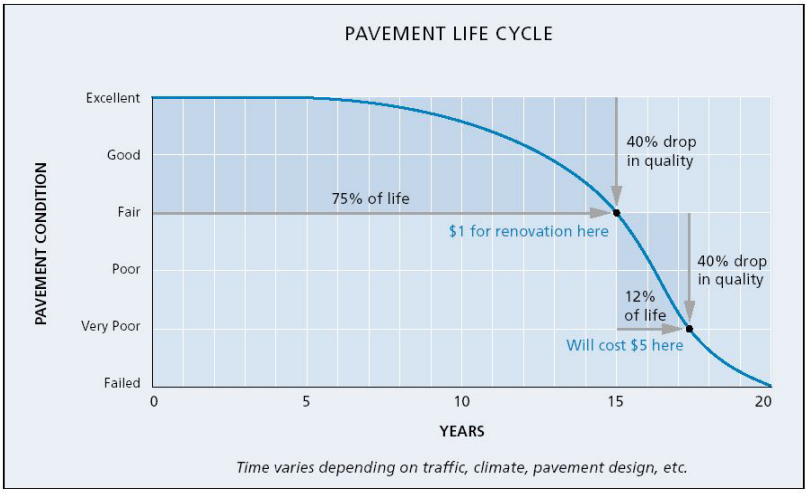
Pavement condition ratings

Like bridges, pavements begin to deteriorate as soon as a road is opened to traffic. Initially, the deterioration is very slow. Over time, the weight of traffic and the weather combine to accelerate the rate of deterioration. Once cracks begin to appear on the pavement surface, water leaks through the cracks and weakens the pavement's subbase. This further damages the pavement. At a certain critical point, the pavement begins to lose its ability to resist water and carry weight and begins to quickly fall apart.

Federal and professional pavement guidelines stress the importance of ongoing maintenance of pavements in good condition – not simply fixing what is broken – as the most cost-effective strategy to pavement management.[7] A rule of thumb among pavement experts is that pavements deteriorate 40 percent in quality in the first 75 percent of their life, but then another 40 percent in the next 12 percent of life. (See Figure 8.) As a result of the accelerating rate of deterioration once a critical point is reached, it is more expensive to rehabilitate pavement that has deteriorated to a poor condition than it is to keep pavement in good condition. Reconstructing a road after 25 years of deterioration can cost 3.5 times as much as preservation treatments administered at timely intervals during its 25-year lifespan.[8]

NYSDOT conducts an annual "windshield" assessment of pavement conditions each year using a visual rating procedure. Pavement surfaces are rated on a scale of "1" (very poor) to "10" (excellent).

Figure 8. Pavement life cycle conditions and costs



Source: Metropolitan Transportation Commission, "The Pothole Report," March 2000.

[7] Cambridge Systematics, Inc. "FHWA Asset Management Position Paper," April 2004. Available: http://www.fhwa.dot.gov/infrastructure/asstmgmt/ampp.htm#11. Accessed: Dec. 2, 2004.

Pavements rated 7 and above are considered in "good" to "excellent" condition. These pavements need, at most, preventive maintenance. Pavements rated 6 are in "fair" condition and need corrective maintenance. Pavements rated 5 and below are in "poor" condition and need some level of rehabilitation. Figure 9, excerpted from NYSDOT's Pavement Ratings Manual, shows the difference between pavements rated 6 (fair) and 5 (poor).

Pavement conditions in the Downstate area

As shown in Figures 10-12, pavement conditions vary in different parts of the New York region. As with bridges, New York City has significantly worse pavement conditions than do the suburbs. All areas of the region show substantial improvements in pavement conditions, however, over the past decade:

- In the Mid-Hudson region, pavement conditions improved in the mid to late 1990s. The proportion of pavement lane miles rated fair or poor declined from 47.6 percent in 1994 to 20.0 percent in 2000. There was essentially no change after 2000 until an increase to 23.0 percent rated fair or poor in 2004.

- On Long Island, pavement conditions improved in both the mid-1990s and first years of this decade, but then worsened in 2004. Overall, the proportion of pavement lane miles rated fair or poor declined from 34.6 percent in 1994 to 13.5 percent in 2004.

- In New York City, pavement conditions improved rapidly in the mid-1990s, with slower improvements shown since 2001. The proportion of pavement lane miles rated fair or poor declined from 77.9 percent in 1994 to 25.5 percent in 2004.

Goals for the 2005-2010 Highway Program

The challenge for the next Highway Program is to resume the progress made in the 1990s and reverse recent deterioration on Long Island and the Mid-Hudson region. Doing so will be more challenging and expensive than it might at first appear. Over the last decade, in part due to extensive single-course overlays (sometimes called "amor coating"), the amount of pavement rated just above "fair" has increased dramatically. In the Mid-Hudson region, the percentage of pavement with a "7" rating increased from 42 percent to 62 percent between 2000 and 2004. Similarly, Long Island saw an increase from 44 percent to 77 percent and New York City saw an increase from 42 percent to 63 percent. The burgeoning number of pavement miles currently rated "7" are poised to need rehabilitation work in the coming years, creating a demand for increased pavement funding.

The goal of pavement maintenance programs should be to maintain pavements in good condition – not simply fix what is broken – as well as to rehabilitate pavements that are in poor condition. This is a cost-effective goal that serves both to minimize life-cycle costs and to maintain a smooth ride for travelers. This goal constitutes a reasonable definition of state of good repair.

Thus, to achieve a state of good repair, the relatively small proportion of pavement on the state system that is in "poor" condition should be rehabilitated, which would reduce the proportion of pavement in "poor" condition to zero percent. The program should also fund the application of preservation treatments to prevent pavement currently in acceptable condition from deteriorating to poor condition. In terms of the NYSDOT pavement rating system, this means maintaining the percentage of pavement in "fair" condition at current levels, using 2003 as the base year (before deterioration on Long Island and Mid-Hudson regions).

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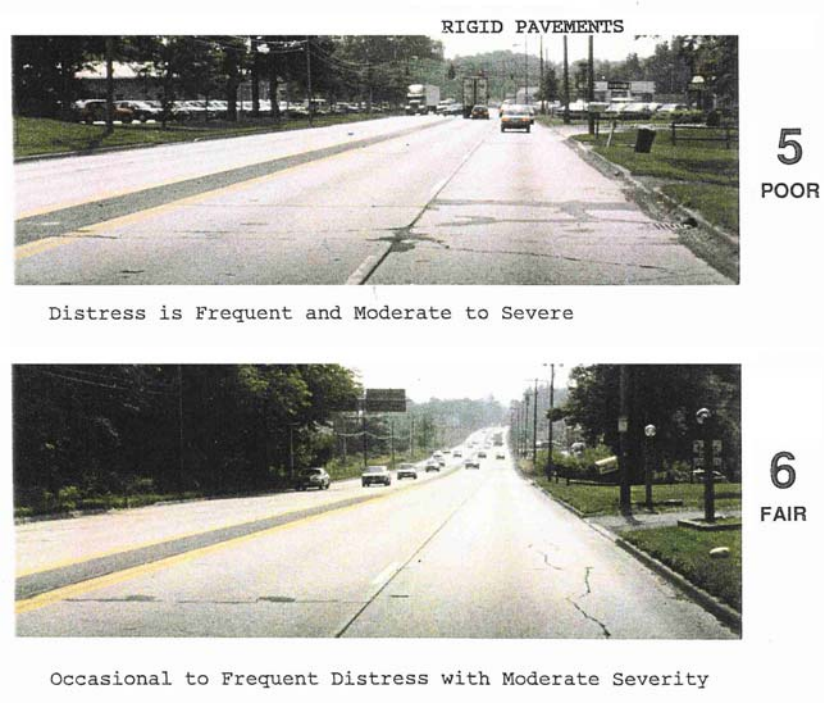
[8] Larry Galehouse, James S. Moulthrop and R. Gary Hicks, "Principles of Pavement Preservation," TR News, September-October 2003, p. 8.

