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Forensic Performance Audit of Metropolitan Transportation Authority's Capital Planning Process

December 20, 2019

Final Report

December 20, 2019

Patrick J. Foye
Chairman and CEO
Metropolitan Transportation Authority
2 Broadway
New York, NY 10004

Dear Mr. Foye:

Crowe LLP (Crowe) transmits this performance audit of the Metropolitan Transportation Authority (MTA) capital planning processes. We assessed MTA's performance with aspects of its capital planning processes, including whether projects included in the 2020-24 Five-Year Capital Plan were appropriate; based on asset conditions, investment strategies, and cost ranges. We evaluated whether cost overruns and duplication from projects included in the 2015-19 Five-Year Capital Plan were evaluated and documented. We assessed compliance with internal MTA policies and procedures. Finally, we compared MTA's capital planning process with leading practices of other transit agencies.

MTA and agency management have the responsibility for establishing and maintaining internal control and for complying with applicable laws and regulations of its capital planning activities. Internal control is a process to provide reasonable, but not absolute, assurance regarding the effectiveness and efficiency of operations, and compliance with applicable laws and regulations. We obtained an understanding of MTA and agency internal controls over the capital planning process sufficient to plan and execute the performance audit. In addition, we considered significance and risk in determining the nature and extent of our procedures.

The audit was conducted in accordance with performance audit standards contained in *Government Auditing Standards* (GAS) issued by the Government Accountability Office of the United States (GAO), those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on the audit objectives. We believe that evidence obtained provides a reasonable basis for our findings and conclusions as presented based on our audit objectives.

We received valuable assistance from the MTA and agencies during the audit. We appreciate the efforts of the wide range of personnel who gave their time to assist us with interviews, on-site inspections, and documentation in response to our data requests.

This report is intended solely for the information and use of the MTA and those parties authorized by law or regulation to receive it and is not intended to be and should not be used by anyone other than these specified parties.

Should you have any questions regarding this report, please contact me at bert.nuehring@crowe.com.

Sincerely,

Bert Nuehring, Partner
Crowe LLP

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Executive Summary

Section 1279-f of the Public Authorities Law required the MTA to conduct an independent forensic audit of the MTA's capital planning process. On April 29, 2019, the MTA issued a solicitation titled Work Assignment on Capital Planning Process Review (Solicitation 15475). The MTA requested proposals for a review of its capital program development process leading to the five-year capital plan (the 5YP) as well as a review of the preliminary mix of projects in the 5YP and initial project estimates as they become available.

Crowe developed a detailed workplan to align with the MTA requirements which included seven (7) audit objectives: Conclusions from our work are presented in **Exhibit 1.** Based on the results of this performance audit, Crowe did not find deficiencies with internal controls over MTA capital planning processes that were significant to the individual performance audit objectives, or significant non-compliance with MTA policies, procedures, practices, and State law, that would necessitate modification to the 2020-24 Five-Year Capital Plan. We have otherwise communicated deficiencies that were significant enough to warrant attention to those charged with governance.

Exhibit 1
Crowe Performance Audit Objectives and Conclusions

Audit Objective	Conclusion
1. Determine whether asset conditions are accurately documented.	Asset condition ratings are accurately documented in all significant respects. We otherwise have identified matters of internal control and areas of non-compliance in Finding 4.
2. Determine whether MTA's condition assessment of current assets warrants the need for replacement and is based on condition standards provided by the MTA.	MTA's condition assessment of current assets warrants the need for replacement and is based on condition standards provided by the MTA in all significant respects.
3. Determine whether MTA's comprehensive policies and procedures are properly designed and implemented for preparation of the Five-Year Capital Plan.	MTA's policies and procedures are properly designed and implemented for preparation of the Five-Year Capital Plan in all significant respects. We otherwise have identified matters of internal control as reported in Finding 9.
4. Determine whether the Five-Year Capital Plan complies with applicable laws, rules, regulations, and ordinances, as designated by the MTA and/or Public Authorities Law.	The Five-Year Capital Plan complies with applicable laws, rules, regulations, and ordinances, as designated by the MTA and Public Authorities Law in all significant respects.
5. Determine whether MTA's capital planning processes are consistent with industry leading practices using a sample of peer organizations as agreed by the MTA.	MTA capital planning processes are consistent with industry leading practices in all significant respects. We otherwise have identified matters of internal control as reported in Findings 3, 5, 6 and 7, and instances of non-compliance with MTA policies and procedures in Finding 3.
6. Determine whether the mix of investments and cost ranges included in the 2020-24 Five-Year Capital Plan are based on the Twenty-Year Needs (TYN) conditions and investment strategies.	The 2020-24 Five-Year Capital Plan is based on TYN conditions and investment strategies in all significant respects. We otherwise have identified matters of internal control as reported in Findings 2 and 8.
7. Determine whether cost overages and/or duplication of projects occurred in projects related to the 2015-19 Capital Plan and assess whether cost overages and duplications are evaluated and documented by the MTA.	Cost overages and/or duplication of projects occurred in projects related to the 2015-19 Capital Plan, and MTA evaluated and documented them in all significant respects. We otherwise have identified matters of internal control and instances of non-compliance in Finding 1.

Our audit identified nine (9) total findings as shown in **Exhibit 2.** Findings are organized into three areas: cost estimates, asset inventories and conditions, and capital planning processes. For each finding, in Exhibit 2, we identify 1) the degree with which we found non-compliance and 2) the extent of an internal control deficiency. Below we provide the basis for how we determined compliance, how we assessed internal control deficiencies, and a summary of our findings.

Compliance Assessment

We considered MTA policies, procedures, practices, instructions and State Law when evaluating compliance of the MTA's capital planning process.

Internal Control Assessment

We considered the following three levels of a control deficiency, as described below, from lowest rated or least problematic (noted green) to the highest rated or most problematic (noted red):

- *Deficiency* – A control deficiency exists when the design or operation of a control does not allow management or employees, in the normal course of performing their assigned functions, to prevent or detect misstatements on a timely basis.
    - A deficiency in design exists when (a) a control necessary to meet the control objective is missing or (b) an existing control is not properly designed so that, even if the control operates as designed, the control objective would not be met.
    - A deficiency in operation exists when a properly designed control does not operate as designed or when the person performing the control does not possess the necessary authority or qualifications to perform the control effectively.
- Significant Deficiency is a *deficiency*, or a combination of deficiencies, in internal control, that is important enough to merit attention by those responsible for oversight of the Five-Year Plan.[1]
- Significant Deficiency with Modification is a deficiency, or a combination of deficiencies, in internal control, such that there is a reasonable possibility that a significant or material misstatement of the Five-Year Plan will not be prevented or detected on a timely basis.

Findings Summary

Of the nine (9) findings, we determined that three (3) findings (Findings 1, 4 and 9) represent significant deficiencies in internal control of the capital planning process requiring management attention. The remaining six (6) findings (Findings 2, 3, and 5 through 8) were not deemed significant to the audit objectives, but based on their nature were deemed to warrant the attention of the MTA and the agencies.

We determined that three (3) findings (Findings 1, 3 and 4) included non-compliance with MTA internal policies and procedures. We did not find MTA out of compliance with the Public Authorities Law.

Findings are detailed in the Schedule of Findings and Recommendations section of the report (Section 4). In **Exhibit 3,** we provide a series of recommendations related to each of the findings.

The Authority provided a letter acknowledging receipt of this report and identifying MTA's management responses to the findings. The letter and management responses are shown in this Executive Summary following Exhibit 3. Crowe did not audit the contents of this letter.

[1] Significance is defined as the relative importance of a matter within the context in which it is being considered, including quantitative and qualitative factors. Such factors include the magnitude of the matter in relation to the subject matter of the audit, the nature and effect of the matter, the relevance of the matter, the needs and interests of an objective third party with knowledge of the relevant information, and the impact of the matter to the audited program or activity. Professional judgment assists auditors when evaluating the significance of matters within the context of the audit objectives.

Exhibit 2
Crowe Findings

Finding	Audit Objective Impacted	Compliance (significant non-compliance or non-compliance[2])	Control Evaluation[3]
Cost Estimates			
1. MTA can improve cost estimates with more formal, standardized, and consistently applied cost estimating procedures and agency documentation requirements	7	Non-compliance	Significant Deficiency
2. MTA's budgeted costs exceed comparative benchmarks for various reasons and the MTA should consider a range of alternative management approaches to control future costs	6	N/A	Deficiency
Asset Inventories and Condition			
3. MTA can enhance linkages between capital projects included in the 2020-24 Five-Year Capital Plan and assets targeted for repair/replacement within agency asset inventories	5	Non-compliance	Deficiency
4. MTA has comprehensive asset condition databases which reflect existing conditions, however MTA should supplement its asset condition database contents to better support asset condition determinations	1	Non-compliance	Significant Deficiency
Capital Planning Processes			
5. MTA has yet to realize significant MTA level capital planning benefits from Enterprise Asset Management (EAM)	5	N/A	Deficiency
6. MTA's largely manual TYN and Five-Year Plan processes and disparate data platforms make it difficult for the MTA and agencies to assess priorities, backlogs, and alternative scenarios	5	N/A	Deficiency
7. The MTA can improve the transparency of performance measures and dashboarding to more closely monitor Five-Year Plan and project outcomes	5	N/A	Deficiency
8. There are some limitations in the MTA's capital planning review and approval processes	6	N/A	Deficiency
9. MTA and agencies do not have comprehensive and fully documented capital planning policies and procedures.	3	N/A	Significant Deficiency

[2] Where "significant non-compliance" is reportable to management, and "non-compliance" is not considered significant to the objectives of the audit but we otherwise wish to communicate this to those in charge of governance.

[3] Where "significant deficiency" is reportable to management, and "deficiency" in control is not considered significant to the objectives of the audit but we otherwise wish to communicate this to those in charge of governance.

Exhibit 3
Crowe Recommendations

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Finding	Recommendation Summary
Cost Estimating	
1. Formal, standardized, and consistently applied cost estimating procedures	a) Develop a Cost Estimating guide for common use by agencies including methodologies (inclusive of standardized contingency usage and exceptions recording), templates, and the requirement of a Basis of Estimate (BOE) with documentation to support use of analogous (historical) estimates and unit costs used in developing its estimates. b) Require immediate master planning, BOE, and detailed cost estimates for projects commencing in the first two years of the 2020-24 Five-Year Capital Plan, in advance of the start of the phase of work (design or construction) and in accordance with Gates requirements.
2. Budgeted costs exceed comparative benchmarks	a) Use an annual capital programming cycle to allow for more frequent and updated cost estimates and more accurate project progress reporting over the Five-Year Plan lifecycle. b) Take measures to manage its capital project expenditures during the 2020-24 Five-Year Planning cycle including: **Planning** • For projects requiring significant stakeholder involvement, actively engage stakeholders early in the planning process to identify agreed upon project parameters (e.g., location and scope) and potentially reduce long and inefficient project lead times • Consolidate projects/procurements across multiple sub-projects for economies of scale and to provide greater opportunity for continuous contractor workflow • Simplify and standardize project design/scope specifications and requirements where possible to reduce complexity and minimize non-critical project elements • Develop database of benchmark costs with accurate “apples to apples” comparisons **Contracting** • Explore greater use of master service agreements (MSAs), including multi-agency ones. Continue to consolidate large rolling stock procurements and other project types (e.g., concrete ties) for economies of scale • Consider additional value engineering options where the MTA and contractor share in the value of cost savings identified by the contractor • Create contractor performance incentives (for early or on-time delivery) • Explore other project delivery methods (e.g., Construction Manager at Risk (CMAR), public-private partnerships (P3), and design-build-operate-maintain (DBOM)) • Perform procurement audit **Logistics** • Consider options for station closures (partial, full), and potentially sacrifice 24/7 operations by offering other transit options **Project Management** • Provide close monitoring of force account (EFA, TA) amounts; including weekly supervisor monitoring, limitations so only a set of pre-identified employees can work on a project, multiple levels of approval for overtime, and prompt project charge code closures upon completion • Examine whether the MTA can reduce potential duplication of effort between internal (force account) and external design/engineering, project management, and construction management services • Require cost-benefit analysis at early stage of projects, for projects above a threshold • Provide active risk management of projects throughout project lifecycle **Communications** • Make work rules options transparent to MTA stakeholders (Board and public) as a basis for them to understand the extent of staffing and related costs required to deliver the project • Conduct continuous outreach to the contractor community to understand issues/concerns. Actively sell new and alternative contracting/procurement options to the contractor population to encourage robust competition • Develop governance around the planned centralized construction agency as to how the agency will oversee the capital program, including the centralized construction agency’s responsibilities relative to other MTA agencies in planning, bundling, and delivery of capital projects.

Exhibit 3
Crowe Recommendations *(continued)*

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Finding	Recommendation Summary
Asset Inventories and Condition	
3. Enhance linkages between planned capital projects and assets	a) Perform a cross-walk between the investment strategies and the asset condition database to ensure the linkage between Twenty-Year Needs (TYN) and the respective Five-Year Plan (5YP) is apparent. b) Prepare internal documentation that identifies initial plans for those assets the agency intends to address with its allotments/allocations (e.g., for annual track or station repair). In keeping with the instructions provided for the TYN, where possible the agency should develop location-specific projects. c) Develop a form indicating condition of the asset(s), the need for replacement, the cost estimate(s), and a detailed cost benefit analysis for projects included in the 5YP. Additionally, corresponding memos should be prepared to record when/why certain assets have been removed from the 5YP and how the condition/need for the asset will be addressed in the future.
4. Supplement asset condition database to better support asset condition determinations	a) Implement procedures and systems to ease manual asset condition processes, provide consistent and accurate asset condition information and other data to establish capital needs. b) Make certain changes/updates to existing data sets. c) Enhance coordination channels between maintenance and capital programs so maintenance can provide timely/current condition information to better inform capital decisions. d) Refine the definitions of state of good repair (SGR), normal replacement (NR) and system improvement (SI) for consistent application across agencies. e) Prepare a succession plan to capture and transfer employee knowledge of capital planning processes and procedures in cases where individuals leave the organization.
Capital Planning Processes	
5. MTA has yet to realize significant MTA level capital planning benefits from EAM	a) Develop a detailed enterprise asset management system (EAM) project schedule with definitive timelines and milestones for implementation of the system. b) Seek opportunities to show near-term progress in capital planning from the EAM initiative. Provide regular reports to management and the Board to demonstrate the progress of the EAM implementation.
6. Manual TYN and Five-Year Plan processes and data platforms create challenges for MTA and agencies	a) Employ an SGR decision-support tool to enable an objective, data driven, risk-based project selection methodology that can "automatically" run scenario analyses. Complete the implementation of the SGR decision-support tool in the next two years. b) Seek opportunities to show near-term progress on the SGR decision-support tool initiative by piloting its use at an agency to demonstrate how the tool can replicate project priorities and project costs programmed for the current 5YP.
7. Improve transparency of performance measures and dashboarding to more closely monitor Five-Year plan and project outcomes	a) Prepare periodic reporting and dashboarding on delivery progress of each 5YP (both dollar value and projects delivered). b) Use Earned Value Management (EVM) and key performance indicators (KPI) for project reporting.
8. Limitations in MTA capital planning review and approval processes	a) Implement capital planning process changes including: • Establish a governing body to be charged with final review and approval of the TYN[4], • Remove or revise the project nomination cycle policy to realistically reflect the time necessary to develop capital plans, • Provide draft TYN and 5YP documents to the Board / public 45 days in advance of planned approval with an opportunity for written public comment (with current plan completion schedules adjusted accordingly to allow for additional review time).
9. Lack of fully documented capital planning policies and procedures	a) Develop comprehensive policies and procedures for the 5 Year Capital Plan and Twenty-Year Needs Assessment processes. b) Develop/update policies and procedures for the acquisition, maintenance, disposition, and inventorying of assets both at the agency and organizational levels.

