Impacts of Deferred Investment on Capital and Operating Budgets

Discussion Document

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Purpose and Method

Purpose

- To illustrate how deferred capital investments impact the MTA's capital and operating budgets.

Methodology

- Met with agency capital planning staff to discuss purpose of the study and identify potential case studies.
- Analyzed proposed case studies to examine feasibility and data availability; sent further data requests.
- Discussed with maintenance, operations, and/or capital planning staff at each agency draft assumptions and conclusions for the case studies.
- Refined estimates and development of conclusions.

Capital Investment
Background on MTA Program

- In the 1970s, after years of inadequate maintenance and capital replenishment, much of the transit system had deteriorated to near collapse.
- Recognizing the systemic problems of under funding, the state authorized additional funding and management flexibility to restore the system.
- Since 1982, the MTA has invested over $50 billion to restore the system to a state of good repair (SGR).
- Key assets such as rolling stock and track are now into normal replacement (NR) cycles.
- Important SGR work remains on the system's massive infrastructure. Remaining components of the NYC Transit system will reach SGR by 2025. Components of the commuter rail will reach SGR by 2019.
- Sustained SGR and NR investments are critical to avoiding a return to the era of disrepair and spiraling operating and capital costs.

Capital Investment
Lessons from Experience

Guiding principles for capital investment:

- Capital assets must be maintained in good repair for a transit system to operate efficiently, minimize costs, and achieve peak performance.
- Healthy budgets minimize lifecycle costs through normal, scheduled replacement of assets that reach the end of their useful lives. A certain level of this investment is essential in perpetuity.
- Under investing in normal replacement causes avoidable and disproportional operating and capital costs.
- Normal replacement optimizes total operating and capital costs based on the useful life of individual assets.
- Performance-based metrics can help quantify the optimum level of normal replacement using individual assets life-cycle costs.

Capital Investment
MTA Classification of Needs

Investments to replenish the system are the focus of this study

- State of Good Repair (SGR): Replacement of capital assets that correct for past deferred maintenance or have exceeded their expected useful lives
- Normal Replacement (NR): Scheduled replacement of capital assets at the end of their useful life to keep the asset in good repair

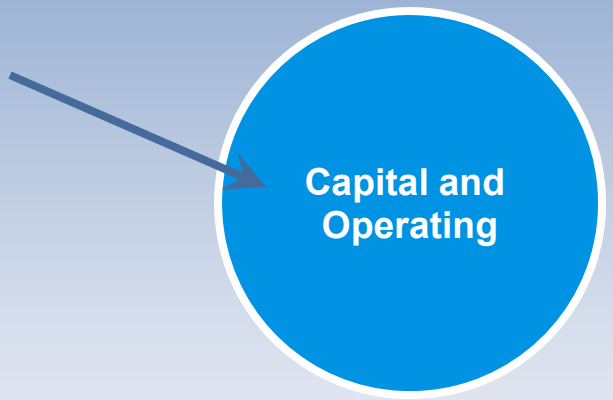
There are also important investments to improve and expand the system with different analytical criteria that are not part of this study

- System Improvement (SI): Projects that expand or improve operations or add new system capabilities or services (e.g. wheelchair accessibility projects, MetroCard implementation, fleet growth etc.)
- Network Expansion (NE): A small number of high-cost projects that physically expand MTA's rail network

Benefits of Capital Investment

Rehabilitation or replacement of aging capital stock has multiple, cascading benefits.

First, at the center, are the direct capital and operating impacts on the agency cost structure.



Internal Benefits

- Reduces cost of operations
- Reduces the need for maintenance and repair
- Improves efficiency of maintenance and repair
- Avoids unforeseen costs
- Minimizes long-term costs of capital assets preservation
- Improves system reliability and performance
- Results in higher farebox recovery ratio

This study focuses on the internal costs and benefits of capital investments. These include direct impacts on the agency's operating and maintenance budgets as well as on future capital needs.