Figure 9. “Poor” (5 rating) and “Fair” (6 rating) pavement conditions



Source: NYSDOT, “Pavement Condition Rating Manual,” January 2002.

Figure 10. State Highway Pavements – Percent Rated Fair and Poor in Region 8 (Mid-Hudson)

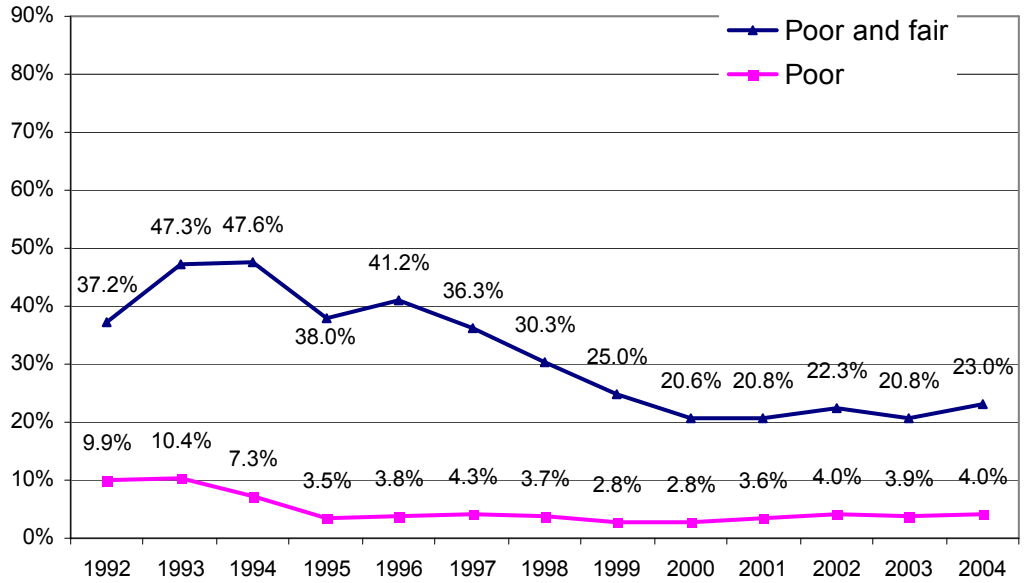


Figure 11. State Highway Pavements – Percent Rated Fair and Poor in Region 10 (Long Island)

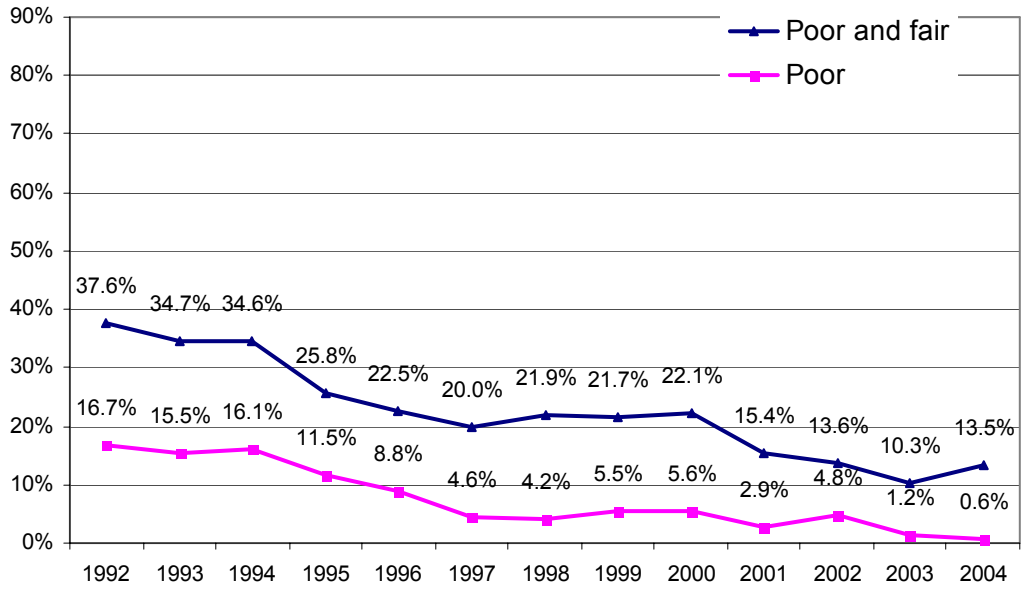
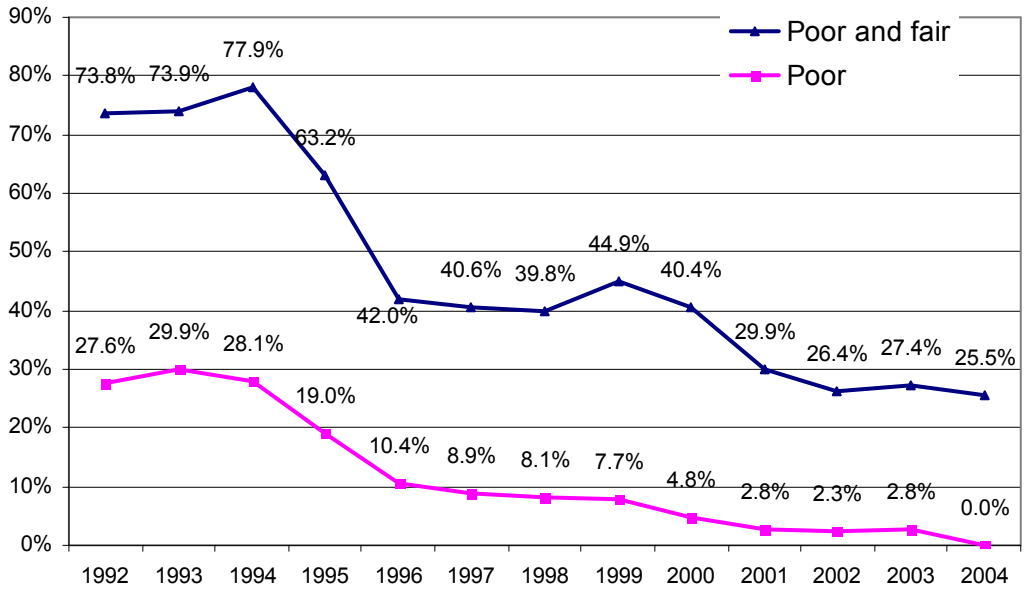


Figure 12. State Highway Pavements – Percent Rated Fair and Poor in Region 11 (New York City)



Source: Pavement Condition of New York's Highways. Issued annually by NYSDOT.

Costs of state-of-good repair pavement program

Table 4 shows the annual cost of achieving a state-of-good repair program as well as of maintaining the status quo in pavement conditions. The center column shows the cost of rehabilitating all pavement lane miles that are in “poor” condition (rating of 5 and below) and maintaining the percentage of pavement in “fair” condition (rating of 6). All remaining lane miles would continue in acceptable condition (rating of 7 or above). The cost of this option for state pavements in the New York region is $354 million annually.

For comparative purposes, Table 4 also shows the option of simply maintaining current conditions, under which a percentage of pavements would continue to be in “poor” condition. The cost of this option for state pavements in the New York region is $296 million annually.