[4] Up until now the MTA has never had a legal requirement to complete or release a 20 year needs assessment document. With recent legislation (NYS Public Authorities Law section 1269-c, April 2019), the MTA is now required to send a new report covering the years 2025-2044 to the State at the end of 2023 for the 2025-29 Capital Plan.

MTA Cover Letter Responding to Audit Findings

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New York, NY 10004
212 878-7000 Tel

Patrick J. Foye
Chairman and Chief Executive Officer

Metropolitan Transportation Authority
State of New York

December 20, 2019

Bert Nuehring, Partner
Crowe LLP
One Mid America Plaza, Suite 700
Oakbrook Terrace, Illinois 60181-4707

Dear Mr. Nuehring:

On behalf of the MTA, I am acknowledging receipt of the independent forensic audit report that Crowe performed on our capital planning process. The MTA accepts these findings, and the conclusions specified in this audit – about the need for better data, more standardized processes, and new systems to improve decision-making and transparency – are in substantial alignment with goals identified in the MTA Transformation Plan adopted by the MTA Board in July 2019.

The MTA management responses to the specific findings are included in the final audit report and also attached to this letter. Implementation of the associated recommendations will be tracked over the course of the next capital program.

We look forward to utilizing the results of your audit as we continue moving ahead to revitalize our system for our customers.

Patrick J. Foye
Chairman & Chief Executive Officer

The agencies of the MTA
MTA New York City Transit
MTA Long Island Rail Road
MTA Metro-North Railroad
MTA Bridges and Tunnels
MTA Capital Construction
MTA Bus Company

Finding 1: ***MTA can improve cost estimates with more formal, standardized, and consistently applied cost estimating procedures and agency documentation requirements***

Response:

The MTA agrees there is a need for improvement in estimating the cost of capital projects. As part of the Transformation, the new Construction & Development function is developing and will consistently apply informed, project-based cost-assessment methodologies appropriate for each stage of the planning and delivery process. Project contingency levels will also follow standard guidelines. These will be summarized in standard guides for common use by the MTA. The MTA is also improving systems it uses to track expenses and other commercial indicators for projects as they are delivered. This data will be readily available for future program and project planning.

- The leader of each project will adopt value-engineering and risk-analysis practices to better estimate project costs and reduce potential overruns. These will include systems to track expenses and other commercial indicators as they happen.
- Construction delivery data will be compiled and analyzed, including variances from original costs and schedule projections. Project leaders will have access to the data for integration into future cost estimating modeling.
- The MTA agrees that the immediate focus for cost estimating should be early on the 2020-24 program.

Finding 2: ***MTA budgeted costs exceed comparative benchmarks for various reasons and MTA should consider a range of alternative management approaches to control future costs***

Response:

The MTA agrees that more can and should be done to lower project costs. As noted, the MTA has already developed, and is continuing to develop, a number of initiatives to reduce costs. New processes, benchmarks and standards will be extensively documented for easy reference by MTA project leads and other staff, and updated as the new Construction & Development organization gains more experience with Design-Build and other innovative delivery practices.

- The MTA will do the following:
    - Provide annual updates on the 2020-24 Capital Plan, including updates on individual projects, and will also amend the original five-year capital plan if necessary.
    - Continue to engage community members around specific place-based capital projects (as it has in the last few years on L Train, Third Track, Second Avenue Subway and other projects).
    - Continue identifying objective, data-driven, and risk-based criteria to evaluate and prioritize capital projects. The function will develop and implement standard approaches across the MTA Capital Program for investment strategies, project

prioritization, Master Planning, scoping, etc.-- resulting in shorter time frames with consistent and transparent strategies.

  - Consolidate smaller projects with common affinities (such as scope, outage requirements, geography) into bigger ones for economies of scale. The L Train Project has already grouped together different projects to minimize track outages and make the most efficient use of the scheduled outages.
  - Utilize a range of project delivery methods, as well as alternative contracting practices, including value engineering options, contractor performance incentives and other measures. The LIRR Expansion project has already employed these incentives, which have encouraged the design-builder to finish sooner.
  - Through the MTA's internal Audit Department, the MTA will undertake a procurement audit within the first two years of the 2020-2024 Capital Plan."

- Capital project planning will prioritize reducing service changes and managing disruptions by providing alternative service options.
- Force account costs are a major cost driver for MTA construction projects. The new Project CEOs will be responsible for tracking force-account and overtime expenditures much more closely than has been the practice.
- Wherever appropriate, the MTA will carry out a cost-benefit analysis.
- The new Construction & Development organization will be responsible for planning, bundling and delivery of the 2020-24 program and will be working with operating agencies to carry out the program in faster, better and more cost-effective ways.
- Improved dialogue with the contracting community will be a priority to better manage risk and reduce change order review and payment processing times.

Finding 3: ***MTA can enhance linkages between capital projects included in the 2020-24 Five Year Capital Plan and assets targeted for repair/replacement within agency asset inventories***

Response:

The MTA's Capital Program development process links individual asset conditions, investment strategies, and capital plans. The MTA is developing new tools and integrated systems to better address the complexities of its network and connect more systematically asset-condition information with investment strategy.

MTA will achieve this reconciliation by bringing all assets into one asset register and inventory database (with standard asset classifications and data structures) across the MTA enterprise, and by providing more detailed information for budget allocation categories—which the MTA can then incorporate into annual budgets and the financial plan. The MTA will develop and implement a standard asset classification or coding system for assets as they go through the Twenty-Year Needs (TYN) and Five-Year Plan (5YP) development processes.

Finding 4: ***MTA has comprehensive asset condition databases which reflect existing conditions, however MTA should supplement its asset condition database contents to better support asset condition determinations***

Response:

Management agrees with the finding. Through the implementation of EAM, the MTA will enhance the quality of information readily available about its assets including useful life determination, inspection and maintenance history, capital investment history, and other operating information that will help determine criticality. Such information will also enhance succession planning and knowledge planning for the MTA, as data will be more transparent and understandable for all employees. This information will help improve condition rating assessments as well as guide capital investment strategies, both of which will be updated in the next planning cycle for the 2025-2044 Twenty Year Needs Assessment. Further, the MTA agrees that the terms State of Good Repair (SGR), Normal Replacement (NR) and System Improvement (SI) need refinement and will update the definitions for these terms for the 2025-2044 Twenty Year Needs Assessment and the 2025-2029 Capital Plan.

Finding 5: ***MTA has yet to realize significant MTA level capital planning benefits from EAM.***

Response:

Management agrees with the finding. Enterprise Asset Management, which is the process of managing the lifecycle of physical assets to maximize their use and improve quality and efficiency, is underway at the MTA and being re-baselined to coordinate with the implementation of Transformation. Core components of the program are new information systems and a standard asset hierarchy and classification structure that is being accelerated for completion within two years--both as part of Transformation and to support the next capital planning cycle for the 2025-29 capital plan.

The MTA is centralizing the EAM function under the Office of Central Engineering, which will be responsible for whole life cycle management of assets, asset modelling and analytics to inform asset management strategies and reporting on asset performance.

The MTA will develop a detailed EAM-Information Systems master plan and project schedule and will continue to seek early opportunities to demonstrate the value of EAM. As EAM becomes available for project planning and prioritization, the MTA will use EAM data to advance the program.

Finding 6: ***MTA's largely manual TYN and Five-Year Plan processes and disparate data platforms make it difficult for the MTA and agencies to assess priorities, backlogs, and alternative scenarios***

Response:

Management agrees. The complex inventories and condition assessments that the MTA has used in its capital planning processes have met the FTA's Transit Assessment Management requirements. But as technology continues to evolve and offer more sophisticated solutions, the MTA is incorporating new, leading-edge tools to improve our capital planning processes.

- The MTA expects to make its State of Good Repair (SGR) database decision support tool--which will assist in capital planning by helping to prioritize projects based on objective criteria--operational and available for agency use by the end of 2020. As this is the MTA's initial entrance in this form of capital planning, future uses may evolve from this experience.
- This Decision Support Tool will allow the MTA to run scenarios on the potential impacts of various parameters on asset investment and State of Good Repair (SGR) backlog. Parameters could be adjusted to help indicate optimal funding levels and to portray for decision-makers long-term trends. Lastly, the new Decision Support Tool will allow the MTA to develop data-driven five-year plans in the future by illustrating the connection between asset condition inventory and investment.

Finding 7: ***The MTA can improve transparency of performance measures and dashboarding to more closely monitor Five Year plan and project outcomes.***

Response:

The MTA agrees on the importance of providing performance indicators that summarize our progress against the five-year capital plan. The MTA has a variety of mechanisms for reporting on capital projects and is currently working on both short-term and long-term improvements to our Capital Program Dashboard, which is currently updated quarterly and can be utilized to generate written reports to stakeholders and the public.

- The MTA will develop a new set of metrics that is easier to understand to report on the capital program both project by project and at the macro-level. We will be building on the MTA's current project tracker to make it more comprehensive (include more projects), consistent (the project descriptions today vary in structure and level of detail), updated (several of the pages there are outdated) and user friendly These metrics will be appropriate to the project and program life-cycle, helping stakeholders understand the program and project development and implementation.
- Improvements in project tracking include the mapping of all capital projects on a GIS map that allows for interactive queries of capital work that fosters better understanding of capital project delivery plans from both the customer and MTA perspectives.

Finding 8: ***There are some limitations in MTA capital planning review and approval processes.***

Response:

As a public authority, the MTA is subject to a number of review processes, including capital programs that must be approved by the MTA Board and the New York State Capital Program Review Board. In addition, the MTA engages in extensive discussions with local elected officials, community members, advocacy and business group representatives about the region's transit priorities in developing the proposed 2020-2024 Capital Program. NYCT's Fast Forward plan, Metro-North's Way Ahead plan, and LIRR's Forward plan—all released in 2018—included extensive public engagement, and provided the material basis for the proposed 2020-2024 Capital Program released in 2019. The MTA agrees there could be improvements to this process.

- The MTA is now required under a recent revision to the Public Authorities Law to submit to the NY State Capital Program Review Board a Twenty-Year Needs for 2025-2044 for review on or before October 1, 2023. The MTA will ensure that this deadline is met.
- Streamlining the project nomination cycle policy will be easier as the MTA unifies the development of its five-year plans. The new requirement that the TYN be submitted 12 months ahead of the five-year plan will also allow for the timely development, submittal and incorporation of bundles of projects into the capital plan with delineation of strategies and benefits. It is anticipated that this will smooth out the plan development and project nomination process for the MTA's 2025-2029 Five Year Capital Plan.
- The MTA will continue to engage with external stakeholders, solicit their input for project strategies and prioritization, and continue efforts to make documents available to the public in advance of Board meetings to allow for more effective public comment.

Finding 9: ***MTA and agencies do not have comprehensive and fully documented capital planning policies and procedures***

Response:

We agree that there is room for improvement in terms of breadth and ensuring policies and procedures are comprehensive yet easy to follow. The consolidation of the MTA's capital planning functions into the new Construction & Development unit provides an unprecedented opportunity to completely redefine business processes and documentation.

- As examples, the MTA is now developing new standards and processes for planning studies; standardizing the approach and requirements for the documents needed to get projects contracted out; defining different design-build paths for different projects; improving tracking systems to monitor project schedules and budgets; and developing new procedures for coordinating outages.

1. Audit Background

In this section, we describe the MTA organization and operations.

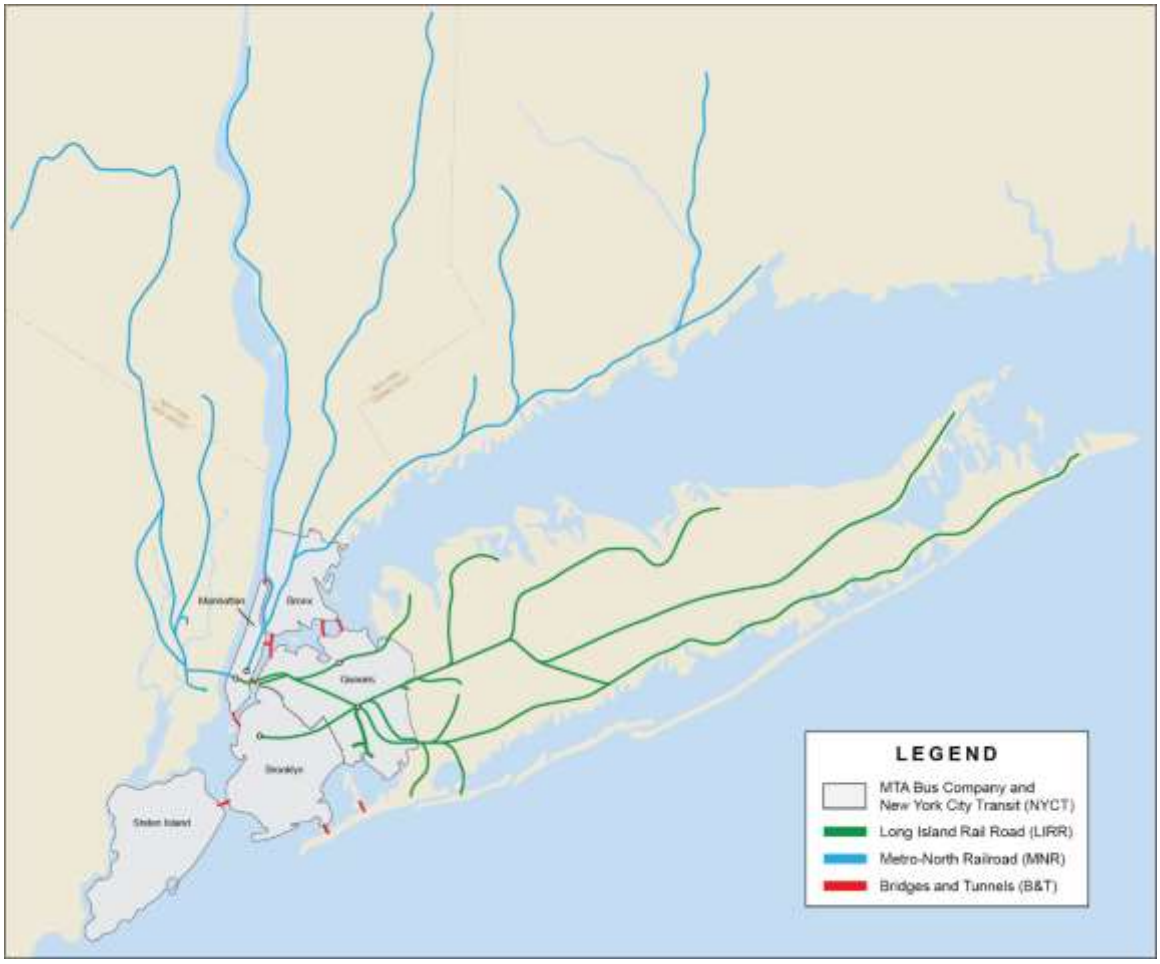
a. MTA Organization

The Metropolitan Transportation Authority (MTA) is a public benefit corporation originally chartered by the New York State Legislature in 1965. The MTA includes the following six (6) agencies:

1. *Bridges and Tunnels (B&T)*
2. *Capital Construction (CC)*
3. *Long Island Rail Road (LIRR)*
4. *Metro-North Railroad (MNR)*
5. *MTA Bus Company*
6. *New York City Transit (NYCT).*

Exhibit 4 provides a map of MTA service areas.