Benefits of Capital Investment

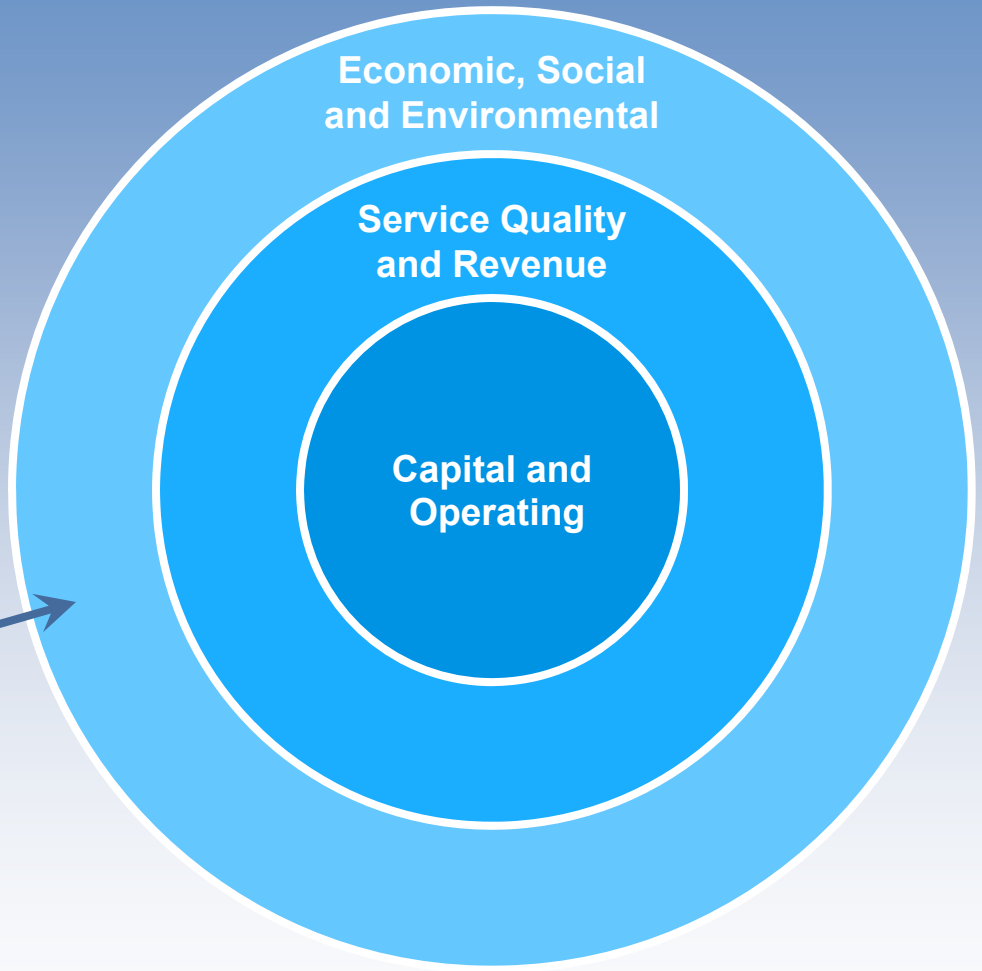
Direct Customer Benefits

- Enables faster, more frequent, more reliable service
- Allows the lowest possible fares
- Increases passenger environment quality and safety
- Increases ridership and revenue

Second, building from the core, are service quality, ridership and revenue improvements.

Users of the MTA system benefit directly from many types of capital investments, even though not all may be visible (e.g. increased safety). In cases where the benefits are apparent, they are likely to help attract additional riders, improving the MTA's revenue stream. These benefits are not quantified in this study.

Benefits of Capital Investment



Capital spending and service improvements have external economic, social and environmental benefits