Table 4. Cost of Pavement Maintenance Program in the Downstate Area, 2005-2010

	State of Good Repair Program (Eliminate "poor" and maintain "fair" percentages)	**Maintenance of Current Conditions** (Maintain 2003 percent fair and poor)
	Pavement ratings	
Region 8		
Pct. Fair	16.9%	16.9%
Pct Poor	0.0%	3.9%
Region 10		
Pct. Fair	9.1%	9.1%
Pct Poor	0.0%	1.2%
Region 11		
Pct. Fair	24.6%	24.6%
Pct Poor	0.0%	2.8%
Annual cost	$354 m	$296 m

Source: Estimates based on historic expenditures and changes to bridge conditions.

4. MOBILITY

The implications of funding decisions for bridges and pavements are reasonably easy to grasp. Bridges and pavements deteriorate over time and if left to the forces of nature, will eventually become unusable.

In some ways, the mobility problem is also easy to understand. People waste time in traffic and are bedeviled by not knowing how much time to allow to get to work on time or reach an airport in time for a flight. Less traffic delay is self-evidently a good thing.

In the context of public investments, however, the impact of funding decisions are harder to measure for mobility than for infrastructure investment. Mobility relates to quality of life and economic vitality. The relationship of mobility to quality of life and the economy are less direct and less visible than the impact of weather and traffic on bridges and pavements.

Given the elusive nature of mobility impacts, it is important to begin with a discussion of mobility and how mobility (and the related concept of accessibility) affect the quality of life and economic vitality of the region. This discussion will lead into consideration the cost of congestion and traffic delay and the shape of a sensible mobility program in the 2005-2010 Highway Program.

Two Key Concepts: Mobility and Accessibility

The problem of traffic congestion is most readily seen as a mobility challenge. In transportation planning terms, *mobility* is defined as the ease of traveling between two points. Is a direct route available between point A and point B? Is a means of transportation available? How long does the trip take? How reliable are travel times?

Mobility is not, however, the fundamental goal of a transportation system. The fundamental goal is *accessibility*, which is defined as the opportunity and the ease of reaching activity sites using a transportation system. In simpler terms, accessibility addresses the lifestyle needs of the traveler, which are best thought of *not* as the need to move from point A to point B but the need to get to a workplace, store, friend's house, movie theater or doctor's office.

The distinction between mobility and accessibility might seem to be a distinction without a difference. Indeed, as mobility is reduced accessibility also tends to be reduced. The slower the traffic to a given destination, the longer it takes to get there. Very congested areas, however, do not necessarily have poor accessibility. In fact, the opposite may be true if desirable activity sites are concentrated in a small area. Thus, Manhattan and other parts of the New York region, while extremely congested, have very good accessibility since huge numbers of jobs, stores, businesses, entertainment and other activities are concentrated in a small space.

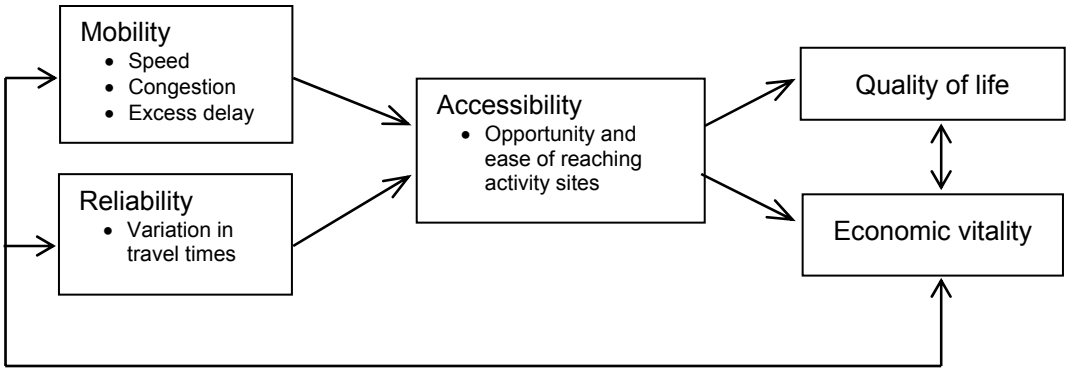
Figure 13 schematically diagrams the relationships among mobility, accessibility and several other key concepts. A range of factors in addition to mobility determines the level of accessibility. These factors include transportation system reliability; system connectivity (how well the transportation network connects destinations); density of jobs, housing and other activities; and degree of mixing of different types of activities (housing, jobs, schools, entertainment, etc.) within a geographic area.[9]

This paper focuses on mobility and reliability of the highway system since these are the determinants of accessibility that are most relevant to the Highway Program. This focus, however, is not meant to obscure or overlook the influence of connectivity, density or land use mix on accessibility.

Figure 13 also diagrams the impact of accessibility on quality of life and economic vitality. These relationships are discussed below.

[9] For a discussion of these factors, see Todd Litman, "Measuring Transportation - Traffic, Mobility and Accessibility," Victoria Transport Policy Institute, December 2003.

Figure 13. Schematic Diagram of the Relationships Between Mobility, Accessibility and Economic Vitality.



Growth in Travel, Travel Delay and Unreliability of Travel Times

While the density of activity centers provides residents and businesses in the Downstate area with a higher level of accessibility than would otherwise be the case, the region does face important mobility challenges. The region is one of the most congested regions in the country. The Texas Transportation Institute, which publishes a comprehensive annual report on mobility in the United States, ranks the New York region sixth in the amount of traffic delay experienced on the average trip, behind only Los Angeles, San Francisco, Chicago, Washington and Boston, regions well known for having a large and growing amount of highway and roadway congestion.[10] (See Figure 14.)

The underlying factors driving increases in congestion are population growth, economic growth and increased automobile ownership. Each of these contributes to increased traffic volumes on the region's already-overloaded highway network. The problems are exacerbated by the fact that highways were planned and built decades ago, often for different travel needs and to different engineering standards. Many of the region's highways fail to meet current design standards. The sharp turns, narrow lanes, steep grades and lack of shoulders on many highways restricts their functional capacity. Poor pavement conditions and truck restrictions on deteriorated bridges further restrict accessibility for motorists and truckers.

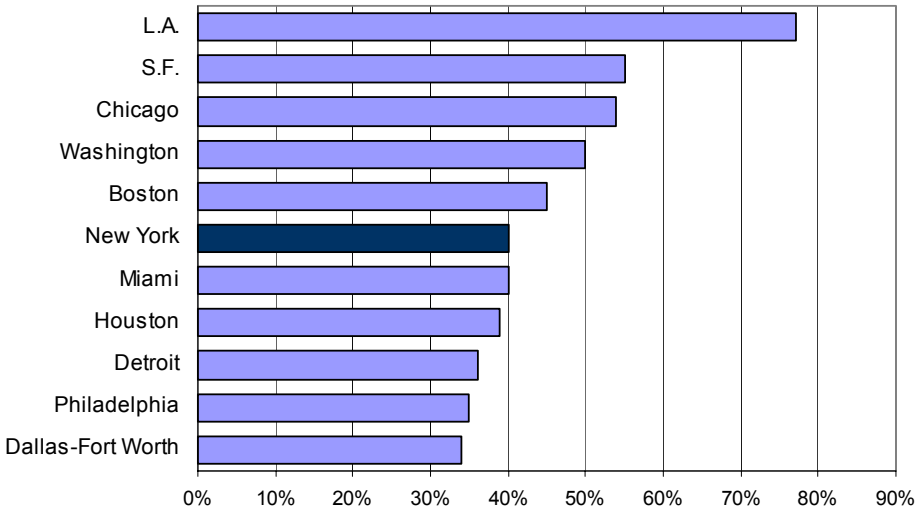
As shown in Table 5, population in the Downstate area increased by 2 percent or more in each of the past two decades, and is projected to increase by 2 to 3 percent in each of the first two decades of the new century.[11] Employment in the region, a key driver of travel demand, grew by 8 percent or more in the 1980s and 1990s. Employment is projected to increase by 4 to 5 percent in the 2000-10 and 2010-20 decades, also significantly faster than population.