Exhibit 4
MTA Service Area Map



i. Operations Overview

The MTA is the largest transit agency in North America. MTA has the following characteristics:

- 2.6 billion annual riders (subways, buses and railroad)
- 8.6 million daily (weekday) riders
- 280 million vehicles use bridges/tunnels each year
- 5,000 square mile area served
- 24/7 operations
- Multi-agency authority.

Exhibit 5 provides a profile of each agency within the MTA.

Exhibit 5
MTA Agency Profile

Agency	Services	Scale	Scope
1. Bridges and Tunnels	Bridges and tunnels	• 7 tolled bridges • 2 tunnels	Largest bridge and tunnel authority in country
2. Capital Construction	Construction management	• 5 mega projects (as described in Appendix G)	Manage the MTA's major capital projects (“mega projects”)
3. Long Island Rail Road (LIRR)	Commuter rail	• 740 daily trains • 689 track miles • 124 stations • 11 branches • 1,185 rail cars	Largest and oldest commuter railroad in North America
4. Metro-North Railroad (MNR)	Commuter rail	• 800 track miles • 124 stations • 1,288 rolling stock units	Five active lines serving both New York and Connecticut. Third busiest commuter railroad in North America
5. MTA Bus Company	Bus	• 1,300 buses • 80 routes • 8 depots	Combined with bus service by NYCT, largest bus fleet in the nation
6. New York City Transit (NYCT)	Subway, bus and rail service	• 6,529 subway cars • 700 track miles • 26 subway lines • 493 stations • 4,428 buses over 230 routes	Busiest subway system in North America

ii. Current Governance and Oversight

The MTA is governed/overseen by the following groups, each of which is described in this subsection:

- MTA Board of Directors
- Capital Program Oversight Committee (CPOC)
- Capital Program Review Board (CPRB)
- Independent Engineering Consultant (IEC).

MTA Board of Directors

The MTA is governed by a 17-member MTA Board (Board), all of which are confirmed by the New York State Senate. The makeup of the Board is as follows:

- 4 members nominated by the Governor
- 4 members recommended by the New York City mayor
- 1 member recommended by each of the following 7 county executives:
  - Dutchess
  - Suffolk
  - Nassau
  - Orange
  - Putnam
  - Rockland
  - Westchester.
- 8 non-voting members.

Capital Program Oversight Committee

The Capital Program Oversight Committee (CPOC), comprised of members of the MTA Board meets monthly (with the exception of August). CPOC oversees all aspects of the MTA's capital program. CPOC reviews the Traffic Light Report which measures project changes by quarter. CPOC regularly reviews reports including the MTA Capital Program Commitments & Completions report and the Status of MTA Capital Funding report. CPOC also receives project status reports on mega projects and other important MTA initiatives.

Capital Program Review Board

The Capital Program Review Board (CPRB) reviews and must approve the MTA Capital Program for the five agencies other than Bridges and Tunnels which is self-funded.[5] The Board must approve bond resolutions associated with the Capital Program and amendments to the Capital Program. The CPRB is composed of four (4) voting members including one representative from each of the following:

- Governor's Office
- Senate Majority Leader
- Speaker of the Assembly
- Mayor of New York City (voting for only New York City portion).

There also are two non-voting appointees including:

- One senate member
- One assembly member.

In addition to MTA Board approval, Capital Plan amendments require CPRB approval if:

- An element budget changes by more than 10 percent from the last CPRB-approved level, or
- A material change occurs in the description of an element of the approved Capital Plan.

Independent Engineering Consultant (IEC)

An Independent Engineering Consultant (IEC) provides monitoring and oversight of MTA capital projects. The MTA's Office of Construction Oversight (OCO) manages the IEC. The IEC provides advice on issues affecting capital projects.

[5] B&T is entirely funded by tolls.

iii. Future Recommended Structure

The 2019-20 New York State Budget resulted in significant changes to the MTA intended to transform the organization. The MTA is required to institute the following major reforms:

- Develop a reorganization plan by June 2019
- Undergo an independent audit and efficiency review
- Increase the competitive procurement threshold from $100,000 to $1 million
- Require public reporting of performance metrics
- Allow MTA to debar contractors that exceed 10% of the project cost or time on a capital construction project
- Require use of design-build for capital projects with costs in excess of $25M.

The MTA engaged Alix Partners to develop recommendations for changes and they completed a report on July 31, 2019. Key Alix Partners recommendations related to the Capital Program include:

- Implement reorganization strategy
- Develop use of project CEOs
- Adopt more appealing contracting terms, including greater risk sharing, and more performance-based incentives
- Add robust project-based cost forecasting
- Shorten change order processing times
- Create a new Major Construction Review Unit (MCRU) required pursuant to PAL 1279-g.

b. Audit of MTA's Capital Program

In this subsection, we describe the guiding legislation that prompted this audit, the MTA's solicitation for services and Crowe's approach to complete the work. The remainder of this subsection is organized as follows:

i. Section 1279-f
ii. MTA Forensic Audit Solicitation

i. Section 1279-f

Section 1279-f of the Public Authorities Law (see **Appendix A**) requires the MTA to conduct an independent forensic audit of the MTA's capital planning process. Specific language is provided below:

> *As required by Section 1279-f of New York Public Authorities Law: The MTA "shall contract with a certified public accounting firm for the provision of an independent, comprehensive, forensic audit of the authority. Such audit shall be performed in accordance with generally accepted government auditing standards. Such audit shall include, but is not limited to a complete and thorough examination and detailed accounting of the authority's capital elements, broken down by agency, including, but not limited to: rolling stock and omnibuses, passenger stations, track, line equipment, line structures, signals and communications, power equipment and substations, shops, yards, maintenance facilities, depots and terminals, service vehicles, security systems, electrification extensions, and unspecified, miscellaneous and emergency.*
>
> *The authority shall also contract with a financial advisory firm with a national practice for the provisions of a review of: (a) any fraud, waste, abuse, or conflicts of interest occurring within any department, division, or office of the authority, its subsidiaries, affiliates, and subsidiaries*

of affiliates; (b) any duplication of functions or duties between the departments, divisions or office of the authority, its subsidiaries, affiliates, and subsidiaries of affiliates; (c) options for potential cost efficiencies and savings that could be achieved through changes in internal controls and management reforms, functional and process streamlining, internal procurement process reforms; (d) the two thousand fifteen to two thousand nineteen capital plan for cost overages and duplication; (e) the development of standardized performance metrics for planning, design, approvals, change orders, project management and delivery; and (f) cash flow and accounting of expenditures of the authority, its subsidiaries, affiliates, and subsidiaries of affiliates for the preceding three fiscal years."

ii. MTA's Forensic Audit Solicitation

On April 29, 2019, the MTA issued a solicitation titled Work Assignment on Capital Planning Process Review (Solicitation 15475). The MTA requested proposals for a review of its capital program development process leading to the five-year capital plan (the 5YP) as well as a review of the preliminary mix of projects in the 5YP and initial project estimates as they become available. Below are the key tasks and required deliverables for this project:

1. As per §1279-f of the NY State Public Authorities Law, review and confirm the quality of existing inventory and condition assessment datasets and their ability to support the SGR analyses and investment strategies; MTA will recommend the minimum number of physical observations the proposer must complete and suggest a variety of categories of assets from which such observations might best be performed including but not limited to the following categories: rolling stock, buses, passenger stations, track, line equipment, line structures, signals and communications, power equipment, substations, shops, yards, depots, etc.; the Proposer should inspect its selected categories and assets and determine, based on a representative sampling, if (a) the asset's condition is accurately documented and (b) if the asset's present condition warrants the need for replacement;
2. Review the 2015-2019 Capital Plan for cost overages and duplication including a sampling of projects from the program based on a review of the MTA's Capital Program Dashboard or other such available reporting tools;
3. Provide a summary of what industry best practices are for development of a multi-year transit authority capital program through either a literature search, peer review exercise or a survey, or consultant knowledge of best practices in the transit industry;
4. Review the appropriate sections of the NY State Public Authority Law (1269(b)) applicable to the MTA, its Agencies, and its capital planning;
5. Review the last Twenty-Year Needs Assessment (2015-2034) document and the instructions provided to the Agencies for the current TYN;
6. Inquire with key members of MTA management, as defined by the MTA, to understand the needs of the system;
7. Review the Twenty-Year Needs document and material for 2020-2039 including investment strategies, project mix and cost estimates; Proposer will test inputs used by MTA management, including estimates and assumptions, in developing the Twenty-Year Needs document; MTA management will provide the proposer with the benchmark(s) the proposer is to use when comparing estimates and assumptions;
8. Review the scope for State of Good Repair Decision Support tool, its development and intended use including discussions with the MTA project manager and perhaps its consultant;
9. Review of the FTA Transit Asset Management (TAM) requirements and the MTA's TAM Plan as submitted in October 2018 and any updates;
10. Review MTA's progress in modernizing its asset management practices for their future utilization in the development of the Twenty-Year Needs Assessments and Five-Year Capital Plans;

11. Review the instructions for the 2020-2024 Capital Plan provided to the Agencies as guidance for the development of the 5YP;
12. Review and confirm the initial mix of projects proposed by agencies for the 2020-2024 Five-Year Plan along with the associated estimates on an agency by agency basis as they become available or, if not available, at the agency Twenty-Year Needs level of detail;
13. Interview relevant MTA HQ (e.g. Capital Program Management, Capital Funding Management, Office of Construction Oversight, Enterprise Asset Management Office) and agency staff (Capital Planning and Budget staff) on the development process for the capital plan including but not limited to instructions, funding limits, cost estimates, development of master plans, and scope efforts, scheduling projects for access to the Right of Way, development of a TYN and 5YP book, etc.;
14. Draft a report and PowerPoint presentation comparing the development process for the MTA's Five-Year Plan to legal requirements and industry best practices, and validate the project cost estimates developed through an examination of a sampling of projects and submit the draft report and presentation for review and comment by MTA HQ executive staff;
15. Draft an interim report due to the MTA no later than September 1, 2019; and
16. Finalize the report and presentation incorporating any comments or corrections from the MTA and publish a final report on or before January 1, 2020.

Solicitation 15475 was developed based on MTA's interpretation of the PAL requirements. Crowe responded to the solicitation requirements listed above and proposed the use of Performance Audit Standards found in Generally Accepted Government Auditing Standards (GAGAS). MTA agreed that the use of GAGAS Performance Auditing Standards as the appropriate approach to meet the audit requirements of the PAL.

c. MTA Capital Planning Process

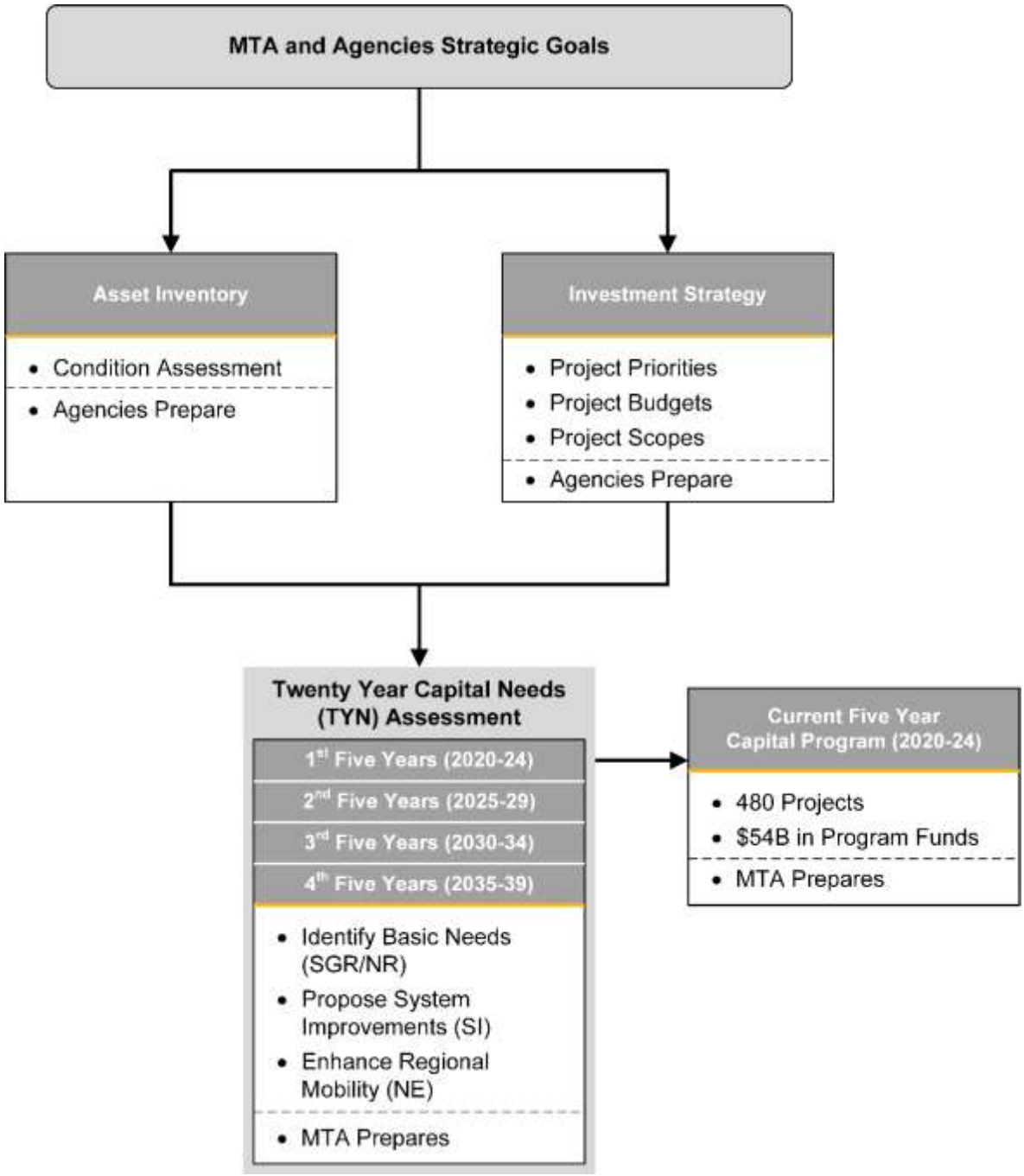
We provide an overview of the MTA capital planning process in **Exhibit 6.**

i. Roles and Responsibilities

MTA and agency personnel involved in capital planning include:

- Board
- CPOC
- CPRB
- Chairman, CEO
- General Counsel
- Chief Financial Officer
- Chief Development Officer, President of MTA Capital Construction
- Deputy Chief Financial Officer
- Director of Capital Program Management
- Director of Capital Program Funding
- Director of Office of Construction Oversight
- Several contacts for each agency (identified in Appendix D).

Exhibit 6
MTA Capital Planning Processes[6]



[6] There are 964 projects using the MTA's detailed ACEP structure. There are 460 projects in the "rolled up" ACEP structure and these which are presented in the 2020-24 Five Year Plan.

ii. Policies and Procedures

Twenty-Year Needs Process and Five-Year Capital Program Instructions

The MTA has developed instructions for agencies to use in completing both the TYN and 5YP. These documents identify schedule, data and documentation requirements.

Asset Management

The MTA and agencies have some asset management policies and procedures. Some of these relate to treatment of fixed assets, asset capitalization, and disposal of property.