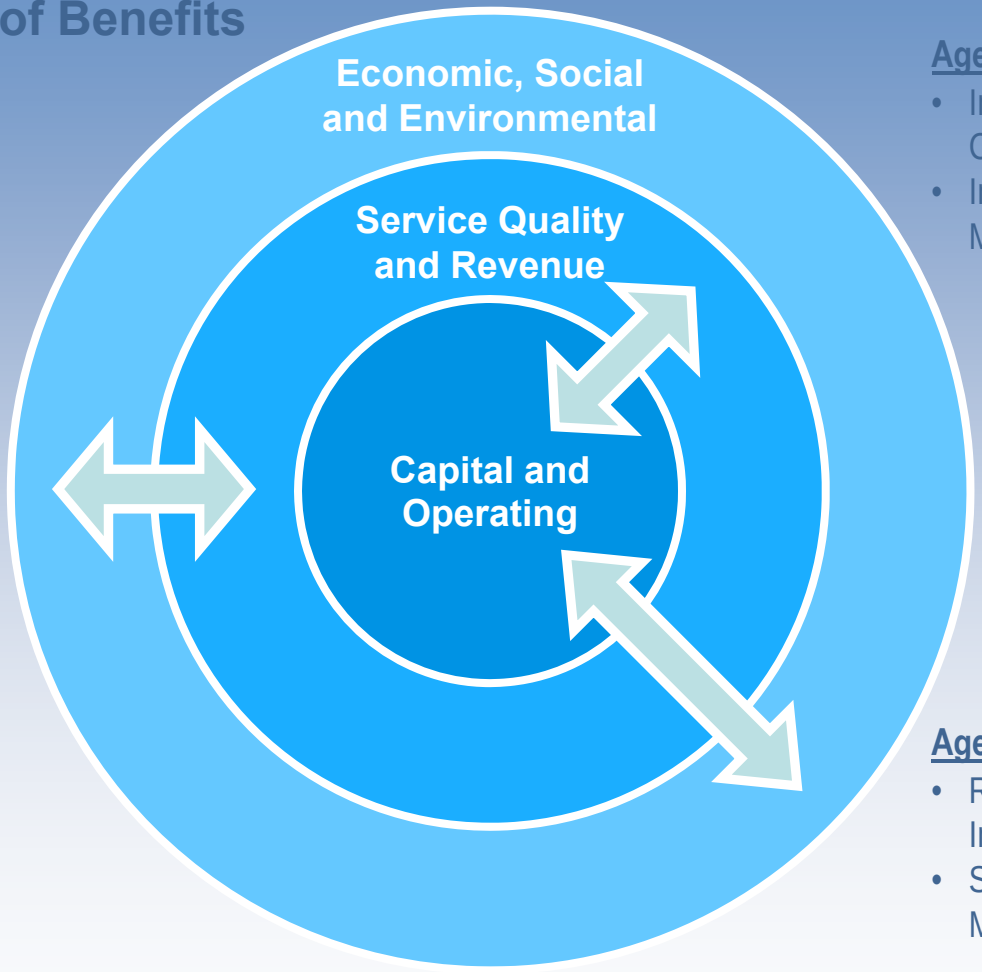
Social Benefits

- Creates jobs
- Underpins regional economic activity
- Anchors local economic development
- Reduces traffic congestion and air pollution
- Spillover benefits to other transit modes, e.g. commercial trucking

MTA capital investments also yield broad social benefits beyond those that accrue directly to riders. These benefits are not included in this study.

Benefits of Capital Investment

Interrelationship of Benefits



Agency ↔ Customers

- Improved reliability → Customer benefits
- Increased service → More value from assets

Customers ↔ Society

- More transit ridership → Less auto congestion
- Stronger economy → More transit ridership

Agency ↔ Society

- Reduced energy use → Improved air quality
- Stronger economy → More capital investment

There are often complex interactions among these benefits. Sustained investing in SGR and NR leads to a "virtuous cycle" of efficiencies, cost savings, and positive spillover effects.

Benefits of Capital Investment

SGR and NR investments often transform the nature of work being done, enabling greater productivity, even if total expenses are about the same.

- New Jamaica Bus Depot will provide additional capacity and modern facilities so more buses can be served, while eliminating inefficiency costs.
- The Harlem-Hudson Power Distribution Project shifted to unstaffed substations, while significantly increasing system capacity and reliability.

Many SGR and NR projects have benefits outside the core concerns of the user departments. These benefits are often unrecognized or unquantified.

- Timely completion of the Verrazano Deck Replacement project will accelerate the creation of a bus/HOV lane on the bridge.
- The smoother ride from concrete ties may reduce equipment maintenance.

Benefits of Capital Investment

Many SGR and NR investments do far more than replace existing facilities in-kind, they improve the system.

Project objectives	Examples of benefits
Achieve or maintain "good repair"	• Minimize future capital NR and SGR requirements – frees future capital to invest in system improvements • Lower operating budgets • Improve system reliability • Maintain system at peak efficiency
Meet contemporary standards and current market demands	• Improve workplace and customer safety • Improve performance and safety in emergencies • Improve passenger comfort and convenience • Improve system reliability
Upgrade systems	• Introduce state-of-the-art technologies. • Add to system capabilities and features.
Enable system improvement	• Take full advantage of System Improvement investments • Greater service speeds/frequencies

Deferred Capital Investment
Impacts on Operating and Capital Costs

- **"Reliability tax"** – Routine and emergency repairs become increasingly frequent as capital reinvestment is deferred *(e.g. bridge deck rehabilitation).*
- **"Efficiency tax"** – Work is needlessly complicated or resources wasted by obsolete facilities, equipment, and spatial constraints *(e.g. bus and rail car maintenance facilities and substation replacement).*
- **"Redundancy tax"** – Extra requirements for reserve capacity (larger fleet spare ratios, additional crews) are needed to keep the system operating at a given performance level *(e.g. rail car lifecycle maintenance).*
- **"Capital tax"** – The degree of disrepair accelerates over time, or repeated capital investments that otherwise might be avoided remain necessary *(e.g. bridge deck rehabilitation and concrete tie replacement).*
- **Cost escalation** – Inflationary pressures increase the cost of a project over time, even if there is no change in its scope. These costs typically grow slightly faster than the CPI. MTA's revenues do not necessarily grow as fast as CPI inflation, so even modest increases in "real" cost can impact the agency.