Also contributing to rapid growth in traffic congestion is the increase in auto ownership. The number of registered vehicles in the Downstate area increased by 16 percent in the 1980s and 10 percent in the 1990s, in both cases more rapidly than either population or employment. Whether this pace will continue is difficult to predict; notably, the number of registered vehicles declined from 2000 to 2004. Whether this decline will reverse as the economy picks up or is a harbinger of a change in the long-term trend remains to be seen.

[10] Texas Transportation Institute, "The 2003 Annual Urban Mobility Report."
[11] The 8.2 percent population increase recorded by the U.S. Census for the 1990s is artificially inflated by the improvements in coverage for the 2000 Census. The actual population increase in the region was significantly less than 8.2 percent.

Figure 14. Excess Delay in Metropolitan Areas of 3 Million or More Population, 2002.

Excess delay is the excess travel time as a result of delay, expressed as a percentage of travel time in free-flow conditions.



Source: Texas Transportation Institute, *2004 Urban Mobility Report.* N.Y. region includes northern N.J. Note that TTI bases free-flow conditions on the posted speed limit.

Table 5. Trends in Population, Employment, Vehicles and Vehicle Miles Traveled, 1980-2020.

	Popu-lation	Employ-ment	Regis-tered vehicles	Vehicle Miles Traveled
1980-1990 (actual)	2.5%	12.6%	16%	38%*
1990-2000 (actual)	8.2%	8.7%	10%	20%
2000-2010 (projected)	2.1%	3.6%	**	13%
2010-2020 (projected)	2.7%	5.1%	**	7%

* Figure is for 1981 to 1990 (figure for 1980 is not available)

** Projections not available

Sources: New York Metropolitan Transportation Council (population, employment and VMT); New York State Department of Motor Vehicles (vehicle registrations). Data are for 10-county NYMTC area (New York City, Long Island, Westchester, Rockland and Putnam counties).

The growth in population, employment and registered vehicles has produced rapid increases in traffic volumes. The standard measure of traffic volumes is vehicle miles traveled (VMT) – one car traveling one mile is one VMT. VMT in the Downstate area increased 38 percent in the 1980s and 20 percent in the 1990s. VMT is projected to increase by 13 percent in the 2000-10 decade and 7 percent in the 2010s. While the long-term trend is toward a slower rate of growth, VMT growth is projected to continue to exceed growth rates for population, employment and registered vehicles. (See Table 3.)

Growth in truck freight movements are an important part of the overall VMT growth. In 1998, 81 percent of freight tonnage in the New York area was moved by truck.[12] Truck traffic is forecast to increase by 21 percent for all trucks and 51 percent for "freight trucks" between 2000 and 2020[13] due to "increased economic activity and changing logistics patterns."[14]

Rising traffic volumes and worsening congestion have made worse the reliability of travel times. Unreliability means that the travel time for a given trip is uncertain. Thus, to be sure of arriving on time to a job, meeting or flight, travelers must leave extra time to guard against unpredictable delays. Although New York-specific data are not available, the Texas Transportation Institute calculates that for peak period congestion levels experienced on New York area highways, travelers would need to leave at least twice as much time, as compared with free flow conditions, to be sure of arriving on time with 95 percent reliability.[15]

Unpredictable (nonrecurrent) delays are a large part of the overall congestion problem in the New York region. Excess delay in the New York region is much more skewed toward incident delay than is the case elsewhere in the country. Texas Transportation Institute data show that in other large metro areas, 52 percent of delay is due to incidents; the comparable figure in the New York/northern N.J. region is 66 percent.

What do these trends mean for Downstate area residents, businesses and the future of the region? This question can be addressed in several parts, starting with the economic costs and other effects of congestion and excess delay.

The impact of congestion and delay

The inconvenience, lost time, uncertainty and stress caused by congestion affect the quality of life of nearly every resident and business in the Downstate area. Environmental and health impacts, although beyond the scope of this report, are also important aspects of the cost of congestion.

The costs of traffic delay and the unpredictability of travel times take myriad forms, some quantifiable, some not quantifiable. One category that is quantifiable measures costs based on the value of time and fuel wasted and freight costs while motorists and truckers are slowed by congested traffic conditions. This is a very direct and tangible cost since travelers directly experience the loss of time and money. The Texas Transportation Institute calculates economic costs in the New York/northern N.J. region of $7.1 billion ($409 per person) in 2002, an increase of 81 percent from 1990.[16]

Based on the Texas Transportation Institute studies and studies of the growth in VMT and congestion in the region,[17] it can be estimated that economic costs will increase by approximately 30 percent by 2010 without steps to mitigate the impact of increased traffic.[18]

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[12] New York Metropolitan Transportation Council, "Regional Transportation Plan Update Discussion Document," January 2004, p. 2-4. Available: http://nymtc.org/files/RTP_DISCUSS_DOC.pdf. Accessed: Dec. 17, 2004.
[13] "Regional Transportation Plan Update Discussion Document," p. 2-9.
[14] New York City Economic Development Corporation, *Cross Harbor Freight Movement DEIS*, pp. 1-1. Available: http://www.crossharborstudy.com/view.htm. Accessed: Sept. 14, 2004.
[15] Texas Transportation Institute, "The 2004 Annual Urban Mobility Report," pp. 28-29. Available: http://mobility.tamu.edu/ums/report/. Accessed: Sept. 9, 2004.
[16] Texas Transportation Institute, "The 2004 Annual Urban Mobility Report."
[17] Long Island Transportation Plan, "Facts, Figures and Forecasts for Long Island," June 1998.

In addition to these measurable economic costs, there are important economic impacts from reduced accessibility and reduced economic competitiveness of firms and workers in the region. These impacts are difficult to quantify in dollar terms since the costs stem from trips not taken, or trips time-shifted, or shortened, or transplanted to other parts of the metropolitan area.

This second category of economic impacts is most readily seen in the costs of goods. In its regional freight plan report, the region's metropolitan planning agency, the New York Metropolitan Transportation Council (NYMTC), notes that traffic congestion:

> forces truck operators, freight transportation consumers, and warehouse and distribution facilities to adopt a variety of alternative, relatively inefficient logistical patterns. Longer travel times translate into longer turnaround times which delay shipments of mail, packages, manufactured goods, raw materials, food and other items. In addition, bridges and tunnels represent "choke points" for regional trips. …
>
> [The region's freight] transportation deficiencies result in higher prices for goods and services, which can impact business locational decisions, reduce the profitability of existing companies, and otherwise hamper the region's economic vitality. The NYMTC region has some of the highest freight shipment costs in the nation. Truck costs are double those of the national average. The high cost of land and the lack of focus on freight needs contributes to the relocation of freight-related businesses to other parts of the metropolitan area or indeed to other distant states. The lack of modal choices reduces the efficiency of the system and suppresses competition, which in turn results in higher costs.[19]

These higher costs affect the prices that firms must charge to be profitable, and can thus reduce the ability of these firms to be cost-competitive with firms in less-congested areas. As their prices rise, their sales are likely to decline – an impact of the reduced competitiveness of these firms.