Gates Project Review Process

All projects are subject to Gates reviews at four critical milestones: (1) during scoping (preliminary engineering), (2) final design, (3) construction, and (4) completion. At each Gate, the MTA/agency reviews project scope and status to determine whether the project continues to be aligned with business priorities, represents the lowest lifecycle cost solution, and will provide the intended benefits. Only if the project clears the Gate will the MTA/agency release funding for the project to move to the next Gate.

Design-Build Guidelines

The MTA has developed a Design-Build Best Practices Guidance (October 2016) to assist agencies with developing procedures for use of Design-Build project delivery. Contents of these guidelines include strategies, process requirements, and roles.

iii. Planning Documents

1. Twenty-Year Needs Capital Assessment (TYN)

The TYN is a planning effort completed by the MTA. The TYN provides an MTA-wide view of investments required to maintain assets in a State of Good Repair (SGR) as well to expand and enhance the MTA system via investments in System Improvements (SI).

The MTA completes the TYN process every Five-Years. MTA provides written instructions to each agency that describes the TYN process, schedule, and documentation requirements. Each agency provides the MTA with two inputs to the TYN (as Microsoft Excel workbooks):

- Asset Inventory Condition Assessment tables (AICA Tables), and
- Investment Strategies.

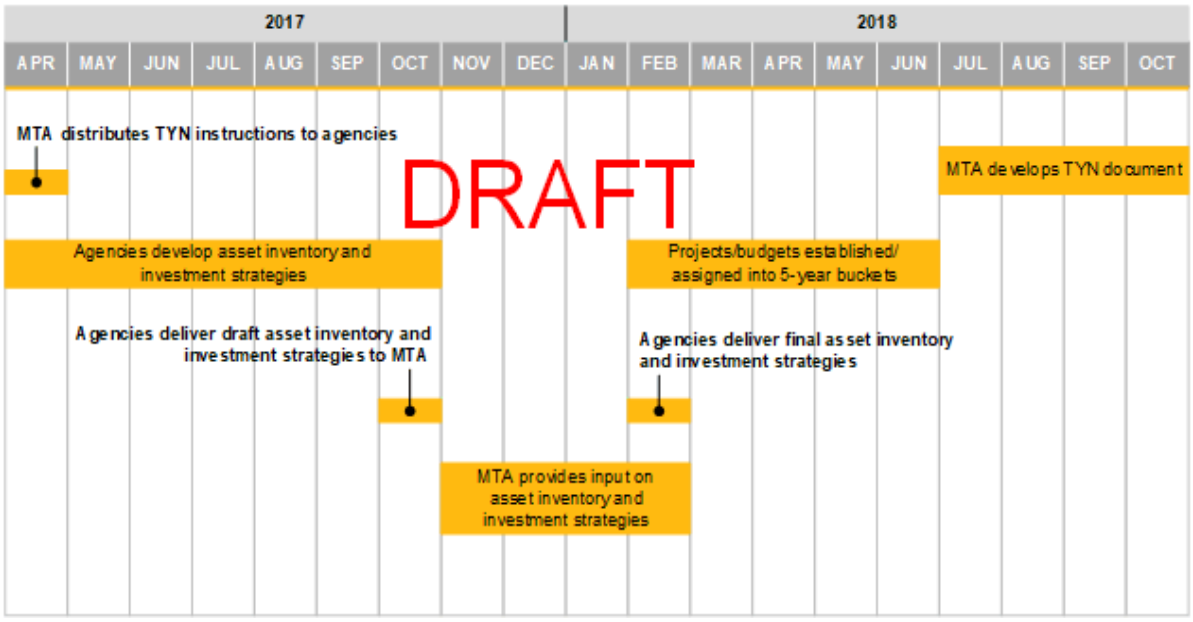
AICA Tables specify the state of agency assets and the Investment Strategies indicate investment priorities, at a project level, based on the condition of the asset inventory. The TYN is delineated into four five-year segments, the first of which becomes the basis for the 5-Year Capital Plan. The MTA HQ Capital Planning team will review the Investment Strategies against the AICA Tables to assess whether the planned investments across the four segments are in line with documented asset conditions.

The TYN represents a constrained view of capital needs (i.e., needs are greater than presented). Constraints include:

- Availability of resources
- Capacity to schedule work and maintain service
- Funding limitations
- Market for consulting/contracting.

Appendix B provides a process flow diagram for the TYN. **Exhibit 7** shows the most recent MTA TYN schedule as established in the initial memorandum.

Exhibit 7
2020-39 Draft TYN Schedule



Up until now the MTA has never had a legal requirement to complete or release a Twenty-Year needs assessment document. With recent legislation (NYS Public Authorities Law section 1269-c, April 2019), the MTA is now required to send a new report covering the years 2025-2044 to the State at the end of 2023 for the 2025-29 Capital Plan.

As part of the development of the MTA's current Five-Year capital plan, agencies updated their condition assessments for critical assets, determined the relative state of good repair for those assets, estimated remaining asset useful lives, and reviewed asset replacement cycles over the next 20 years. These steps represent the technical part of the 20 year needs process.

Rather than include this information in the traditional TYN report, the MTA is in the process of working to make the next TYN assessment report a more strategic document that better depicts how it makes investment decisions, how projects are put together and prioritized over the 20 year period, and the ramifications of not investing in certain areas or assets over certain time periods.

As described in Section 1 iii., the MTA is undertaking a transformational reorganization through which the MTA will change capital program planning and delivery, identify new perspectives, and rethink how the MTA develops and determines long term capital needs. For these reasons, the MTA is delaying publishing a TYN report.

Condition Assessments

In developing the AICA Tables, each agency performs condition assessments for all of its assets. An agency does not assess all of its assets at the same frequency. Agencies assess some assets (e.g., stations) every Five-Years as a specific input to develop the AICA Tables. Agencies assess other assets (e.g., substations) as often as daily based on the criticality of the asset. Additionally, some assets are subject to State or Federal requirements that define specific inspection frequencies (e.g., bridges, every two years). Regardless of asset type or the inspection frequency, assessments generally include the following condition attributes:

- Age
- Condition (based on the MTA's 1 to 4 rating detailed in **Exhibit 8**)

- Location
- Performance
- Reliability
- Safety.

Exhibit 8
MTA Condition Ratings

Rating	Asset Description
1	Modernized. Considered to meet most or all important technical and functional standards. Will not require normal replacement investment in the next Five-Years.
2	Acceptable. While not meeting all modern technical and functional standards, considered adequate for service and expected to experience normal stoppages that can be fully accommodated within the existing maintenance framework over the next Five-Years. Will not require normal replacement investment in the next Five-Years.
3	Deficient. Functional deficiencies and/or can be expected to experience above-normal stoppages over the next Five-Years, but the severity of customer impacts can be held within acceptable bounds for a time within the existing maintenance framework capital investment can be deferred, but at a price of added maintenance and operating expense, and possibly some non-critical reduction of service standards.
4	Deteriorated. Operable with extraordinary maintenance, but with serious functional deficiencies and/or can be expected to experience potentially unacceptable stoppages over the next Five-Years, which would have serious negative impacts on service within the existing maintenance framework (force, budgets, programs). Capital investment is needed on a priority basis.

Investment Strategies

Investment strategies include proposed projects. Investment strategy content includes:

- Agency
- Base year
- Asset category
- Asset class
- Investment description
- Investment type
- Investment level
- Needs category (described in **Exhibit 9**)
- Number of units (affected/acquired/retired)
- Cost.

Exhibit 9
MTA Needs Categories

Asset Type	Description
Network Expansion (NE)	Expand to support growth needs. Includes investments in new routes and grid fill-in intended to carry more passengers, reduce reliance on automobile and support the economic vitality of the region.
Normal Replacement (NR)	Investments needed to maintain reliability of assets already in SGR.
State of Good Repair (SGR)	Investments for ongoing needs of system to maintain a state of good repair.
System Improvement (SI)	Improve existing network. Improve service delivery and quality of passenger environment within the system.

2. 5-Year Capital Plan (5YP)

In 1982 the New York State Legislature required that the MTA prepare five-year capital plans to rebuild and improve the transit system. The MTA prepares the 5YP every Five-Years. The 5YP process immediately follows the TYN and focuses on the first Five-Years of the TYN. The Five-Year Capital Plan provides a list of projects planned for each agency. Appendix B provides a process flow diagram for the Five-Year Capital Plan. **Exhibit 10** shows the most recent MTA FYP schedule. **Exhibit 11** shows FYP funding levels since 1982. **Exhibit 12** provides the 2020-24 FYP budget and number of projects.

Exhibit 10
2020-24 Planned Five-Year Plan Schedule

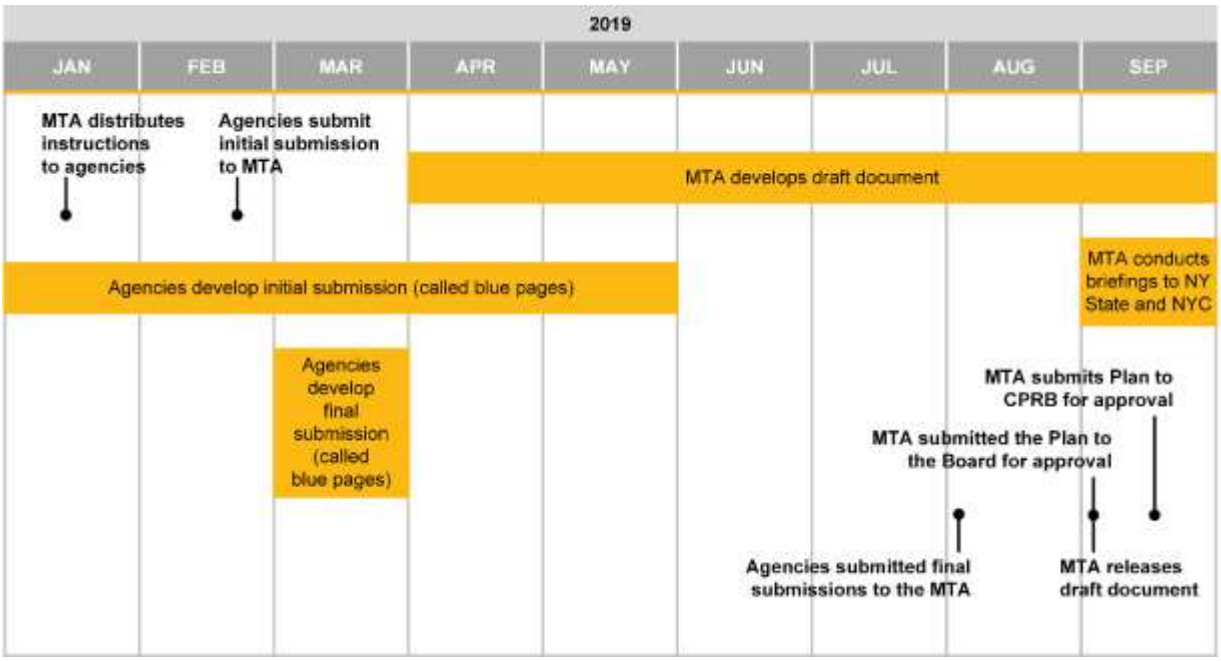


Exhibit 11
MTA Historic Five-Year Capital Plan Budgets

Period	Budget Amount
1982 through 2004	$55.2B
2005-09	$24.4B
2010-14	$31.6B
2015-19	$33.3B
Total	$144.5B

Exhibit 12
2020-24 Five-Year Plan
Planned Cost and Projects, by Agency
($ in billions)

Agency	Project Costs	Number of Projects (ACEPs)[7]
New York City Transit (NYCT)	$35,389	155
Bridges and Tunnels	3,327	75
Long Island Rail Road (LIRR)	3,737	83
Metro-North Railroad (MNR)	3,558	71
MTA Capital Construction	7,798	70
MTA Bus	871	14
MTA Interagency	119	12
Total	$54,799	480

Each Capital Plan is divided into project IDs called ACEPs, which is an acronym for Agency, Category, Element, and Project. The dashboard compares each ACEP's budget in the Capital Plan to its budget in the MTA's capital budget system as it appears at the end of the quarter.

MTA may amend the Five-Year Capital Plan for:

- Changes in project costs; or new project estimates
- Changes in project schedules
- Changes in funding sources/amounts
- Changes in plan scope; or new unforeseen project needs.

Following approval by the MTA Board, the Capital Plan is submitted to the CPRB for approval. The 2020-24 Capital Plan was presented to the MTA Board on September 25, 2019 and unanimously approved. As of this writing the 2020-24 Five-Year Capital Plan is awaiting review and approval by the CPRB.

Though not specifically required, the Five-Year Capital Plan is generally amended annually. The MTA Board must approve amendments. CPRB must approve amendments if the element budget changes by 10 percent from the prior CPRB-approved amount or there is a material change in the description of an element in the approved plan.

[7] Number of projects in the rolled up ACEP structure. Corresponds to 964 projects in the detailed ACEP structure.

3. Transit Asset Management (TAM) Plan

The FTA requires transit agencies to prepare a TAM. On July 26, 2016, the FTA issued its TAM Final Rule, requiring FTA grantees to:

- Develop a TAM plan, including asset inventories, asset condition assessments, and investment prioritizations by October 2018 and update every four years thereafter
- Expand annual National Transit Database (NTD) reporting requirements on capital assets
- Set and report progress toward state of good repair (SGR) performance targets.

The MTA completed its current TAM on October 1, 2018. The MTA TAM covers the January 1, 2019 to December 31, 2039 period.

iii. Primary Information Systems Used for Capital Planning

Asset Management systems used to support each agency's capital planning processes are currently decentralized and vary by agencies and within asset classes. Agencies extract data from these systems for capital planning purposes. The complete list of asset management systems used by MTA agencies is provided in **Exhibit 13.**

There are two primary program management tools that MTA uses for capital planning as follows:

- Project Status Reporting System (PSR) – a reporting and capital budget tool used to support capital program management. MTA uses it to control and record budget, expenditure, schedule, funding, and narrative data.
- Integrated Management of Payment Accounting and Capital Tracking (IMPACT) – a financial application that the MTA and agencies use to define, budget, fund, track, and requisition capital projects.

Additionally, the MTA reports progress on Capital Programs using the Capital Program Dashboard (Dashboard). This Dashboard provides project budgets, schedules and scope. The Dashboard is updated quarterly and provides progress on the MTA's five-year Capital Plans, starting with selected projects in the 2005-2009 Capital Plan, and includes nearly all projects in the 2010-2014 and 2015-2019 Capital Plans.