Deferred Capital Investment
Long-Term Impacts

Deferring needed investments in SGR and NR ultimately produces higher long-term costs as illustrated below and in the following slide.

Year 1: The system is in disrepair at the beginning of a rebuilding program.

Year 9: Spending reduces urgent capital needs to the point that some funds can begin to be invested in system improvement.

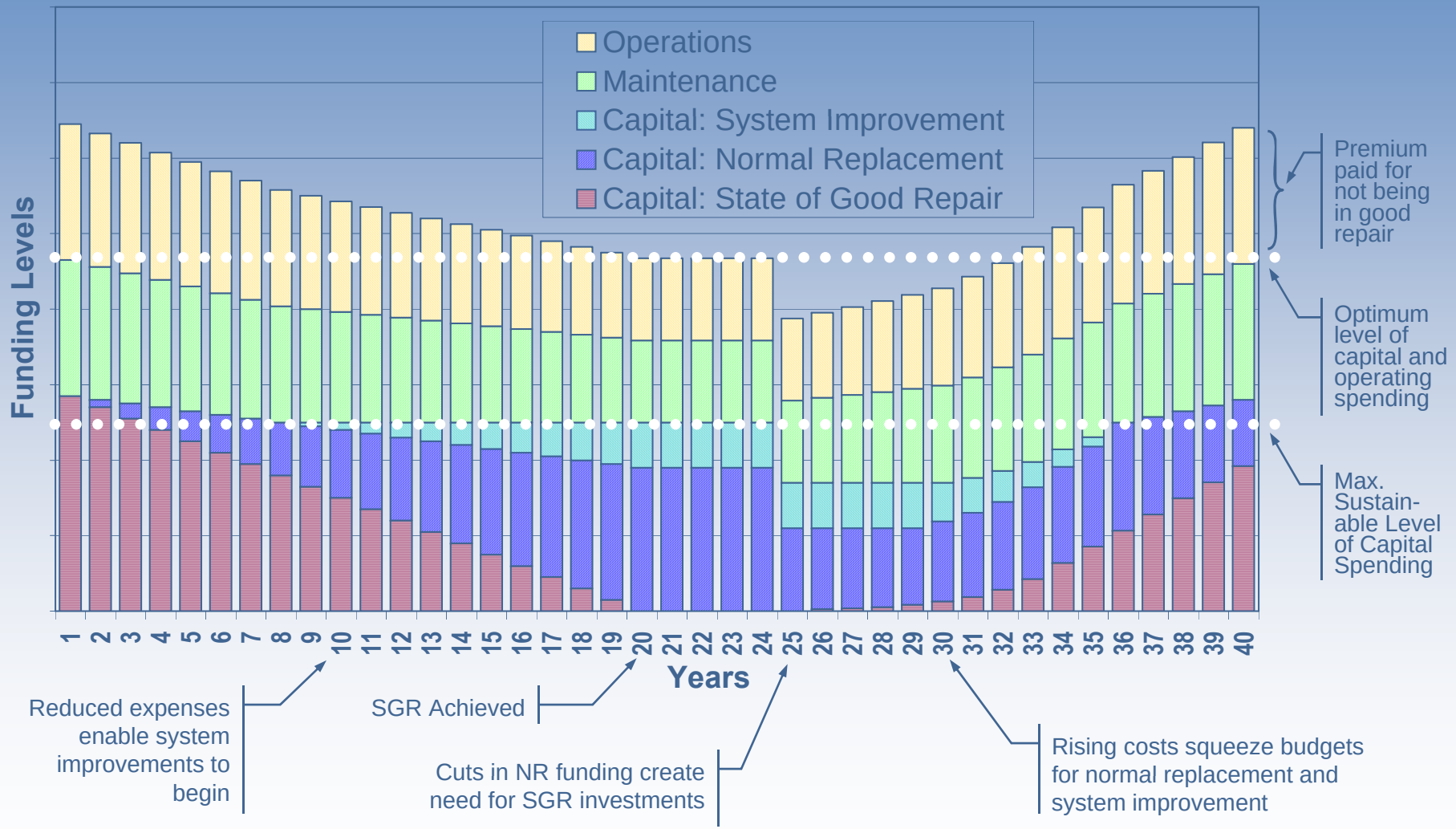
Year 20: State-of-good-repair is achieved. Operating and maintenance costs are reduced to optimum levels.