Another unquantifiable economic cost occurs within the labor market. Both workers and firms in the New York area benefit from their ability to participate in the nation's largest labor market and employment market. This market is attractive and beneficial to firms that need world-class and often highly specialized talent. The market is also attractive and beneficial to workers who want the widest possible choice of employers. Good accessibility to jobs is particularly important to two-worker couples, each of whom may work in quite different parts of the metropolitan area and thus are limited in their ability to move closer to their place of work.

Commute times to their place of business limits the area from which firms can draw workers. Likewise, workers are limited in the jobs they will consider depending on commute times to the place of employment. Congestion and travel delay reduce the size of the "commuter shed," and thus limit the benefit derived from doing business and working in the New York area.

Congestion and travel delay can also reduce the accessibility of entertainment, goods and services. Residents make choices, for example, on whether the pleasure derived from seeing a live performance is worth the trip to see it, as compared with the pleasure derived from staying home to watch a video or television show. Whether in the field of entertainment or shopping, where the Internet provides a ready alternative to shopping in person, unacceptable travel times may prompt individuals to export their spending dollars to firms outside the region rather than travel to entertainment and shopping venues and spend those same dollars locally.

In addition to affecting the amount of travel and cost of travel, congestion affects the place and time of travel. To avoid congestion, people shift *when* they travel and *where* they travel, changing land use and travel patterns. This is clearly seen in the New York region. Seeking to avoid congested parts of

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[18] Based on VMT increasing by slightly over 1 percent per year and about a 5:1 ratio between congestion cost growth and VMT growth, based on TTI data for the N.Y./northern N.J. region between 1996 and 2002. This figure may be conservative in that congestion grows more quickly as congestion levels rise. The 1995 Long Island Transportation Plan forecasted a 5.1:1 ratio.

[19] New York Metropolitan Transportation Council, "Regional Transportation Plan Update Discussion Document," January 2004, p. 2-8.

the highway system, drivers have shifted some travel from highways to arterials, from peak to off-peak hours, and from the region's core to outlying areas:

- *From highways to arterials:* Texas Transportation Institute data show that while freeway VMT increased by 29 percent from 1990 to 2002, VMT on principal arterial streets increased 34 percent in the New York/northern N.J. region.

- *From the traditional "peak" hours to off-peak hours:* On the Southern State Parkway between Eagle Avenue and Peninsula Blvd. (Interchanges 18 and 19), for example, "rush hour" now ends at 10 or 11 a.m. for eastbound motorists while the westbound "rush hour" starts at 3 p.m. and lasts until about 8 p.m. Midday traffic volumes approach the former peak period volumes. This same story is evident throughout the region. The Texas Transportation Institute now estimates that the New York/northern N.J. region has 7.4 hours of "rush" hour, up from 6.0 hours of "rush" hour in 1990.

- *From the region's core to outlying areas*: NYMTC forecasts indicate that VMT is growing more quickly, relative to population growth, in the fast-developing Lower Hudson Valley region than in either New York City or Long Island.[20]

How these shifts affect residents of the Downstate area is best understood in the context of the concept of a "travel time budget." The "time budget" concept is that individuals have a fixed budget for daily travel time. Although varying between individuals, the average travel time budget is generally considered to be in the range of 1.0 to 1.2 hours per day. If they save time through faster travel speeds, individuals generally regard the number of accessible destinations as increasing. Individuals take advantage of the improvements in accessibility to travel further, which they can do while still keeping within their overall travel time budget. Conversely, if travel speeds decline, they may take shorter trips or fewer trips, or shift their travel to other parts of the region by moving their place of residence and/or place of business or place of work.

The 1.0 to 1.2 hours of travel per day are national averages shown to be consistent across a diverse group of countries.[21] Travel times vary considerably by employment status, age, family situation, income, metropolitan area and other factors. Total travel times for the New York/northern New Jersey region are slightly higher than national averages and on par with the average for large metro areas.[22] There is recent evidence that increased congestion nationally has led individuals to increase their travel budgets,[23] although at least a portion of the apparent increases are due to improved survey methods rather than actual changes.

The importance of the concept of a "travel time budget" is that individuals do take steps to hold the amount of time spent traveling to stay within their personal travel time budget. The shifts to arterials, off-peak hours and outlying areas are the widespread, visible outcomes of millions of individual decisions. The final step is to simply reduce the overall amount of travel. Declines in the rate of VMT growth, projected to continue well into the future, are evidence that the region's roads are becoming

[20] New York Metropolitan Transportation Council, "Regional Transportation Plan Update Discussion Document," January 2004.
[21] Andreas Schafer, "Regularities in Travel Demand: An International Perspective," *Journal of Transportation and Statistics*, December 2000.
[22] Residents of the New York area (excluding northern N.J.) traveled for an average of 80.8 minutes per day, compared with the national average of 77.2 minutes and an average of 79.5 minutes for U.S. metro areas of 3 million of more population in 2001. For comparison, the average resident of the Los Angeles area (which includes Orange County and Riverside County) spent 82.8 minutes traveling per day. Source: Author's analysis of 2001 National Household Travel Survey.
[23] Steven E. Polzin, Xuehao Chu and Lavenia Toole-Holt, "The Case for Moderate Growth in Vehicle Miles of Travel," Center for Transportation Research, University of South Florida, September 2003; and Patricia L. Mokhtarian and Cynthia Chen, "TTB or Not TTB, that is the Question: A Review and Analysis of the Empirical Literature on Travel Time (and Money) Budgets," Institute of Transportation Studies, University of California at Davis, July 2002.

saturated with traffic, with a direct impact on limiting future growth in travel, and with it, the economic potential of the region.

Mobility Solutions and the Highway Program

What is the solution to congestion and travel delay – or is there a solution? What level of funding will achieve what level of reduction in travel delay? What are the implications for the region of inadequate funding for mobility improvements? What is the appropriate approach for setting mobility goals? A brief general discussion of these questions lays the groundwork for a more specific discussion of costs and benefits of the NYSDOT mobility program.

As discussed in the bridges and pavements sections of this paper, "state of good repair" provides a benchmark for evaluating transportation funding needs for pavements and bridges (as well as the transit capital program). With a finite sum of funding, bridge and pavement conditions can be put into and kept in a state of good repair. With sufficient funding, the region's "infrastructure problems" can be "solved."

The mobility problem is fundamentally different from the infrastructure problems that can be addressed in a state of good repair framework. Congestion cannot be "solved" in a large, dense and economically thriving metropolitan area like New York. To illustrate this point, the Texas Transportation Institute calculates the amount of new highway construction that would be required to simply maintain a constant level of congestion. For the New York/northern New Jersey area, 258 lane-miles of highway would need to be constructed each year. This is the equivalent of the region constructing about as many lane-miles of highway every two years as currently exists in the Albany-Schenectady metropolitan area. Considerations of cost, environmental and community impacts render a road-building program of this scale well outside the range of available options.

Given the impracticability of building the region's way out of congestion, the demand for road space will continue to exceed the supply. Thus, the congestion problem cannot be "solved" the way the infrastructure problem can be solved. That is why transportation planners talk about "congestion management" rather than state-of-good-repair with respect to the mobility challenges of large urban areas.

If not "solvable," are there benefits from allocating scarce dollars to better manage congestion? Can mobility investments pay off in ways that matter to residents and businesses?

The benefits of mobility improvements are best understood by considering congestion in literal pricing terms. One might think of congestion and excess delay as a "delay toll" that is levied on every mile of travel. The "delay toll" is higher for some stretches of roadway than others, and higher at some times of the day than other times of the day. But a majority of motorists pay a "delay toll" on a typical trip during peak times and during at least some off-peak trips.