Exhibit 13
MTA Agency
Information Systems

Agency	System Name	Description
New York City Transit	Infor Spear maintenance management information system	Used by MTA New York City Transit Department of Buses and MTA Bus to manage the maintenance activities on the bus fleet, the non-revenue support fleet and certain classes of support equipment.
	MP2 Enterprise Version 6.1 SQL Server Edition & 7i	CMMS systems generate and track work orders for all maintainable facility assets. The systems record labor hours for all scheduled and unscheduled work performed on equipment. The systems serve as a live equipment database for NYCT-DOB and MTA-Bus Facilities assets.
	Spear-Rolling Stock Maintenance Information System (RSMIS)	Maintenance Management System for Revenue Railcar Fleet
	Work Order for Non-Revenue NR Cars (AS400)	Maintenance Management System for non-revenue railcar fleet
	MP2 Computerized Maintenance Management System (CMMS)	Maintenance and Inspection Schedules for facilities
	Infor EAM	Enterprise Asset Management System currently being implemented for Subways. The current implementation status by division as of 9/27/19: is as follows • *Track* – Switch and Bridge Clip Inspections • *Signals* – All trouble calls, maintenance/testing/inspections for two subdivisions *Infrastructure* - Defect mgmt./corrective maintenance for subway and elevated line structures, Drain inspections • *E&E* – Inspections and corrective maintenance work stations – Includes most inspections and all corrective maintenance.
	Remedy	Asset Management system for communications assets
	AFC Maintenance Management System	Maintenance management information system used to manage the maintenance activities for Fare Collection Equipment
	Spear-AFCRAIL	Maintenance management information system used to manage the maintenance activities for station fare collection equipment
	Drawing Real-time Access Website - DRAW	Maintenance management and visualization system for various MOW drawings, inspections for signals, structures, power, track, and stations
	EERMS	Elevator and escalators remote condition monitoring system
	LIFT-NET	A dial-up Ethernet system to monitor availability and response time to down elevator/escalators in passenger stations
	VIADUCT – NYCT / SIDE - NYCT / SIDS - NYCT	Viaduct/elevated structure and subway structure inspection information systems

Agency	System Name	Description
	Track Geometry Car (TGC) / Quadrennial Track & Switch Condition Surveys Databases	Automated TGC track inspection system using various on-board tech/inventory condition measurements, and condition ratings.
	Integrated Signals Equipment Information System (ISEIS)	Maintenance management system for signal equipment that holds inventory, preventative maintenance tasks, records, defects, and delay data
	Spear-IRIS	System for managing track defects
	MOW Power Maintenance Access Database	Inventory and work orders
Long Island Rail Road	IBM Maximo	Maximo system used to manage rolling stock, stations, and line structure assets
	Microsoft Excel	Excel data sheets used to maintain AICA tables (primarily used for facilities, track, communications, shops, and power assets)
	Infor EAM	Will use as centralized system to manage asset inventory data
Metro-North Railroad	Asset Management System (AMS)	AMS is a maintenance management tracking system used by Maintenance of Equipment Department (MOE) to create, track, and manage activities (e.g., work orders (covering labor and maintenance) and scheduling). MOE looks at patterns in AMS historical data to assess failure rates and trends and undertakes analysis and corrective action. This analysis also serves as an input to the Rail Fleet Management Plan and to the Twenty-Year Needs Assessment
	Track Information Systems	Multiple tools used to continually assess the current state of track in order to inform capital and maintenance decisions.
	RailAdvise	A bridge management system used to capture a variety of inventory, and load and condition data on structures throughout the system, including undergrade bridges and culverts, overhead bridges, tunnels and viaducts, and other structures such as rock cuts and retaining walls.
	Infor EAM	Data collected includes inspection of switches, interlockings and grade crossings, with additional assets planned to be added in the future
	Power Department Inspection Maintenance Management System	Provides inspection checklists, records of inspections due, and the dates that inspections are performed. Used to inform both maintenance and repair activities as well as capital planning efforts as part of the Twenty-Year Needs Assessment
Bridges & Tunnels	ScanPrint by Sixense	A bridge inspection system to capture element conditions and generate required mandated reporting with NYS and Federal agencies.
	Access Database	A database that holds inspection data for all nine TBTA facilities
	Infor EAM	Used as work order system and inventory repository. In the future it will be synced with other systems to capture whole life costing and asset lifecycle

2. Performance Audit Objectives and Methodology

a. Crowe Objectives and Approach

Crowe developed a detailed workplan to align with the requirements included above. We had seven (7) audit objectives:

1. Determine whether asset conditions are accurately documented.
2. Determine whether MTA's condition assessment of current assets warrants the need for replacement and is based on condition standards provided by the MTA.
3. Determine whether MTA's comprehensive policies and procedures are properly designed and implemented for preparation of the Five-Year Capital Plan.
4. Determine whether the Five-Year Capital Plan complies with applicable laws, rules, regulations, and ordinances, as designated by the MTA and/or Public Authorities Law.
5. Determine whether MTA capital planning processes are consistent with industry leading practices using a sample of peer organizations as agreed by MTA.
6. Determine whether the mix of investments and cost ranges included in the 2020-24 Five-Year Capital Plan are based on the Twenty-Year Needs conditions and investment strategies.
7. Determine whether cost overages and/or duplication of projects occurred in projects related to the 2015-19 Capital Plan and assess whether cost overages and duplications are evaluated and documented by MTA.

In **Appendix C,** we describe our approach to meet these objectives as well as show how these objectives align with the MTA's scope of work. In **Exhibit 14,** we provide our project schedule.

Exhibit 14
Crowe Audit Schedule

Date	Description of Activity
6/19/19 to 8/19/19	Complete interviews with headquarters and agency staff to review the processes in place and documentation for the capital program
9/6/19	Complete benchmarking analysis
9/13/19	Complete initial physical observations of assets
9/13/19	Complete review of 2015-2019 Program
9/15/19	Complete review of AlixPartners report and its impact on the audit
9/30/19	Interim draft results report provided to MTA management
10/18/19	Complete additional physical observation of assets and review of 2020-2024 Five-Year Capital Plan, Twenty-Year Needs Assessment and TAM
11/15/19	Provide Draft Report to MTA Management
12/31/19	Provide Final Audit Report, as required in legislation

b. Government Auditing Standards for Performance Audits

Crowe conducted this audit under the performance auditing standards appearing within Chapters 6 and 7 of the Generally Accepted Government Auditing Standards (GAGAS, 2011 version). Crowe conducted this engagement to comply with general, field work and reporting standards for performance audits.

Performance audit standards permitted Crowe to meet the applicable audit objectives as prescribed by the MTA and the State legislature within the MTA's statement of work (SOW) and authorizing legislation (PAL 1279-f).

The PAL included language for a forensic audit to be performed in accordance with GAGAS. MTA and Crowe agreed that the use of Performance Auditing Standards was applicable to meet the requirements of the PAL as forensic auditing is not addressed in GAGAS. In conducting the audit in accordance with Performance Auditing Standards, Crowe assessed the risk of fraud significant to the context of the audit objectives and considered incentives, pressures and the opportunity to commit fraud related to the capital planning process in the development of the audit plan and procedures.

i. Internal Control

GAGAS required that we obtain an understanding of MTA's internal controls over capital planning. As a result, we included within our audit program, a plan to obtain this understanding through inquiries and interviews with the MTA and agencies narrowed in scope to controls over capital plan development and monitoring processes, physical asset management, change order processes, and information systems as well as through reviews of previously completed audits related to the capital planning processes. In addition, we requested documentation to support whether significant controls, identified by Crowe through our interviews and reviews of MTA and agency policies and procedures, were implemented and placed in operation. For instances where we noted an issue regarding compliance or reporting, we made an effort to understand the cause of the error, which may include additional targeted reviews of controls in place over the applicable process and related compliance area.

ii. Follow-Up on Prior Findings

Crowe performed a review of previous findings pertaining to the MTA's capital planning program. Crowe evaluated whether MTA has taken appropriate corrective action to address findings and recommendations from previous audits that were deemed significant to the audit objectives. We inquired of MTA and agency management to identify related audits directly related to the objectives of this audit and obtained information from MTA and agency management regarding the status of implementation of audit recommendations by management. We used this information in assessing risk and to determine the nature, timing and extent of the audit procedures.

Through inquiries of MTA management eight (8) audit reports pertaining to the MTA's capital planning process were identified. The audits identified included audits performed by the Internal Audit Department of the MTA, the MTA Office of Inspector General and the New York State Comptroller's Office within the past 5 years. Within those audits there were over 60 audit recommendations with some pertinence to the MTA's capital planning process. MTA or agency management provided an update on the status of corrective actions taken by management. Crowe used the applicable audit findings and recommendations to develop audit procedures particular to our audit objectives, but we did not test the implementation of the corrective actions because the audit objectives were confined to the capital planning processes of the MTA. However, during the performance of our audit procedures, Crowe noted certain circumstances similar in nature to the findings and recommendations in the previous audit report. Where such items were noted Crowe commented in Appendix F, Prior Audits Related to MTA's Capital Program.

c. Sampling

Our sampling methodology for this audit was based on guidance in the AICPA's Audit Guide: Government Auditing Standards and Single Audits – Clarified, Chapter 11: Audit Sampling Considerations of Uniform Guidance Compliance Audits.

Sampling is the application of an audit procedure to less than 100 percent of the items within an account

balance or class of transactions for the purpose of evaluating some characteristic of the balance or class. In other words, sampling may provide the auditor an appropriate basis on which to conclude a characteristic of a population based on examining evidence regarding that characteristic from a subset of the population.

Sampling is one of many techniques designed to provide sufficient appropriate audit evidence to support the auditor's conclusion. We often do not solely rely on the results of any single type of procedure to obtain sufficient appropriate evidence on compliance. Rather, our conclusions are based on evidence obtained from several sources and by applying a variety of testing procedures. Auditors combine evidence obtained from the various types of procedures to determine whether there is sufficient appropriate evidence to provide a conclusion regarding performance.

Our sampling methods used a combination of both random and judgmental sampling. Judgmental sampling was utilized to test individually important items. Specifically, we used the judgment and experience in examining a population for risky or unusual transactions that were selected for testing. These individually important items were selected based on our risk assessment and based on the data analytical procedures completed during the audit.

When sampling is used to test transactions, sampling risk exists. Sampling risk represents the risk that the sample is not representative of the population. In other words, that the evaluation of a population based on a sample is different from what it would be if the entire population was tested. When based on a statistically valid sample, our sampling methodology is designed to provide a high level of assurance (90 - 95%) in accordance with the AICPA Audit Guide's guidance on Sampling.

Risk-based Approach

Crowe utilizes a risk-based approach for conducting performance audits. As part of this risk-based approach, we assess risks during the planning phase and re-assess risks throughout the audit. As such, our planning activities included establishing and documenting an overall audit strategy, developing a detailed written plan; and determining the extent of involvement of professionals with specialized skills. Based on the risks identified, we designed and implemented overall responses to address our assessed risks of non-compliance significant to the audit objectives and control deficiencies and we performed audit procedures whose nature, timing, and extent were based on, and are responsive to, the assessed risks.

Crowe used several samples in the performance of our audit procedures. We selected a sample of assets and a separate sample of projects from the 2020-24 Five-Year Plan and a sample of projects with cost overruns from the 2015-19 Five-Year Plan. Additional information about each sample can be found below.

2020-24 Asset Condition Assessment Sample

In its scope of work, MTA required that Crowe conduct physical observations. MTA suggested that these cover a variety of categories of assets from which observations were best performed including but not limited to the following categories: rolling stock, buses, passenger stations, track, line equipment, line structures, signals and communications, power equipment, substations, shops, yards, depots, etc. MTA required us to inspect selected categories of assets and determine, based on representative sampling, if (a) the asset's condition is accurately documented, and (b) if the asset's present condition warrants the need for replacement.

MTA required the sample to include a minimum of 20 physical asset observations for each of the following four (4) agencies: (1) NYC Transit (NYCT), (2) Long Island Rail Road (LIRR), (3) Metro-North Railroad (MNR) and (4) Bridges and Tunnels (B&T). MTA required physical asset observations for assets included in the 2020-24 Five-Year Capital Plan.[8]

[8] These four agencies include over 90 percent of the assets in the inventory and represented over 84 percent of the dollar value of projects proposed in the 2020-24 Five Year Capital Plan; and as a result the MTA determined that assets selected from the agencies were representative of the population.

As part of the 2020-2039 Twenty-Year Needs process, each agency provided a comprehensive inventory of its assets, including the asset condition rating. There was no uniform format each agency used to present each asset within the inventory. The agency determined the level of specificity of its asset inventory based on how it manages the assets. The agency provided the inventory at a component level with the intent of monitoring and maintaining at that component level (e.g., superstructure, substructure, or deck) as opposed to at a more aggregated higher level (e.g., section of bridge).

For purposes of our assessment, we refer to the unit of measure as an asset. After reviewing the asset inventory, and conducting discussions with agency management, we were unable to readily identify from the asset inventories those assets that corresponded to projects proposed in the 2020-24 Five-Year Capital Plan. This deficiency is addressed in Finding 3.

We therefore judgmentally selected a range of projects proposed in the 2020-24 Five-Year Capital Plan, and then matched those projects back to the assets included in an agency's asset inventory. To verify that we had the population of projects included in the 2020-24 Five-Year Capital Plan we obtained the MTA's database of projects included in the 2020-24 Five-Year Capital Plan and confirmed this data set matched the published 2020-24 Five-Year Capital Plan. Projects aligned with the project types presented in **Exhibit 15.**

Our sample size included 107 assets for the four of the six agencies as shown in **Exhibit 16.**[9] For each agency, these assets spanned a range of different asset types. **Exhibit 17** provides additional detail for the sample of assets, noting the assets selected for each asset category.

2020-24 Project Sample

We sampled a total of 48 projects proposed from the 2020-24 Five-Year Capital Plan to assess the basis for inclusion of the project in the plan and the reasonableness of budget estimates. We used a combination of risk-based and random selections from the population of projects included in the 2020-24 Five-Year Capital Plan. The total current budget for these 48 projects amounted to $1.98 billion of the $54 billion budgeted for the 2020-24 Five-Year Capital Plan.

2015-19 Cost Overage Sample

We sampled a total of 42 projects with cost overages included in the 2015-19 Five-Year Capital Plan to assess whether sufficient documentation was available to support the cost overage. We used a combination of risk-based and random selections from the population of projects with overages identified in the MTA Dashboard. The total current budget for these 42 projects amounted to $1.19 billion of the $33 billion budgeted for the 2015-19 Five-Year Capital Plan.

d. Interviews

We conducted a series of interviews with representatives from MTA and agency management and staff involved in the capital planning functions and processes (see list of interviewees in **Appendix D**). These interviews included auditee staff members at the MTA level involved in capital planning, such as those responsible for developing the TYN and 5 Year Capital Plan. We also interviewed management at the NYCT, LIRR, B&T, MNR and MTCC involved in developing inputs to the TYN and 5 Year Capital Plan, including those who develop investment strategies, prepare asset inventories, and conduct asset condition assessments.

[9] As part of our scope, the MTA directed us to select assets for physical inspection from these four of the six agencies.

Exhibit 15
2020-24 Five-Year Plan
Project Types[10]
Organized by Agency

New York City Transit (NYCT)	Bridges and Tunnels	Long Island Rail Road (LIRR)	Metro-North Railroad (MNR)
801 Subway Cars	801 Structures	801 Revenue Equipment	801 Rolling Stock
803 Bus	802 Roadways & Decks	802 Stations	802 Stations
804 Passenger Stations	803 Transportation Systems Management Operations	803 Track	803 Structures, Track
805 Track	804 Utilities	804 Line Structures	804 Communications & Signals
806 Line Equipment	805 Buildings & Sites	805 Communications & Signals	805 Power
807 Line Structures	806 Miscellaneous	806 Shops and Yards	806 Shops & Yards
808 Signals & Communications	807 Structural Painting	807 Power	808 Miscellaneous
809 Traction Power		809 Miscellaneous	
810 Shops & Yards			
812 Depots			
813 Service Vehicles			
816 Misc./Emergency			

Exhibit 16
Number of Assets Sampled for Physical Inspection
Listed By Agency ($ in billions)

Agency	Project Costs	Number of Assets Inspected
New York City Transit (NYCT)	$4.030	36
Bridges and Tunnels	0.851	27
Long Island Rail Road (LIRR)	1.060	23
Metro-North Railroad (MNR)	2.207	21
Total	$8.148	107

[10] Where the three-digit number (i.e., 801) represents the asset "category code" for a particular agency. The three-digit code is included within the ACEP number, or the unique project identifier. For example, for an ACEP code such as T8010101, the "T" corresponds to the agency (in this case "T" represents New York City Transit), the "801" is the category code for subway cars, the next "01" after the "801" is for the Subway Cars element, and the final "01" represents an "A Division Car Purchase, the individual project coding within the element."