Year 25: Under a new policy, funding is reduced or shifted away from NR investments. Operating and maintenance costs and SGR requirements begin to rise.

Year 36: Growth in SGR requirements forces elimination of system improvement spending and begins to encroach on NR spending.

Deferred Capital Investment

Long-Term Impacts



Deferred Capital Investment
Learning from the past

When SGR and NR investments are short-changed, they can trigger a *"cycle of disinvestment."*

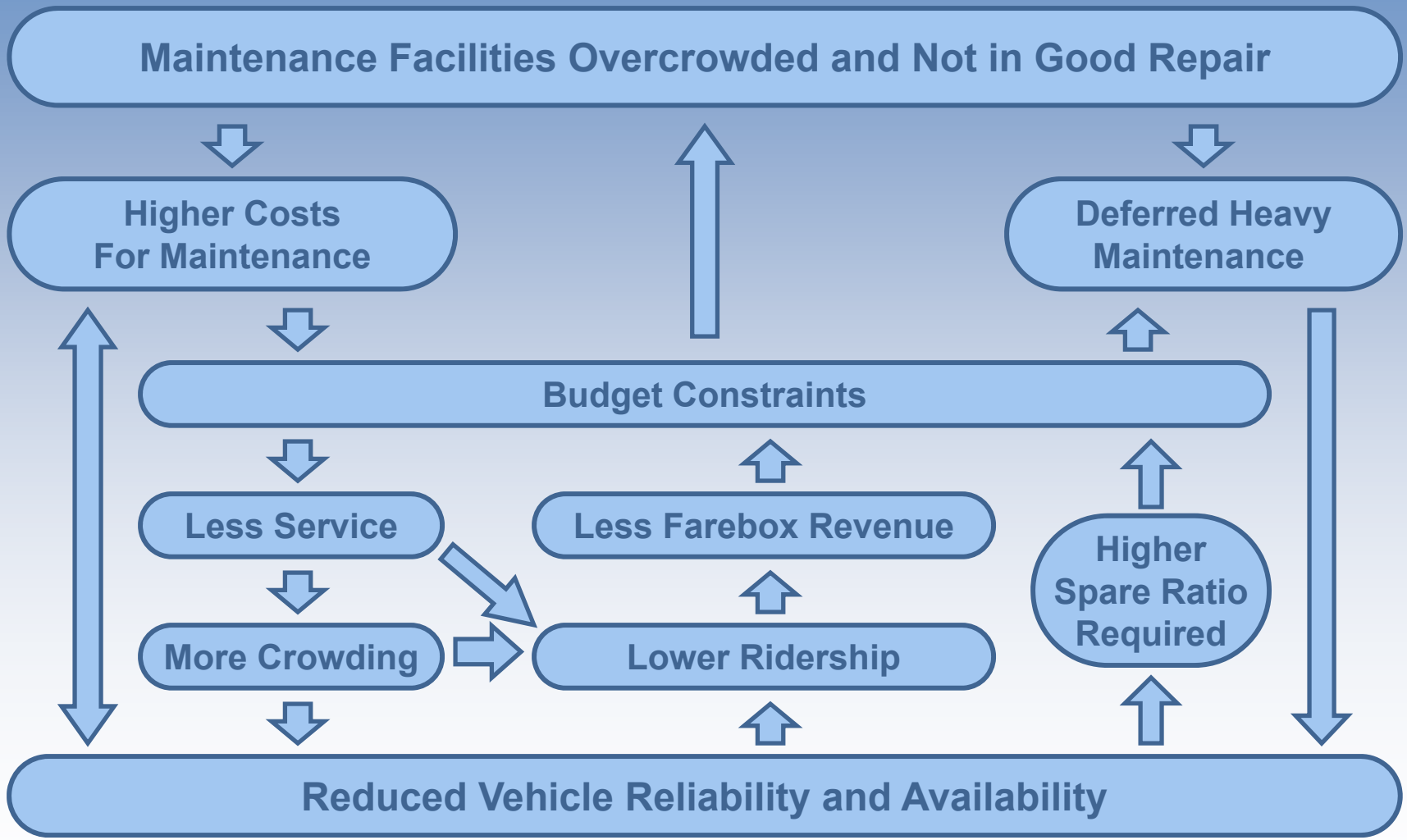
- Disinvestment undermines the agency's performance and strategic objectives, such as increasing operating efficiency and improving service.
- Poor service quality begets a decline in ridership which in turn harms revenues and public support for the agency's subsidies.
- Differed investments exacerbate deteriorating asset conditions amplifying the cost of future investments squeezing the money available for normal replacement.