If the "delay toll" is reduced, some travelers will take the same trips, for the same distances, at the same times of the day. Their trip behavior will not change, and they will simply pocket the time savings from the reduced toll. That time savings is one type of benefit.

Other travelers will switch from traveling during relatively low-congestion times to somewhat higher-congestion times. Individuals may not have to get up as early to get to work, for example. The opportunity to travel somewhat more at one's convenience is another type of benefit.

Still other travelers will take advantage of the "delay toll" reduction to increase the amount of travel. Rather than pocket the savings they will spend the savings on additional travel – additional trips or longer trips. An individual might find it attractive to take a "better" job further from home, for example. Individuals who save time on their commute may have the time and energy to drive to a ballgame on a Tuesday night. Businesses that could make three deliveries during peak periods might be able to

make four deliveries, and thus save on the number of trucks and drivers they need. These are other types of benefits from reducing the "delay toll."

In sum, the benefits of improved mobility are the flip side of the economic and quality of life impacts of congestion and excess delay discussed earlier:

- Less time wasted
- Less fuel wasted
- Lower costs for businesses
- Greater economic competitiveness
- Accessibility of a larger workforce to employers
- Greater accessibility to jobs, entertainment, social and other activities for residents.

Approaches to reducing congestion and traffic delay

Approaches to reducing congestion and traffic delay can be categorized in a number of different ways. Three broad categories summarize the types of approaches available:

1. Increase the *physical capacity* of the highway system. Examples: widening highways; relieving bottlenecks; eliminating traffic-slowing and unsafe weaving movements; and other improvements to roadway geometry such as eliminating steep grades, e.g, in replacement of the Kosciuszko Bridge.

2. Increase the *functional capacity* of the highway system. Examples: incident management programs that clear stalled vehicles and accidents more quickly; and Intelligent Transportation Systems that channel motorists toward less-congested routes, warn of delays and provide other useful information.

3. Increase the *efficiency of use of existing capacity*. Examples: high-occupancy vehicle lanes and additional transit services.

These approaches are not mutually exclusive and, in fact, can often be usefully combined. On the Staten Island Expressway, for example, new capacity will be used for high-occupancy vehicles and buses.

Due to the pressing bridge and pavement needs of New York State, the 2000-2004 Highway Program focused on infrastructure needs. While NYSDOT policy is to sustain the infrastructure as the first priority, the Department has integrated bottleneck improvements and HOV lanes into reconstruction and rehabilitation projects. An excellent example is the establishment of the HOV lane on the Gowanus Expressway in Brooklyn and extensions of the HOV lane into Staten Island. NYSDOT also has a $200 million Intelligent Transportation Systems (ITS) program that is designed to facilitate travel for motorists, transit riders, commercial vehicle operators and public safety providers. The ITS program "emphasizes cost-effective deployment that will result in area-wide, real time operation of the transportation system, integration of an enhanced, multi-modal transportation system, and the development of user-friendly transportation systems."[24]

NYSDOT also has major studies completed or underway that are centered on improved mobility or have both state of good repair and mobility components. Examples are the Bronx Arterial Needs Study and Staten Island Expressway Corridor. Studies that have been completed at this point demonstrate that substantial mobility improvements can be achieved:

[24] Rudin Center for Transportation Policy and Management, "The Context for Intelligent Transportation Systems in New York State," July 2002, p. 9.

- A package of improvements evaluated in the Bronx Arterial Needs study would reduce excess delay in the 6 Community Boards in the area by 11 percent in the morning peak and 13 percent in the afternoon peak.

- An extensive set of improvements to the Staten Island Expressway would reduce vehicle hours of travel by 28 percent compared with the no-build condition.

NYMTC's Regional Freight Study identified a menu of projects for further advancement or study with a total identified cost of $2 billion. Big-ticket highway projects on this list are:

- Improvements to the Sheridan-Bruckner Interchange ($200 million)

- Assess upgrading the Goethals Bridge crossing ($450-$650 million)

- Assess completing a continuous bus/HOV system on the Staten Island Expressway and related improvements ($500 million).[25]

Potentially major highway projects without a cost estimate include Cross Bronx service road improvements (part of the Bronx Arterial Needs Study) and removing clearance restrictions on the Brooklyn Queens Expressway.

In New York City, the Department of City Planning (NYCDCP) released a studies of bottlenecks in 1999, 2001 and 2003. The 1999 report identified a master list of 42 bottlenecks that could, potentially, be addressed to reduce congestion. Detailed analysis of five locations in the 1999 study estimated costs of $60 to $65 million in capital funds. Analysis of four additional locations in the follow-up reports did not estimate costs. None of the studies quantified reductions in delay, but the report characterized delay reductions as "significant."

In sum, studies conducted to date show substantial opportunity for improving mobility conditions in the Downstate region, even in dense parts of New York City, without trying to "build our way" out of the problem with new highways. What are the prospects for funding these major projects?

The planning work of NYSDOT, NYCDCP and other agencies in the New York area come under NYMTC's planning umbrella. NYMTC has identified Regional Investment Proposals in the context of its Regional Transportation Plan (RTP) Update Discussion Document.[26] Regional Investment Proposals are "large-scale studies, concepts, and projects with regional impact on the movement of people and goods, and which support the vision, guiding principles and goals of the Plan."[27] The guiding principles and goals include mobility and accessibility improvements.

Current and proposed ongoing construction work and planning studies relevant to the Highway Program are reproduced from the RTP Discussion Document in Appendix 1. This list is included here to provide a sense of the projects that might be included in a sensible mobility program but is not meant to be an evaluation or endorsement of any particular project. Included on this list are projects related to the I-84/Newburgh-Beacon Bridge, Major Deegan Expressway/Cross Bronx Expressway, Tappan Zee Bridge/I287 Corridor, Long Island Transportation Plan, Nassau Hub, County Route 97/Nicolls Road, Long Island Rapid Commute System, Goethals Bridge, Staten Island Expressway, Southern Brooklyn/Belt Parkway/JFK Air Cargo and Canal Area Transportation Study.

Like the NYSDOT 2000-2004 Highway Program, NYMTC's RTP Discussion Document, covering 2000-2025, devotes most of its funding to normal replacement and state of good repair. In the RTP,

[25] New York Metropolitan Transportation Council, "Regional Freight Plan – Public Draft," April 2004, Table 5.1. The $2 billion figure does not include the cost of a cross-harbor tunnel.
[26] New York Metropolitan Transportation Council, "Regional Transportation Plan Update Discussion Document," January 2004.
[27] RTP Discussion Document, page 41.

these are classified as "Level 1 investments," which are "needed to bring the region's existing infrastructure to a state-of-good-repair and maintain normal replacement cycles thereafter."[28] "Level 2" projects address mobility needs. The Level 2 projects that are contained as fiscally-constrained Capital Needs and Resources are "system expansions have already received some level of commitment and should be in place by 2025." There are two Level 2 projects, East Side Access and the Second Avenue Subway, both of which are transit projects.

Thus, within the framework of the RTP, highway mobility improvements are classified as Level 3 projects. These are projects under evaluation. The RTP does not propose to carry out these projects, does not provide funding for them in the fiscally-constrained Capital Needs and Resources section of the plan, and does not propose alternative funding (although the plan includes a discussion of possible funding sources).

Costs of state-of-good repair mobility program

The project-specific nature of mobility improvements makes it difficult to provide a precise estimate of the cost of achieving a given level of mobility improvements on a regional basis. Costs and potential improvements can be estimated, however, using a simplified set of goals and assumptions.