Exhibit 17
Assets Sampled for Physical Observation
Organized by Agency

New York City Transit (NYCT)		Bridges and Tunnels		Long Island Rail Road (LIRR)		Metro-North Railroad (MNR)	
Category	**Sample**	**Category**	**Sample**	**Category**	**Sample**	**Category**	**Sample**
801 Subway Cars	1.-3. 640 B Division Car (R46s) 4.-7. A-Division CBTC-Ready Car (R142s)	801 Structures	1. RFK Bridge Fenders 2. Cross Bay Bridge (CBB) Abutment Bearing Pedestals So. 3. Cross Bay Bridge (CBB) Abutment Bearing Pier Wall 4. Cross Bay Bridge (CBB) Abutment Bearing Pedestals No. 5. Hugh Carey Tunnel Pedestrian Bridge Timber Beams 6. Hugh Carey Tunnel Pedestrian Bridge Timber Pile Cap 7. Hugh Carey Tunnel Pedestrian Bridge Timber Piles 8. Hugh Carey Tunnel Concrete Deck Slab 9. Hugh Carey Tunnel Gutter-West 10. Hugh Carey Tunnel Gutter-East 11. Henry Hudson Bridge Abutment Stem 12. Henry Hudson Bridge Abutment Wings 13. Verrazano Narrows Bridge Diagonal Bracing 14. Verrazzano Narrows Bridge Floortruss 15. Verrazzano Narrows Bridge Main Truss	801 Revenue Equipment	1. DE-30 Locomotives 2. DM-30 Locomotives 3. C-3 Coaches	801 Rolling Stock	1. M-3 Locomotives 2. P32 Genesis dual-mode Locomotives
803 Bus		802 Roadways & Decks	16. Verrazzano Narrows Bridge Barriers 17. Verrazzano Narrows Bridge Deck Joints 18. Verrazzano Narrows Bridge Structural Deck 19. Henry Hudson Bridge Wearing Surface (Section 2) 20. Henry Hudson Bridge Wearing Surface (Section 3) 21. Henry Hudson Bridge Wearing Surface (Section 5) 22. RFK Wearing Surface (Section 9)	802 Stations	4. Copiague Platform and Elevator 5. Merrick Station Platform and Viaduct 6. Mineola Elevators 7. Hunters Point Station Canopy, Platform, Shelter	802 Stations	3. 47th Street Viaduct 4. 48th Street Viaduct 5. Elevators (Freight), GCT 6. Plumbing standpipe for fire, GCT (valves, pumps, devices, distribution) 7. Parking lot, Harlem Line 8. Harlem Line Station (Vernon West) 9. Harlem Line Station (Scarsdale)

New York City Transit (NYCT)		Bridges and Tunnels		Long Island Rail Road (LIRR)		Metro-North Railroad (MNR)	
Category	**Sample**	**Category**	**Sample**	**Category**	**Sample**	**Category**	**Sample**
804 Passenger Station	8. Turnstiles (Second Ave) 9. Station Painting (Union Square) 10. Station Painting, Nassau Ave 11. Station Renewal, Jamaica 12. Station Renewal, 3rd Ave 13. Mezzanine and Lighting (Forest Ave.) 14. Platform Components, Norwood Ave	803 Transp Systems Mgt Operations	23. EZ Pass Equipment	803 Track	8. Port Washington Yard Track Systems 9. Valley Steam Concrete Ties 10. Cherry Valley Road Bridge	803 Structures, Track	10. Hudson Line Track, Rail 11. Hudson Line Track, Ties 12. GCT & CP 1 Switches 13. Marble Hill Retaining Wall 14. Park Ave Stone Viaduct 15. Park Ave Steel Viaduct 16. Moodna Viaduct 17. Woodbury Viaduct
805 Track	15. Switch (6th Ave) 16. Switch (4th St.) 17. Track (Broadway St.) 18. Track (Lexington Ave.) 19. Track (Jerome Ave.) 20. Track (6th Ave.)	804 Utilities	24. BVB Mechanical Sump/Drainage Pump 25. MPB Elevators & Hoisting Machinery	804 Line Structures	11. Viaducts and Merrick and Massapequa Park	804 Communications & Signals	18. Portable Radios 19. Harmon to Poughkeepsie Signals
806 Line Equipment	21. Deep Wells (Crosstown Line)	805 Buildings & Sites	26. Hugh Carey Tunnel, Building Envelope	805 Com & Signals	12. Bethpage Signal Bridge 13. Jamaica Radio Head End System 14. Signal Allotment (Valley to Far Rockaway/ Hall to Queens/ Valley to Babylon/ Oyster Bay Branch 15. Signal Allowance	805 Power	20. Signal Substations (Harlem Line, Pelham and Brewster)
807 Line Structure	22. Overcoat Painting (Sutter Ave Portal) 23. Overcoat Painting (9th Ave Portal) 24. Signals (W/E Huguenot) 25. Switch (SIR Line)	806 Misc.		806 Shops and Yards	16. Morris Park Yard Turntable 17. Train Wash Replacement	806 Shops & Yards	21. Automotive Fuel Station, Brewster Shop
808 Signals & Communi-cations	26. Telephone Switch PBX 27. Comm Room 28.-29. CBTC Queens Blvd Signals	807 Structural Painting	27. MP Painting (Main Truss High)	807 Power	18. Murray Hill Substation 19. Morris Park 4160V Feeders	808 Misc.	
809 Traction Power	30. Stanton Street Substation 31. Village Substation			809 Misc.	20. Fire Alarm System (CCTV)		
810 Shops & Yards	32. 207th Street Car Washer						
812 Depots	33. Charleston Drainage and Fire Protection						
813 Service Vehicle	34. Hopper Cars						
816 Misc/ Emergency	35. Underground Tank 36. Employee Facility						

i. Site Inspections

Crowe obtained the "Blue Pages"[11] for the MTA's proposed draft 2020-24 Five-Year Capital Plan from the Director of Capital Program Management on August 20, 2019. From the listing of projects proposed for 2020-24 Five-Year Capital Plan, Crowe randomly selected ACEPs for the purpose of performing site inspections (see section above for additional details of the sampling methodology). Assets under review were selected for the following agencies:

- New York City Transit (NYCT)
- Bridge and Tunnels (B&T)
- Long Island Rail Road (LIRR)
- Metro-North Railroad (MNR).

Crowe, together with its engineering subcontractors, performed an independent inspection of the various assets, which spanned all 5 boroughs. The purpose of this inspection was to understand the current state and condition of the asset relative to its reported condition and whether that asset warranted repair or replacement.

e. Peer Agency Benchmarking

Crowe conducted benchmarking interviews with peer transit agencies to analyze trends in the industry and identify capital planning leading practices applicable to MTA. MTA assisted us to identify those agencies considered peers based on comparative metrics such as system size, age, and budget. To gain meaningful data and insights from the benchmarking interviews Crowe developed a standardized interview template covering capital planning processes, use of information systems in the capital planning and asset management process, and cost estimating practices. Crowe also reviewed and analyzed publicly available capital planning documents prepared by these peer agencies. Crowe compared MTA capital planning processes to industry trends and leading practices. Additional benchmarking results are provided in **Appendix E.**

[11] "Blue Pages" represent a list of proposed projects by agency and are provided in the back of each Five Year Capital Plan. The pages themselves are blue.

3. Results and Conclusions

Crowe's conclusions regarding this performance audit of MTA are provided in **Exhibit 18.** We organized our conclusions to align with our project objectives as specified in Section 2a. Based on the results of this performance audit, Crowe did not find deficiencies with internal controls over MTA capital planning processes that were significant to the individual performance audit objectives, or significant non-compliance with MTA policies, procedures, practices, and State law, that would necessitate modification to the 2020-24 Five-Year Capital Plan. We have otherwise communicated deficiencies that were significant enough to warrant attention to those charged with governance.

Exhibit 18
Crowe Performance Audit Conclusions

Audit Objective	Conclusion
1. Determine whether asset conditions are accurately documented.	Asset condition ratings are accurately documented in all significant respects. We otherwise have identified matters of internal control and areas of non-compliance in Finding 4.
2. Determine whether MTA's condition assessment of current assets warrants the need for replacement and is based on condition standards provided by the MTA.	MTA's condition assessment of current assets warrants the need for replacement and is based on condition standards provided by the MTA in all significant respects.
3. Determine whether MTA's comprehensive policies and procedures are properly designed and implemented for preparation of the Five-Year Capital Plan.	MTA's policies and procedures are properly designed and implemented for preparation of the Five-Year Capital Plan in all significant respects. We otherwise have identified matters of internal control as reported in Finding 9.
4. Determine whether the Five-Year Capital Plan complies with applicable laws, rules, regulations, and ordinances, as designated by the MTA and/or Public Authorities Law.	The Five-Year Capital Plan complies with applicable laws, rules, regulations, and ordinances, as designated by the MTA and Public Authorities Law in all significant respects.
5. Determine whether MTA capital planning processes are consistent with industry leading practices using a sample of peer organizations as agreed by MTA.	MTA capital planning processes are consistent with industry leading practices in all significant respects. We otherwise have identified matters of internal control as reported in Findings 3, 5, 6 and 7, and instances of non-compliance with MTA policies and procedures in Finding 3.
6. Determine whether the mix of investments and cost ranges included in the 2020-24 Five-Year Capital Plan are based on the Twenty-Year Needs (TYN) conditions and investment strategies.	The 2020-24 Five-Year Capital Plan is based on TYN conditions and investment strategies in all significant respects. We otherwise have identified matters of internal control as reported in Findings 2 and 8.
7. Determine whether cost overages and/or duplication of projects occurred in projects related to the 2015-19 Capital Plan and assess whether cost overages and duplications are evaluated and documented by MTA.	Cost overages and/or duplication of projects occurred in projects related to the 2015-19 Capital Plan, and MTA evaluated and documented them in all significant respects. We otherwise have identified matters of internal control and instances of non-compliance in Finding 1.

4. Schedule of Findings and Recommendations

Crowe's findings are listed below in **Exhibit 19.** For each finding we identify 1) the degree with which we found non-compliance and 2) the extent of an internal control deficiency. Compliance is determined based on requirements found in internal policies, procedures, practices, rules, regulations and laws. For purposes of this report MTA policies, procedures, practices, instructions and State law were considered when evaluating compliance of the MTA's capital planning process.

There are three levels of a control deficiency, considered in this report, as described below from lowest rated (noted green) or least problematic to the highest rated or most problematic (noted red):

- *Deficiency* – A control deficiency exists when the design or operation of a control does not allow management or employees, in the normal course of performing their assigned functions, to prevent or detect misstatements on a timely basis.
    - A deficiency in design exists when (a) a control necessary to meet the control objective is missing or (b) an existing control is not properly designed so that, even if the control operates as designed, the control objective would not be met.
    - A deficiency in operation exists when a properly designed control does not operate as designed or when the person performing the control does not possess the necessary authority or qualifications to perform the control effectively.
- *Significant Deficiency* is a deficiency, or a combination of deficiencies, in internal control, that is important enough to merit attention by those responsible for oversight of the Five-Year Plan.
- *Significant Deficiency with Modification* is a deficiency, or a combination of deficiencies, in internal control, such that there is a reasonable possibility that a significant or material misstatement of the Five-Year Plan will not be prevented or detected on a timely basis.

Significance is defined as the relative importance of a matter within the context in which it is being considered, including quantitative and qualitative factors. Such factors include the magnitude of the matter in relation to the subject matter of the audit, the nature and effect of the matter, the relevance of the matter, the needs and interests of an objective third party with knowledge of the relevant information, and the impact of the matter to the audited program or activity. Professional judgment assists auditors when evaluating the significance of matters within the context of the audit objectives.

The remainder of this section provides a description of each of the nine (9) findings, including the condition, criteria, cause, effect, and our recommendation related to the finding. Also included at the end of each finding is MTA's response to the finding. MTA's response was not subjected to the procedures applied in the performance audit of the audit objectives and, accordingly, we express no conclusion on them.

Exhibit 19
Crowe Findings

Finding	Audit Objective Impacted	Compliance (significant non-compliance or non-compliance[12])	Control Evaluation[13]
Cost Estimates			
1. MTA can improve cost estimates with more formal, standardized, and consistently applied cost estimating procedures and agency documentation requirements	7	Non-compliance	Significant Deficiency
2. MTA budgeted costs exceed comparative benchmarks for various reasons and MTA should consider a range of alternative management approaches to control future costs	6	N/A	Deficiency
Asset Inventories and Condition			
3. MTA can enhance linkages between capital projects included in the 2020-24 Five-Year Capital Plan and assets targeted for repair/replacement within agency asset inventories	5	Non-compliance	Deficiency
4. MTA has comprehensive asset condition databases which reflect existing conditions, however MTA should supplement its asset condition database contents to better support asset condition determinations	1	Non-compliance	Significant Deficiency
Capital Planning Processes			
5. MTA has yet to realize significant MTA level capital planning benefits from Enterprise Asset Management (EAM)	5	N/A	Deficiency
6. MTA's largely manual TYN and Five-Year Plan processes and disparate data platforms make it difficult for the MTA and agencies to assess priorities, backlogs, and alternative scenarios	5	N/A	Deficiency
7. The MTA can improve the transparency of performance measures and dashboarding to more closely monitor Five-Year plan and project outcomes	5	N/A	Deficiency
8. There are some limitations in MTA capital planning review and approval processes	6	N/A	Deficiency
9. MTA and agencies do not have comprehensive and fully documented capital planning and procedures.	3	N/A	Significant Deficiency

[12] Where "significant non-compliance" is reportable to management, and "non-compliance" is not considered significant to the objectives of the audit but we otherwise wish to communicate this to those in charge of governance.

[13] Where "significant deficiency" is reportable to management, and a "deficiency" in control is not considered significant to the objectives of the audit but we otherwise wish to communicate this to those in charge of governance.

Finding #*1:* MTA can improve cost estimates with more formal, standardized, and consistently applied cost estimating procedures and agency documentation requirements

Non-compliance Conclusion: *Non-compliance*
Internal Control Conclusion: *Significant Deficiency*

Condition

We initially found that 29% (14 of 48) of the projects (representing 23% of the sample budget) we reviewed for the 2020-24 Five-Year Capital Plan either did not have cost estimates, had outdated estimates, or the estimates did not include a basis of estimate of sufficient detail to fully support costs of the asset's replacement. For many of these 14 projects, we found a lack of support identifying goals, alternatives, benefits, costs, operating budget impacts and long-term operating significance.

In some cases, the agency indicated that the project represented a budget based on planned needs similar to projects from prior years, but the agency did not initially provide us with sufficient data to support the budgeted amount. Additionally, in some cases, the estimate documentation did not reconcile exactly to the budget included in the 5 Year Capital Plan.

Upon subsequent analysis, using our own external comparative cost benchmarks and additional historical unit cost data furnished by agencies, we determined that 8% (4 of 48) of projects with costs of 2% percent of the sample budget were considered unsupported for purposes of inclusion in the plan.

Additionally, very few of the projects we reviewed included a risk profile for the project which is intended to inform MTA on the level of confidence in the estimate and schedule (e.g. placeholder/none, master plan/completed scope, etc.); the major scope, budget and schedule risks; and how the project budget and implementation plan mitigates those risks.