There are also the opportunity costs of regaining "lost ground":

- If the system had been in SGR in 1982, then much more could have been spent on system modernization, capacity improvements, and expansion.

Deferred Capital Investment

"Cycle of Disinvestment"



Case Studies
Overview of the Cases

Case Study		Project	Award	Scenario
Name	Agency	Type	(Duration)	Tested
Railcar Lifecycle Maintenance Investments	LIRR	NR/SI	2005 (10 yrs.)	No Build
Jamaica Bus Depot Replacement	NYCT	SGR	2007 (3 yrs.)	5-Yr Delay
Cross Bay Bridge Deck Rehabilitation	B&T	NR	2005 (3 yrs.)	9-Yr Delay
Verrazano Bridge Deck Replacement	B&T	NR	2008 (3 yrs.)	2-Yr Delay
Commuter Rail Power Distribution	MNR	NR	1984 (7 yrs.)	5-Yr Delay
Commuter Rail Concrete Tie Installation	LIRR	NR	2005 (4 yrs.)	No Build

Case Studies

Benefits Provided

Project Name	Type	Agency Benefits					Public Benefits				
		Improve working conditions	Reduce unscheduled repairs	Optimize O&M budgets	Reduce long-term capital costs	Improve energy efficiency	Facilitate system improvements	Reduce travel time	Improve reliability	Improve comfort/convenience	Improve safety
Railcar Lifecycle Maintenance Investments	NR/SI	*	✓	✓	✓				*		
Jamaica Bus Depot Replacement	SGR	*	*	✓		*				*	
Cross Bay Bridge Deck Rehabilitation	NR		✓		✓			*	*	*	*
Verrazano Bridge Deck Replacement	NR		✓		✓		*	*	*	*	*
Commuter Rail Power Distribution	NR			✓		✓	*	*	*		
Commuter Rail Concrete Tie Installation	NR		*	✓	✓		*		*	*	

✓ = This benefit is considered in this study.

* = This benefit is provided by the project, but was not quantified for this study.

Case Studies

Results of Cost-Benefit Analyses

Project Name[1]	Useful Life (Years)	(Millions of Dollars)			Budget Impact vs. Capital Cost
		Capital Cost[4]	Net Budget Impact[5]	2005 Net Present Value	
Railcar Lifecycle Maintenance Investments	25[2]	$167.6	$422.2	$35.6	252%
Jamaica Bus Depot Replacement	100	$130.0	$30.0	-$4.6	23%
Cross Bay Bridge Deck Rehabilitation	50	$48.8	$42.2	$34.1	547%
Verrazano Bridge Deck Replacement	50	$165.0	$93.9	$18.0	57%
Commuter Rail Power Distribution	35[3]	$207.9	$63.9	$10.8	31%
Commuter Rail Concrete Tie Installation	50	$116.2	$239.7	$10.2	214%

[1] These cases are not directly comparable, but illustrate that SGR and NR investments bring long-term savings across a variety of capital systems.

[2] Project has a useful life of 50+ years, but analysis was terminated at 25 years due to data constraints.

[3] Useful life of a substation is 35 yrs, and useful life of 3rd rail is 50 yrs; analysis assumed 35 years.

[4] In current (year of expenditure) dollars.

[5] Total lifecycle savings in current dollars.

Study Assumptions

Inflation rate (growth in Consumer Price Index) = 2.5%

- Based on the average inflation rate over the past 10 years.
- A broad index is used because the MTA's costs do not resemble transportation or transport equipment sectors more generally.
- Used to describe how the value of the dollar varies over time.

Cost escalation rate = Inflation + 0.5% = 3%

- Unless otherwise indicated, labor, material, and capital costs are assumed to grow at this rate
- This value was recommended by MTA Bridges & Tunnels based on its own analysis of how its costs rise over time.
- Used to estimate the net budgetary impacts of capital investments.

Cost of capital = 2.65%

- This is MTA's historic long-term cost of borrowing, in real dollar terms based on the MTA 1997 Guidelines for Cost-Benefit Analysis.

Discount rate (in current dollars) = Inflation + Cost of capital = 5.15%

- Used to calculate the net present value of an investment over its expected useful life.