Three alternatives are evaluated for the 2005-2010 time period:

1. Reduce hours of delay between 2004 and 2010 at the same rate that delay increased between 1990 and 2003. This is the most ambitious of the three alternatives and, by making achieving an overall reduction in congestion, represents a reasonable state-of-good-repair program. Under this alternative, delay would be reduced by about 5 percent a year from 2004 to 2010. This reduction would turn the clock back to delay conditions that were experienced in 1996-97.

2. Maintain the cost of delay in 2010 at the 2004 level. This goal would reduce the change in delay costs from the estimated 30 percent increase to zero percent and thus maintain 2004 congestion conditions through 2010.

3. Reduce the rate of growth in delay costs between 2004 and 2010 to one-half the projected rate of growth. Traffic delay is projected to increase by 30 percent in this period; this goal would reduce the increase to 15 percent.

The cost of achieving each of these goals is based on benefit/cost ratio of 5:1, meaning that $5 in reduced excess delay costs is assumed to cost $1 in project costs. This benefit/cost ratio is based on modeling of benefits (in saved excess delay) for projects that were included in the 2000-2004 Highway Program. The benefit/cost ratios for a sample of projects provides a reasonable estimate of the benefit/cost ratio that can be anticipated for the next round of projects, on average. The ratio will vary by project and the overall average will naturally depend on which specific projects are selected. The 5:1 ratio is used to estimate the scale of mobility program needs, but should not be viewed as anything approaching a precise number.

Table 6 presents mobility program costs for each program goal, using the 5:1 ratio of reduction in the cost of excess delay to project costs. The estimated cost of achieving each goal is:

- *Alternative 1*. $775 million for mobility projects to reduce delay between 2004 and 2010 at the same rate that delay costs increased between 1990 and 2003 (5 percent per year over the 2004-10 period).

- *Alternative 2*. $400 million for mobility projects to maintain costs of delay in 2010 at the 2004 level.

[28] RTP Discussion Document, page 71.

- *Alternative 3*. $200 million for mobility projects to reduce growth in costs from excess delay to one-half the projected growth.

The $200 million per year is slightly higher than the recent spending on mobility projects in the Downstate area. Thus, a mobility program that does anything more than slow the rate of growth in congestion will require substantially higher spending in the new Highway Program.

Table 6. Estimated Costs of Achieving Three Levels of Reduction in Projected Growth in Excess Delay in the Downstate Area, 2004-2010
(See text for assumptions)

	State of Good Repair Program (Reduce excess delay at rate of 5.25%/year – the rate of growth in 1990-2004)	**Maintenance of Current Conditions** (Hold excess delay costs at 2004 amount)	**Reduction in rate of deterioration** (Reduce growth in excess delay costs to one-half projected growth)
Change in excess delay between 2004 and scenario for 2010	-25%	0%	15%
Estimated mobility program cost (millions)	$775	$400	$200

Source: Author's calculations based on estimated growth in excess delay and Benefit/Cost ratio of projects in 2000-04 Highway Program.

5. CONCLUSION

The physical condition and congestion levels on state-owned highways and bridges in the 14-county Downstate area are at a critical junction. Continuation of recent funding levels, as proposed in the Governor's Highway Program, would result in deterioration of highway and bridge conditions, rapid growth in congestion or a combination of the two. Improving the condition of state-owned bridges and highways in the state system and combating congestion will require substantially greater funds than are proposed.

Table 7 summarizes the estimated Highway and Bridge Capital Program funding for the Downstate area and three alternatives based on achieving specified conditions by 2010. The alternatives are based on maintaining current conditions and making reasonable progress toward a state of good repair for the highway and bridge infrastructure, both in terms of conditions and mobility.

Table 7. Proposed and Needed Highway and Bridge Capital Program Funding for the State System in the Downstate Region (billions of dollars)

	Estimated future Downstate allocation	State of Good Repair Program	Maintain Current Conditions	
			Bridge, Pavement and Congestion	Bridge and Pavement only
		(Improves bridge and pavement conditions and reduces congestion to 1996-97 levels)	(Maintains current bridge and pavement conditions and congestion levels)	(Maintains current bridge and pavement conditions but congestion worsens)
Contract lettings:				
Pavement and bridges, including preventive maintenance	$ 0.39	$ 0.92	$ 0.68	$ 0.68
Mobility	0.19	0.77	0.40	0.20
Safety	0.06	0.06	0.06	0.06
Total lettings	0.64	1.76	1.15	0.94
In-house and consultant design and consultant support*	0.36	0.99	0.65	0.53
Total state highway/bridge system – annual**	$ 1.00	$ 2.75	$ 1.80	$ 1.47
Total 5-year Capital Program	$ 6.0***	$ 13.7	$ 9.0	$ 7.3

* Includes construction inspection, right-of-way easements and acquisitions and preventive maintenance non-let work.
** For estimated funding level, annual figure is spending for FY'05-06. For need columns, annual figure is need per year for FY'05-06 through FY'09-10.
*** Includes higher annual figures for FY'06-07 through FY'09-10. Assumes that the Downstate area's share of the Highway and Bridge Capital Program is constant over the 5-year term of the program. Note that need columns are annualized figures for the full 5-year period and thus the 5-year total is simply 5 times the annual need.

Notes:
Alternative programs assume that in-house design and engineering is constant percentage of lettings for each program funding level.
Table does not include $200 million per year for work on local highways and bridges that are not part of the state system. Note that this spending may have crossover benefits to the state system through, for example, intelligent transportation system investments.

The estimated $6.0 billion Highway Program for the next five years would be less than one-half the funding needed for a program to make reasonable progress toward a state of good repair, and $1.3 billion less than needed for even a bare-bones funding level that would maintain current bridge and pavement conditions. As Table 7 shows:

- $13.7 billion is needed to make real progress toward a very reasonable set of goals. These goals are to attain a state of good repair for bridges and pavements and to reduce congestion back to levels experienced in 1996-97. The estimated Capital Program is $7.7 billion short of this funding level.

- $9.0 billion is needed to simply maintain current conditions of bridges and pavements and maintain current congestion levels. The estimated Capital Program is $3 billion short of this funding level.

- $7.3 billion is needed for a minimal program. This program would also maintain current conditions of bridges and pavements but allow continued deterioration of mobility, with increased congestion throughout the region. The estimated Capital Program is $1.3 billion short of this funding level.

NYSDOT could address budgetary constraints by giving first priority to maintenance and operations and secondary priority to mobility projects. Even if literally no funds were allocated to mobility, however, Highway Program funding would barely be able to maintain current bridge and pavement conditions. A “maintenance first” policy at the estimated funding levels would not fix substandard conditions, and would also mean rapid growth of congestion. Economic costs from excess delay under this policy would increase by 30 percent between 2004 and 2010.

Not addressing mobility needs would have serious consequences for residents and businesses in the Downstate area. The high congestion-induced costs and uncertainties that already plague freight movement, a topic being given increasing attention, would escalate, with serious ramifications for the Downstate area’s economic health. Residents’ accessibility to jobs and leisure activities would be further eroded, reducing economic opportunities and the quality of life in the region.

The alternative allocations of funding, however, are no better. Maintaining a modest mobility program with the estimated funding levels would mean allowing bridge and pavement conditions to deteriorate. As the Downstate area knows from the experiences of the 1970s, postponing vital maintenance work today creates even larger long-term costs.