Additionally, in our review of the 2015-19 Five-Year Capital Plan data, we found approximately 20 percent of projects had cost overages, representing 3.9 percent of the total amended $33B 2015-19 Five-Year Capital Plan budget and 12 percent of the original $29B 2015-19 Five-Year Capital Plan budget. We found that of the 42 projects with overruns we sampled, a total of 8 (representing 3.4 percent of the project costs) did not have sufficient documentation to support the cost overage. We found that the lack of documentation in these cases largely related to the quality of cost estimates associated with these cost overruns. This is similar to a finding from a prior audit conducted by the Office of the Inspector General (see Appendix F, item iii.2.).

While we did not find instances of project duplication with an agency's set of 2015-19 projects, we did find some instances of project duplication across agency projects within the 2015-19 Plan (e.g., concrete ties, power upgrades, switch upgrades, painting). Going forward, the MTA has an opportunity to consolidate some of these projects into larger projects to take advantage of economies of scale.

Criteria

The 2020-24 Five-Year Capital Plan instructions specify that "projects include the cost breakdown and schedule by major work element and task. It should indicate the basis of estimate, including methodology and factors for determining cost, schedule and inflation assumptions (referencing recent rebid and cost experience) Project budgets should be provided with task-level detail."

The GAO has developed a document titled *GAO Cost Estimating and Assessment Guide; Best Practices for Developing and Managing Capital Program Costs*. These guidelines specify 12 components of a high-quality cost estimating process, including:

1. Define estimate's purpose
2. Develop estimating plan
3. Define program characteristics
4. Determine estimating structure (WBS)
5. Identify ground rules and assumptions (i.e., basis of estimate)
6. Obtain data
7. Develop point estimate and compare to independent cost estimate
8. Conduct sensitivity analysis
9. Conduct risk and uncertainty analysis
10. Document the estimate
11. Present for management approval
12. Update the estimate to reflect actual costs and changes.

Cause

Agencies also do not have documented cost estimating guidelines with uniform templates. The MTA has a wide variety of cost estimators (internal and external). MTA agencies are sometimes constrained from a staffing and schedule perspective to spend the level of effort required to develop high-quality cost estimates in time to include them with projects programmed in the capital plan.

Effect

For some projects included in the 2020-24 Five-Year Capital Plan, it is difficult for a third-party to validate or reproduce cost estimates from the information provided by the agency.

Recommendation

1a. MTA should develop a Cost Estimating guide for common use by agencies. The guide should include a standard cost estimating methodology and templates for project cost estimates depending on the state of the project's lifecycle (e.g., order of magnitude or at end of design). MTA should require each project to have a clear basis of estimate (BOE) and a common format/line item detail with consistent inclusion of contingency and soft costs (e.g., similar to that provided by FTA).

1b. MTA should require master planning, basis of estimate, and detailed cost estimates for projects in the first two years of each Five-Year Capital Plan. Thereafter, the MTA should consistently require master planning, BOE, and detailed cost estimates in advance of the planned start of the phase of work (design or construction) in accordance with gates requirements. Agencies also should consistently provide full documentation to support use of analogous (historical) estimates and unit costs used in developing its cost estimates.

The methodology should provide standard guidelines for project contingency levels to use for projects throughout the various stage of project development. Agencies should document exceptions to these suggested contingency levels. When using contingencies, the MTA should clearly document the basis for project contingencies which differ from these suggested guidelines.

Management Response

The MTA agrees there is a need for improvement in estimating the cost of capital projects. As part of the Transformation, the new Construction & Development function is developing and will consistently apply informed, project-based cost-assessment methodologies appropriate for each stage of the planning and delivery process. Project contingency levels will also follow standard guidelines. These will be summarized in standard guides for common use by the MTA. The MTA is also improving systems it

uses to track expenses and other commercial indicators for projects as they are delivered. This data will be readily available for future program and project planning.

- The leader of each project will adopt value-engineering and risk-analysis practices to better estimate project costs and reduce potential overruns. These will include systems to track expenses and other commercial indicators as they happen.
- Construction delivery data will be compiled and analyzed, including variances from original costs and schedule projections. Project leaders will have access to the data for integration into future cost estimating modeling.
- The MTA agrees that the immediate focus for cost estimating should be early on the 2020-24 program.

Finding #*2:* MTA budgeted costs exceed comparative benchmarks for various reasons and MTA should consider a range of alternative management approaches to control future costs

Non-compliance Conclusion: *N/A*
Internal Control Conclusion: *Deficiency*

Condition

MTA budgeted costs included in the 2020-24 Five-Year Capital Plan exceed the high end range of comparative agency costs for some projects and asset types we reviewed. While we found several project costs in line with those of other agencies (e.g., commuter rail cars, coaches, buses, CCTVs, and wood/concrete ties), some project costs exceeded the high end of comparative agency costs.[14] These included ADA station upgrades, elevator/escalator replacement, and track repair/replacement costs.[15]

The MTA recently responded to ongoing concerns regarding higher capital costs with plans for transformational efforts intended in part to address these cost concerns, including:

- A project CEO concept for mega-projects
- Design build project (D-B) delivery, which should mitigate some risk and potentially lead to greater on-time delivery schedules
- Reinforcement of stage-gate approach for project advancement
- Simplified project specifications
- Debarment for contractors with cost overruns over 10 percent of budget.

Except for the debarment provision, we find these new plans in line with those of other benchmarked agencies and consistent with leading practices in the construction industry.

There are a number of explanations why MTA costs exceed comparative benchmarks (see causes below). We accept these reasons for higher MTA costs. Through proposed transformation efforts, the MTA has identified and has plans to proactively address acknowledged higher costs. However, we believe that the MTA can take additional efficiency measures as it implements the 2020-24 Five-Year Capital Plan in an effort to closely manage its capital costs. as identified in the recommendations, we identify additional measures that MTA should consider to further address future cost concerns as the MTA implements its 2020-24 Five-Year Capital Plan.

Criteria

We compared selected MTA budgeted costs included in its 2020-24 Five-Year Capital Plan to comparative agencies for a variety of project types, both at a project cost level and at an asset unit cost level.

Many large transit agencies make capital needs forecasts every year. For example, one agency we surveyed uses a rolling 5-year Capital Investment Plan (CIP), with a time horizon that advances one year. This agency presents incremental CIP revisions for consideration and approval by its Board, based on information provided through a decision support processes, changes in expected funding,

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[14] It is important to identify that exact cost comparisons are most challenging for station construction projects (e.g., ADA compliance) as the scopes, size, and elements addressed by these projects are not often the same.

[15] Comparisons of project cost data between agencies for certain types of projects (e.g., station enhancements or ADA work) poses challenges as often times the publicly available comparative cost data is not equivalent due to differences in the project's scope, timing, project phase, and costs included (construction only versus total costs). As an example of a project scope difference, in the case of MTA's ADA projects, often times MTA projects are delivered in a more costly underground environment compared to other agencies completing an ADA project to an elevated platform. Similarly, MTA project costs are fully inclusive of internal force account costs (e.g., TA labor) whereas other project cost estimates may be for the construction-only portion of the project.

and/or revised project needs and schedules. Another agency we surveyed uses a rolling five-year CIP process where in each year a new fifth year is added and one year is dropped. Additionally, one agency we surveyed indicated that every year the general manager submits a proposed six-year CIP to its Board of Directors.

Cause

Through discussions with MTA management, and our interviews conducted throughout the MTA and the agencies, there are a wide range of reasons provided for the higher MTA costs, including:

- *Unrealistically low initial cost estimate that were not actively reviewed/revised*
- *Highly detailed project specifications* – MTA may require more rigorous engineering specifications than those required by other transit agencies
- *Significant soft costs* – in some cases, MTA budgeted "soft" costs which include design, engineering, construction management, and force account labor are higher than average
- *Unforeseen project schedule delays resulting from unknown field conditions associated with old infrastructure*
- *Higher employee benefit costs than other areas*
- *Higher material costs than other areas*
- *Higher insurance costs than other areas*
- *24/7 operations* – restricts access to work areas to nighttime/weekends, often necessitating high overtime use. Other comparable agencies have more flexibility to close stations to complete projects.

As a result of these uncertainties, agencies may include contingencies within the cost estimates to levels that approach the higher end of the range for early stage projects. For example, there is a 50 percent contingency level budgeted for the construction component of some projects. Agencies indicated that the extent of project uncertainties merited these higher early stage contingencies.

In addition to those described above, budgeted costs will reflect construction cost escalations. In some cases, where MTA based 2020-24 cost estimates on experience with projects in prior capital plans (i.e., analogous methods), the prior project costs may have been escalated by several years for a project programmed in the later years of the 2020-24 Capital Plan.

Effect

There are negative public perception impacts when capital construction projects cost far exceed those of comparable jurisdictions. The perception may be that relative to others, MTA projects are not managed well, and construction projects are delivered more inefficiently. Additionally, higher expected budgets may not result in the most favorable contractor pricing.

Recommendation

2a. To proactively enhance the transparency and accountability of capital project management, we recommend an annual capital programming cycle. The MTA currently uses a five-year process with amendments as needed when budget changes exceed a threshold. We recommend that MTA instead use an annual process to allow the MTA to update project cost estimates more frequently and report on and manage project progress in a more accurate manner over the life of the Five-Year Plan cycle.

2b. We also recommend that the MTA take the following measures to manage its capital project expenditures during the 2020-24 Five-Year Planning cycle.

<u>Planning</u>

- For projects requiring significant stakeholder involvement, actively engage stakeholders early in the

planning process to identify agreed upon project parameters (e.g., location and scope) and potentially reduce long and inefficient project lead times

- Consolidate projects/procurements across multiple sub-projects for economies of scale and to provide greater opportunity for continuous contractor workflow
- Simplify and standardize project design/scope specifications and requirements where possible to reduce complexity and minimize non-critical project elements
- Develop database of benchmark costs with accurate “apples to apples” comparisons

Contracting

- Explore greater use of master service agreements (MSAs), including multi-agency ones. Continue to consolidate large rolling stock procurements and other project types (e.g., concrete ties) for economies of scale
- Consider additional value engineering options where the MTA and contractor share in the value of cost savings identified by the contractor
- Create contractor performance incentives (for early or on-time delivery)
- Explore other project delivery methods (e.g., CMAR, P3, DBOM)
- Perform procurement audit

Logistics

- Consider options for station closures (partial, full), and potentially sacrifice 24/7 operations by offering other transit options

Project Management

- Provide close monitoring of force account (EFA, TA) amounts; including weekly supervisor monitoring, limitations so only a set of pre-identified employees can work on a project, multiple levels of approval for overtime, and prompt project charge code closures upon completion
- Examine whether MTA can reduce potential duplication of effort between internal (force account) and external design/engineering, project management, and construction management services
- Require cost-benefit analysis at early stage of projects, for projects above a threshold
- Provide active risk management of projects throughout project lifecycle

Communications

- Make work rules options transparent to MTA stakeholders (Board and public) as a basis for them to understand the extent of staffing and related costs required to deliver the project
- Conduct continuous outreach to the contractor community to understand issues/concerns. Actively sell new and alternative contracting/procurement options to the contractor population to encourage robust competition
- Develop governance around the planned centralized construction agency as to how the agency will oversee the capital program, including the centralized construction agency’s responsibilities relative to other MTA agencies in planning, bundling, and delivery of capital projects.

Management Response

The MTA agrees that more can and should be done to lower project costs. As noted, the MTA has already developed, and is continuing to develop, a number of initiatives to reduce costs. New processes, benchmarks and standards will be extensively documented for easy reference by MTA project leads and other staff, and updated as the new Construction & Development organization gains more experience with Design-Build and other innovative delivery practices.

- The MTA will do the following:
  - Provide annual updates on the 2020-24 Capital Plan, including updates on individual projects, and will also amend the original five-year capital plan if necessary.
  - Continue to engage community members around specific place-based capital projects (as it has in the last few years on L Train, Third Track, Second Avenue Subway and other projects).
  - Continue identifying objective, data-driven, and risk-based criteria to evaluate and prioritize capital projects. The function will develop and implement standard approaches across the MTA Capital Program for investment strategies, project prioritization, Master Planning, scoping, etc.--resulting in shorter time frames with consistent and transparent strategies.
  - Consolidate smaller projects with common affinities (such as scope, outage requirements, geography) into bigger ones for economies of scale. The L Train Project has already grouped together different projects to minimize track outages and make the most efficient use of the scheduled outages.
  - Utilize a range of project delivery methods, as well as alternative contracting practices, including value engineering options, contractor performance incentives and other measures. The LIRR Expansion project has already employed these incentives, which have encouraged the design-builder to finish sooner.
  - Through the MTA's internal Audit Department, the MTA will undertake a procurement audit within the first two years of the 2020-2024 Capital Plan.
- Capital project planning will prioritize reducing service changes and managing disruptions by providing alternative service options.
- Force account costs are a major cost driver for MTA construction projects. The new Project CEOs will be responsible for tracking force-account and overtime expenditures much more closely than has been the practice.
- Wherever appropriate, the MTA will carry out a cost-benefit analysis.
- The new Construction & Development organization will be responsible for planning, bundling and delivery of the 2020-24 program and will be working with operating agencies to carry out the program in faster, better and more cost-effective ways.
- Improved dialogue with the contracting community will be a priority to better manage risk and reduce change order review and payment processing times.

Finding #*3:* MTA can enhance linkages between capital projects in the 2020-24 Five-Year Capital Plan and assets targeted for repair/replacement within agency asset inventories

Non-compliance Conclusion: *Non-compliance*
Internal Control Conclusion: *Deficiency*

Condition

In some cases, agencies did not provide sufficient documentation as part of the 5YP process to understand how the agency prioritized a project for inclusion in the current 5YP relative the TYN. Data sets generally do not provide a direct link from a project proposed in the TYN and 5YP to an asset in need of repair/replacement.

Additionally, MTA changes to the TYN and 5YP over the planning cycle are not fully supported by documentation which explains the change. We found it difficult to trace adjustments made to the TYN and 5YP throughout the development lifecycle.

While it is acknowledged that programmatic projects are necessary for flexibility, over 25 percent of projects proposed in the 2020-24 5YP represent allotments/allocations for systemwide work (e.g., track repair; signal replacement; switch repair). These allotments/allocations make it difficult to determine whether the allocation/allotment amounts and resulting projects were aligned with project needs and are appropriate for inclusion in the 5YP.

The MTA would benefit from a more data driven and risk-based project selection methodology (e.g., as used by three of the other agencies we surveyed). This approach would be greatly enhanced with EAM and the SGR decision-support tool.

Criteria

Part C of the 2020-39 Twenty-Year Needs Assessment instructions, titled “Needs Summary for Existing Assets,” specifies that the agencies should identify when, how, and how many assets in the asset class will be replaced and rehabilitated in the twenty-year timeframe (with detail provided for each affected inventory group in the asset class). The instructions indicate that agencies should “identify the types of assets to be replaced or rehabilitated” and “include all assets or components that are on distinct investment cycles or that represent major cost drivers for the overall investment.”

Cause

The MTA and agencies are constrained by existing manual tools/databases that do not easily allow them to make project to asset linkages. In some cases, agencies submit allotments for certain types of work without fully identifying which projects in the inventory the allotment will address.[16]

Effect

Projects could potentially be improperly included or excluded in the 5 Year Capital Plan. Changes to plans may be overlooked or not included in underlying investment strategy needs or asset condition assessments.

[16] This is acceptable practice for ill-defined future work (in the case of an annual track or switch program), but where possible agencies should provide linkages of allotment amounts to the underlying assets within the inventory to establish the basis for the budgeted amount.