Study Assumptions

Effects of these assumptions:

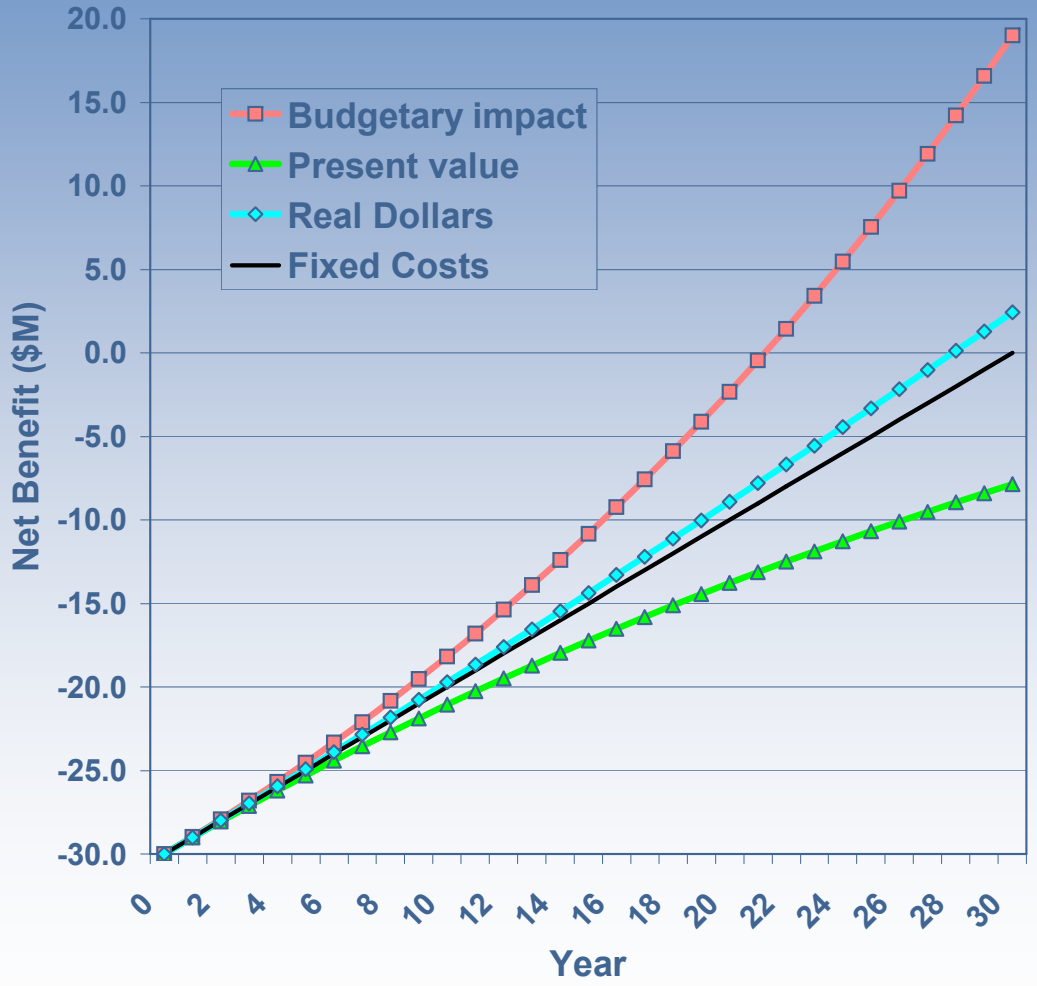
- Since the discount rate of 5.15% is greater than the cost escalation rate of 3%, there is a conservative bias built into this methodology.
- Everything else being equal, deferring or canceling investments looks more attractive than proceeding now.

Example:

- Suppose an investment costs $30M, has an estimated benefit of $1M per year, and has a useful life of 30 years.
- Assuming fixed costs and real dollars, the project will break even in its 30th year.
- Since costs rise over time, the project does provide benefits in both constant and current dollars. It has a positive net impact on budgets.
- However, if borrowing costs are taken into account, then the project fails to break even. It has a negative net present value.

Study Assumptions

Illustration of the effects of these assumptions



Including inflation, project has strong positive impact on budget.

Escalation in real costs provides a small net benefit

Assuming fixed costs, project breaks even in 30th year.

Negative net present value due to costs of capital.

Results reported in this study

Study Limitations

These case studies are not directly comparable.

- Cases were selected for diversity, in terms of the agencies, types of assets considered, and whether the investments occurred in the past or are proposed for the future.
- Direct comparisons among these cases should be made with caution, since the nature of the scenarios themselves is not uniform.
  - Longer delays produce higher apparent costs.
  - "No-build" scenarios produce the highest costs of all, since the entire useful life of the project comes into play.
- Similar methodologies could be applied to compare projects that are more similar to one another, under more uniform assumptions, and then adopted as part of the capital budgeting process.
- The approach taken in this study is useful for illustrating the benefits of maintaining MTA's commitment to its core capital program – in many cases, money spent today helps avoid greater costs in the future.