Funding levels for the 2005-2010 Highway Program will seriously affect bridge and pavement conditions, mobility and the quality of life and economic vitality of the region in the coming years. The policy choice is clearly to continue current funding levels, with predictable infrastructure and economic costs to the region, or to better fund these vital needs.

APPENDIX 1. REGIONAL INVESTMENT PROPOSALS FROM REGIONAL TRANSPORTATION PLAN (RTP) UPDATE DISCUSSION DOCUMENT

- **I-84/Newburgh-Beacon Bridge.** A Major Investment Study is proposed to be undertaken for Interstate 84 from I-684 to the Connecticut State line. The Study will look at the feasibility, cost, impacts and schedule of reconstruction. Currently underway is the reconstruction of the I-87 (Thruway)/I-84 interchange. This will provide travelers with a direct connection between the two interstates without having to travel on the local road system. The Newburgh-Beacon Bridge currently handles 3.4 million trucks per year. The Newburgh-Beacon Bridge has the second highest number of truck crossings behind the George Washington Bridge for Hudson River crossings.

- **Major Deegan Expressway/Cross Bronx Expressway.** A Major Investment Study is currently underway in the Bronx and northern Manhattan, focusing primarily on the Cross Bronx Expressway and the Major Deegan Expressway. The study is assessing travel conditions and problems along these corridors and plans are being developed to implement programs, projects and strategies to help optimize the movement of people and goods. Solutions will address concerns with traffic operations and safety, transit services, goods movement and bicycle and pedestrian mobility in these congested highway corridors. Special consideration will be given to the Highbridge Interchange, which provides a connection between the Cross Bronx and Major Deegan expressways. The study has focused on improvements at the Highbridge Interchange; service road opportunities; and access to the George Washington Bridge.

- **Tappan Zee Bridge/I287 Corridor**, which includes the Tappan Zee Bridge and extends for 30 miles from the I-287/I-87 interchange in Suffern, New York to the I-287/I-95 interchange in Port Chester, New York. The study will identify and evaluate alternative proposals to address identified transportation needs for the corridor while taking into account the structural needs of the Tappan Zee Bridge as well as other existing New York State Thruway infrastructure.

- **Long Island Transportation Plan.** A long-range area-wide transportation plan to relieve traffic congestion and improve the movement of people and goods throughout Long Island is being prepared as a Major Investment Study by New York State DOT. The comprehensive study identifies a variety of solutions, some of which will be implemented in the short-term and some over the period of the Plan. Potential solutions include the Long Island Rapid Commute system, using modern Rapid Commute Vehicles (RCVs) with complementary roadway, freight, bicycle and pedestrian improvements and strategies; transit priority network; and goods movement.

- **Nassau Hub.** The area defined as the Nassau Hub in central Nassau County represents a significant economic engine for the County. It encompasses almost three square miles with about 15 million square feet of commercial and office space, and generates $50 billion in annual revenue. It is the Hub's high concentration of retail and commercial space and sports and entertainment destinations that has contributed to the sharp increase in traffic over the years of growth and development. Projections estimate that left unchecked, traffic will increase 36 percent – from 480,000 to 650,000 weekday trips – into and out of the Hub in the next 10 years. To combat this problem, Nassau County is now engaged is a study of the transportation and land use options in and around the Nassau Hub, with findings from this study expected to help shape one of the most important planning decisions to be made by Nassau County in recent years.

- **County Route 97/Nicolls Road.** CR97, Nicolls Road, is a principal north-south arterial in Suffolk County that forms a vital link in the region’s transportation system. It intersects major east-west corridors: Long Island Expressway (NYS 495), Sunrise Highway (NYS27), Nesconset Highway (NYS 347), Middle Country Road (NYS 25), North Country Road (NYS

25A), and Montauk Highway (CR 80). CR97 provides direct access to major trip generators such as SUNY Stony Brook, Stony Brook University Hospital and Suffolk Community College; and indirect access to large areas of commercial and residential development. Traffic volumes have been growing faster on this facility than on many other regional roadways, and currently during peak weekday periods, it is operating at or over capacity at many locations. This Major Investment Study will examine a 13 mile section of the CR97 corridor between NYS 25A in the Town of Brookhaven and NYS 27 in the Town of Islip to develop transportation improvement alternatives that address these congestion issues.

- **Long Island Rapid Commute System (LIRC)**. The proposed Long Island Rapid Commute (LIRC) system would have two major components: a bus rapid transit component and a priority-lane system. LIRC Transit System would be a new workable rapid transit system to serve origins and destinations within Long Island. Developed exclusively for Long Island's unique character, it would serve Long Island's diverse travel needs and patterns and be responsive to projected travel growth. It would be coordinated with other travel modes for maximum efficiency. The LIRC transit system includes 91 new transit routes, modern, comfortable Rapid Commute Vehicles (RCVs)—rubber-tired for travel on roadways—combining the look and comfort of monorail or light rail vehicles with the benefit of routing flexibility because they are not bound by fixed rail. Features of the RCVs are 20 to 45 seats per vehicle; sleek and modern; low floor boarding; flexible routing; fast and reliable; clean fuels; and low emission technology. RCVs would use major roadways near residential areas to pick up passengers within a short walk of LIRC transit stops. Some routes would begin at park-and-ride lots for those people not within walking distances of LIRC stops. LIRC routes would be coordinated with local bus routes and with LIRR stations. The LIRC system would also serve residents traveling to major shopping centers and other attractions. The system would operate seven days per week for most hours of the day to conveniently serve shoppers, late-working employees and others on flexible schedules. The LIRC route system would be a seamless intra-island system consisting of east-west and north-south RCV express routes with limited stops.

- **Goethals Bridge.** The Goethals Bridge provides a key link in this gateway between northern New Jersey and Staten Island. In September 2003, a draft Environmental Impact Statement was initiated to study options and recommend a preferred alternative for upgrading the bridge. It is anticipated that the preferred alternative will improve customer service, modernize the bridge, provide the capacity for transit options, and enhance the safety and reliability of the crossing.

- **Staten Island Expressway.** A recently completed major investment study identified current and future transportation problems and recommended an intermodal range of alternatives within the Staten Island Expressway/Gowanus Expressway corridor (I-278) from the New Jersey Turnpike to the Brooklyn-Battery Tunnel. These included bus prioritization and interchange improvements.

- **Southern Brooklyn/Belt Parkway/JFK Air Cargo.** An areawide major investment study is currently in progress for Southern Brooklyn. This study will assess current and future travel conditions and deficiencies and develop multimodal transportation improvement alternatives that prioritize solutions for improving the movement of people and goods within and through the study area. JFK Airport air cargo and routes/corridors such as the Belt Parkway are included in the study. iv) Gowanus Expressway At this time NYSDOT is in the process of selecting a tunnel alternative route for potential evaluation in the DEIS for the Gowanus Expressway, a key portion of I-278 which connects the Verrazano Narrows Bridge with the Brooklyn Battery Tunnel and the Brooklyn-Queens Expressway.

- **Canal Area Transportation Study**. A multi-modal, multi-agency area wide analysis focused on Street and its environs, a primary interest area of Lower Manhattan bounded by Houston

Street to the north and Chambers Street to the south. The study is an outgrowth of many years of effort on the part of both community interests and transportation agencies to define solutions to transportation problems in the Street corridor, which is both a main street and a significant link for people and goods in the regional transportation network. The first track of this study, initiated in April 2002, has concluded and immediate, localized improvements have been identified. CATS Track 2 will provide a regional, long-term view of transportation issues facing the Canal Street corridor.

Source: New York Metropolitan Transportation Council, "Regional Transportation Plan Update Discussion Document," January 2004, pages 42ff.