Study Limitations

Limitations of Cost-Benefit Analysis

Cost-benefit analysis is a tool for decision-making and not a substitute for strategic planning. It does not adequately capture:

- Inter-dependencies among projects
- Changes in mandates, standards or consumer demands
- The benefits of additional flexibility (or "option values") that investments may provide for future decision-making.

Non-financial benefits of capital investments

Several of the projects described here are important for reasons that reach beyond the quantitative logic of benefit-cost analysis.

- For example, the Harlem-Hudson power distribution project was justified by the need to adapt to new types of power supply, as well as by the need to expand service capacity on the line.

Conclusions

Focusing only on internal budgetary benefits, the case studies illustrated how timely capital investments:

- Improve support facilities like shops and depots enabling more efficient operations and lower maintenance costs.
- Arrest structural deterioration thereby lowering maintenance costs and averting more expensive replacement projects.
- Upgrade infrastructure such as power and track improving service, reducing operating and maintenance costs, preventing costly disruptions in service.

Investment in the core capital program now will ensure that…

- MTA will have even more capital funds for future discretionary investments.
- MTA's operating units can continue their efforts to improve productivity.
- MTA will have the basic infrastructure in place to take advantage of the full benefits of "system improvement" investments.
- The public will see continuous improvement in the quality of MTA's services.

Conclusions

The estimates in this study are conservative. They do not include:

- Key internal benefits that could not be quantified due to data limitations.
- Benefits to MTA customers.
- Benefits to region more generally.
- Secondary effects of customer and social benefits on MTA revenues.

Despite these conservative assumptions, the study found that good repair delivers higher performance at a lower price.

- Failing to reinvest in the system costs more in the long run.
- Minimizing long-run capital and operating costs requires analysis of the optimal reinvestment schedules for each asset category.
- Reinvesting below these levels damages the system's quality, efficiency, and reliability, raising costs for both the agency and its customers.

Conclusions

MTA and the operating agencies will have a continuing need for strategic analysis of capital planning proposals.

- In 1981, Richard Ravitch said “operating budgets are inexorably intertwined with the requirements of capital replenishment.” This remains is as true as ever.
- Ties between operating and capital programming need strengthening.
- This requires the tracking of key operating data across the full range of asset categories, tied to key policy variables to facilitate analysis.
- But it is critical to recognize that many projects cannot be analyzed in isolation – they often have strategic interrelationships that must be analyzed on a *programmatic* basis:
  - A group of subprojects may all need to be completed to fulfill a single common strategic objective and provide significant benefits.
  - But individually, some may not appear beneficial if the analysis is drawn too narrowly.

Recommendations

MTA should incorporate into its capital planning and its daily operations a more strategic approach to asset management.

- Asset management systems provide a framework that seeks optimum benefits at minimum cost.
- They help prioritize investments, reduce risk, communicate value, and ensure that investment decisions are tied to the organization's mission.
- The quality and effectiveness of asset management efforts depends on the quality of information available on direct and indirect costs, benefits, and risks.

Recommendations

The capital planning process should assess a wide range of project benefits.

Operating impacts – Some operating agencies already conduct internal "budget impact" analysis of proposed capital investments. These efforts would be strengthened by parallel efforts to quantify the operational impacts of new investments in the field.

Risk reduction – More systematic assessment and quantification of risks and liabilities would enable the agencies analyze projects that:

- Reduce the frequency of derailments or emergency repairs
- Improve system safety during emergency conditions.
- Reduce risks of worker injuries.

User benefits –The inclusion of user benefits in the analysis of NR and SGR investments will help demonstrate the value of these investment categories in broader discussions about funding the overall capital program.

- Long-term planning and decision-making would be enhanced by access to assessments of the external benefits of projects.
- Many investment decision are made with an emphasis on immediate, avoided and long term costumer impacts.

Recommendations

For these analyses to become useful tools in the capital planning process, operating agencies need to track costs and performance more systematically and creatively.

- Better maintenance records would help agencies analyze and explain more effectively the benefits of modern shops and depots.
- Statistical analysis of the reliability of substations, transformers, and other electrical equipment would help the agencies assess what the replacement cycles of this equipment should be.
- More comprehensive tracking of costs and performance measurement would enable the operating agencies to adopt real-time, intelligent management strategies. That can help identify and diagnose problem areas quickly, and provide a system for internal accountability. Examples: NYPD's CompStat and similar projects like HealthStat and TrafficStat.