Recommendation

3a. MTA should perform a cross-walk, or reconciliation, between the investment strategy database and asset condition database, specifically identifying assets which are addressed by projects planned in the TYN and 5YP to ensure the linkage is apparent.

3b. Where possible, the MTA and agencies should prepare internal documentation that identifies initial plans for those assets the agency intends to address with its allotments/allocations (e.g., for annual track or station repair). In keeping with the instructions provided for the TYN, where possible the agency should develop location-specific projects.

3c. During the Five-Year planning cycle, MTA should require agencies to complete a form that details the state of the assets included, the need, the estimate(s), and a detailed cost benefit analysis. Similarly, agencies should prepare a corresponding memorandum or log indicating when/why a project was removed from the plan and how this asset need will be addressed in future capital and/or maintenance efforts.

Management Response

The MTA's Capital Program development process links individual asset conditions, investment strategies, and capital plans. The MTA is developing new tools and integrated systems to better address the complexities of its network and connect more systematically asset-condition information with investment strategy.

MTA will achieve this reconciliation by bringing all assets into one asset register and inventory database (with standard asset classifications and data structures) across the MTA enterprise, and by providing more detailed information for budget allocation categories—which the MTA can then incorporate into annual budgets and the financial plan. The MTA will develop and implement a standard asset classification or coding system for assets as they go through the Twenty-Year Needs (TYN) and Five-Year Plan (5YP) development processes.

Finding #4*:* MTA has comprehensive asset condition databases which reflect existing conditions, however MTA should supplement its asset condition database contents to better support asset condition determinations

Non-compliance Conclusion: *Non-compliance*
Internal Control Conclusion: *Significant Deficiency*

Condition

MTA agencies have developed asset condition databases and have rated asset groups on a scale of 1 to 4 (see section 2c.iii. for asset inventory and condition assessment discussion). To develop asset condition ratings that agencies use to prioritize repair/replacement needs, agencies rely on a wide range of inspections, studies and other data on the status of their capital assets. Based on our review of selected assets included in projects planned for the 2020–24 Five-Year Capital Plan, we noted some of the agencies' supporting documentation was insufficient or unavailable as follows:

- For 17% (17/103) of assets reviewed, through our review of the agency's inspection reports, there was insufficient documentation to support the agency's own asset condition rating and therefore the need to replace/repair of the asset

However, for those 17 assets noted above where we could not determine how the agency reached its own condition determination based on its own documentation, through our independent inspections of those assets we agreed that all but five of these 17 assets merited inclusion in the 2020-24 plan for repair/replacement (a total error rate of 4.9 percent for this analysis).

We also found some exceptions in our testing of asset condition datasets:

- Datasets did not always contain enough information to determine when an agency last renovated/rehabilitated an asset.
- Datasets did not always contain the correct useful life for a given asset as required by MTA's instructions.
- Datasets did not include replacement costs.
- Datasets did not always provide sufficient detail to identify which assets within a specific line item were in an SGR or not in an SGR due to aggregation.
- In one case, we found data sets did not always provide a current/accurate condition for an asset due to an adjustment in the workbook (data set) for a planned rehabilitation/refurbishment in the 2015-19 5YP which never occurred. This incorrect updated condition remained in the asset inventory for 2020-24.
- Some largely SGR (State of Good Repair) and NR (Normal Replacement) projects are classified as SI (System Improvement). Data sets do not always capture when an asset is targeted for replacement by a SI project.

We determined there was large variability in the condition of assets with a specific rating category (e.g., condition 3 of the condition ratings 1-4), making it difficult to determine which assets within a category represent priorities for repair/replacement.

Criteria

Section D Part III of the 2020-24 Five-Year Capital Plan instructions, titled "Justification of the Need for the Capital Investment" specifies that there should be a very clear rationale for doing the project. For example, what are the age and condition of the affected asset; the replacement cycle; or the ways in which the asset doesn't do the job the way it needs to be done today? Updated condition ratings must be cited for needs categorized as SGR or NR and the project must have continuity with the 2020-2039 Twenty-Year Capital Needs Assessment. Needs categorized as SGR or NR must be explained, at a minimum, in terms of useful life and condition of the asset.

Cause

Agencies mainly rely on manual systems to manage the volume of disparate asset inventory and condition data and must manually update their data sets. Decisions often are made based on the experience of agency field personnel which are not always well-documented. MTA and agencies have not implemented procedures to reconcile data between these disparate systems and to provide an audit trail of the underlying condition assessment database leading to the inclusion or exclusion of assets in the 5YP.

Effect

MTA utilizes data from its asset inventories to inform investment strategies**;** consequently, errors of any kind for an asset impede an agency's ability to make decisions regarding SGR ratings, repair/replacement needs/costs, and ultimately the prioritization of projects. An agency faces a risk that assets are improperly categorized / misclassified because of inconsistent asset condition documentation, potentially leading to an inappropriate prioritization of replacement/rehabilitation need.

Recommendation

4a. MTA should develop procedures and implement systems which could ease some of the manual asset condition processes. Asset condition data sets should include consistent and accurate information related to asset condition ratings, useful life determination, refurbishment data, and other pertinent data used in determining capital needs.

4b. MTA should require that agencies make the following updates/changes to its asset inventory databases:

- Identify inspection source document used for condition ratings
- Add renovation/rehabilitation date, if applicable
- Provide asset useful life data in all cases
- Provide additional column for criticality
- Identify and determine reasons why assets rated above 3 in the AICA Tables (candidates for repair/replacements) were not addressed by projects planned in the TYN
- Correct minor errors.

4c. Additionally, MTA should enhance coordination channels between maintenance and capital programs so maintenance can provide information to better inform capital decisions. If maintenance personnel observe an altered condition of an asset, whether it was improved from work performed, or its conditioned declined (since the last formal inspection), the identified current state should be updated/reflected in the condition tables.

4d. The terms SGR (state of good repair), NR (normal replacement) and SI (system improvement) needs types are used to label capital assets and contributes to prioritization of repair/replacement needs. Consequently, we believe it is important for agencies to consistently apply these terms to make appropriate capital planning decisions amongst competing priorities. We recommend that MTA work with agencies to refine the definitions of SGR, NR and SI for consistent application across the agencies.

4e. MTA should prepare a succession plan to capture and transfer employee knowledge of capital planning processes and procedures in cases where individuals leave the organization.

Management Response

Management agrees with the finding. Through the implementation of EAM, the MTA will enhance the quality of information readily available about its assets including useful life determination, inspection and maintenance history, capital investment history, and other operating information that will help determine criticality. Such information will also enhance succession planning and knowledge planning for the MTA, as data will be more transparent and understandable for all employees. This information

will help improve condition rating assessments as well as guide capital investment strategies, both of which will be updated in the next planning cycle for the 2025-2044 Twenty-Year Needs Assessment. Further, the MTA agrees that the terms State of Good Repair (SGR), Normal Replacement (NR) and System Improvement (SI) need refinement and will update the definitions for these terms for the 2025-2044 Twenty-Year Needs Assessment and the 2025-2029 Capital Plan.

Finding #*5:* MTA has yet to realize significant MTA level capital planning benefits from Enterprise Asset Management (EAM)

Non-compliance Conclusion: *N/A*
Internal Control Conclusion: *Deficiency*

Condition

In 2013, the MTA embarked on an Asset Management Improvement Program including development of an Enterprise Asset Management System (EAM).[17] In 2016, the MTA engaged Infor EAM to implement a standardized MTA-wide IT solution for asset management. In 2018, the MTA hired a consultant to further develop EAM by helping MTA plan, track, and optimize maintenance activities. In 2019, MTA reestablished leadership for the program to further develop EAM by helping MTA plan, track, and optimize maintenance activities in coordination with the capital plan. Through these efforts, the MTA has had some agency-level successes, including most recently efforts to advance location intelligence.

EAM progress is as follows: NYCT Subway Division uses Infor EAM to capture track, signal, and elevators and escalators (E&E) inspection data; Metro-North Railroad uses Infor EAM to conduct Federal Railroad Administration (FRA) inspections, capture switch, interlockings and grade crossing inspection data that is visualized across the entire network; Long Island Rail Road has established a robust Geographic Information System (GIS)-based asset inventory for Maintenance of Way assets and Bridges and Tunnels uses Inform EAM as a work order management system and asset inventory repository.

While the MTA has targeted EAM advancement for six years now, the MTA has realized relatively limited results to date that directly contribute to TYN and Five-Year Capital planning processes. Given the history of EAM efforts, we have concerns as to whether the MTA can implement an EAM system within the next five-year capital planning cycle and whether MTA will remain committed to EAM over the long-term.

Other comparable agencies we surveyed are further along with EAM implementation. For example, one agency surveyed completed its Transit Asset Management system in 2011 using Infor EAM. Another agency surveyed implemented phase 1 of its Enterprise Asset Management System in March 2018 and expects to implement Phase 2 by December 2020.[18] Two agencies surveyed use Maximo for EAM, while another is continually evolving its EAM capabilities. Most agencies currently use EAM to track data related to asset inventory, inspection, and work performed and several use data directly from their EAM system to develop their capital improvement plans.

Based on discussion with personnel managing the EAM initiative, we understand that the MTA has developed a strategic roadmap for implementing EAM basic functionality by 2022. The roadmap envisions a “One MTA.” The MTA’s EAM strategy includes several goals such as developing a system that provides a single asset registry, asset health and condition, asset costs (from a lifecycle perspective), investment prioritization capability, and readily available information for decision-making. MTA also wants to ensure proper investment/training for personnel using the system. The MTA has customized its strategic roadmap for each of the agencies and integrated agency roadmaps into an enterprise implementation roadmap. MTA also recently has strengthened a centralized unit with dedicated leadership, management and resources.

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[17] The term “enterprise asset management” refers to asset management conducted at an enterprise and strategic level, focusing on the interfaces between functions as they carry out asset management processes and activities, rather than just the specific processes engaged in at the operational levels in just one section/ department of an agency/enterprise. A maintenance management system, when integrated with business intelligence, condition tracking and forecasting, and other enterprise tools, forms a true enterprise asset management system/tool.

[18] The EAM-IS includes complete life-cycle management, preventative maintenance scheduling, requisitioning and purchase orders, inventory and warehousing capability, financial and human resource management, warranty management, mobile wireless handheld options and web-based software interfaces. Through the EAM Improvement program, the EAM-IS project will also integrate with all key agency business systems such as Peoplesoft Financials and the MTA’s State of Good Repair Database.

Criteria

We benchmarked progress with other comparative transit agencies. Additionally, TAM Final Rule 49 CFR 625.25 suggests the use of best asset management practices.[19]

Cause

This EAM undertaking represents a highly complex and transformational initiative. The MTA has acknowledged difficulties with its prior efforts to implement EAM including:

- Multi-agency coordination
- Scale of asset inventory
- Consolidating multiple disparate legacy systems
- Inconsistent management commitment
- Change management challenges.

Effect

In the current and prior Five-Year capital planning cycles, MTA has allocated $135M toward EAM efforts. There is the potential that the MTA may not realize enough benefits from this investment if the MTA continues to have difficulties with implementing an EAM system.

Recommendation

5a. The MTA should develop a detailed EAM project schedule and MTA should be held accountable for delivery on that schedule. The MTA should leverage the Project Management Institute's *Guide to the Project Management Body of Knowledge, PMBOK® Guide* for elements of good project management and their importance in achieving organizational goals. The MTA should establish and manage definitive timelines for EAM progress. Steps required for MTA to modernize its system include:

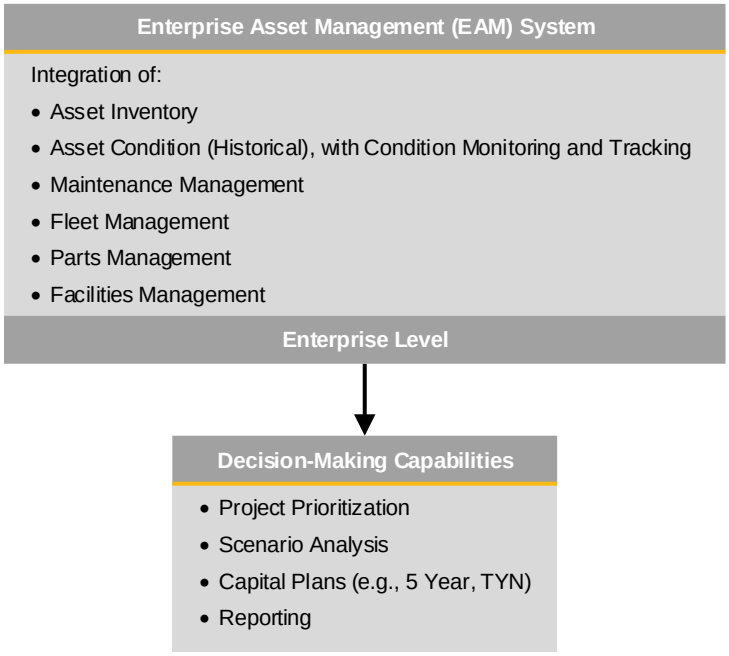
- Establish a formal EAM governance across the MTA and agencies to ensure alignment of program to strategic goals and desired outcomes of the MTA
- Develop a consistent EAM data governance structure across all agencies
- Develop a common asset breakdown structure, classification and hierarchy to align agency financial and operational asset data
- Develop current and future state business process documentation, conduct gap analyses and establish performance metrics
- Consolidate asset information into a single system
- Use EAM consistently for maintenance management and capital program practices and principles throughout asset lifecycle
- Incorporate use of risk-based sampling methodologies, and decay curves, to inform the future timing and extent of asset condition inspections
- Conduct agency level training
- Integrate EAM into capital planning efforts
- Develop reporting capabilities.

5b. The MTA also should seek opportunities to show near-term progress in capital planning from the EAM initiative. One example to show progress might be that the MTA standardize the format and content of existing asset inventories in the EAM system and for critical asset classes, build out the inventories and introduce as each asset class is completed.

[19] The TAM Final Rule 49 CFR 625.25 does not require EAM but suggests the use of best practices. Best practices, as identified through an analysis performed of benchmark agencies suggests EAM is an effective tool for capital programming

Exhibit 20 summarizes the general elements required for an effective EAM system. We believe that an EAM system will provide MTA with a stronger linkage between maintenance and capital planning efforts. An integrated EAM system will allow the MTA to have the capacity to evaluate lifecycle cost decisions, including the consequences of not making asset replacements when needed; and to significantly enhance repair versus replace decision-making.

Exhibit 20
Enterprise Asset Management



Source: FTA Transit Asset Management Guide

Management Response

Management agrees with the finding. Enterprise Asset Management, which is the process of managing the lifecycle of physical assets to maximize their use and improve quality and efficiency, is underway at the MTA and being re-baselined to coordinate with the implementation of Transformation. Core components of the program are new information systems and a standard asset hierarchy and classification structure that is being accelerated for completion within two years--both as part of Transformation and to support the next capital planning cycle for the 2025-29 capital plan.

The MTA is centralizing the EAM function under the Office of Central Engineering, which will be responsible for whole life cycle management of assets, asset modelling and analytics to inform asset management strategies and reporting on asset performance.

The MTA will develop a detailed EAM-Information Systems master plan and project schedule and will continue to seek early opportunities to demonstrate the value of EAM. As EAM becomes available for project planning and prioritization, the MTA will use EAM data to advance the program.

Finding #6: MTA's largely manual TYN and Five-Year Plan processes and disparate data platforms make it difficult for the MTA and agencies to assess priorities, backlogs, and alternative scenarios

Non-compliance Conclusion: *N/A*
Internal Control Conclusion: *Deficiency*

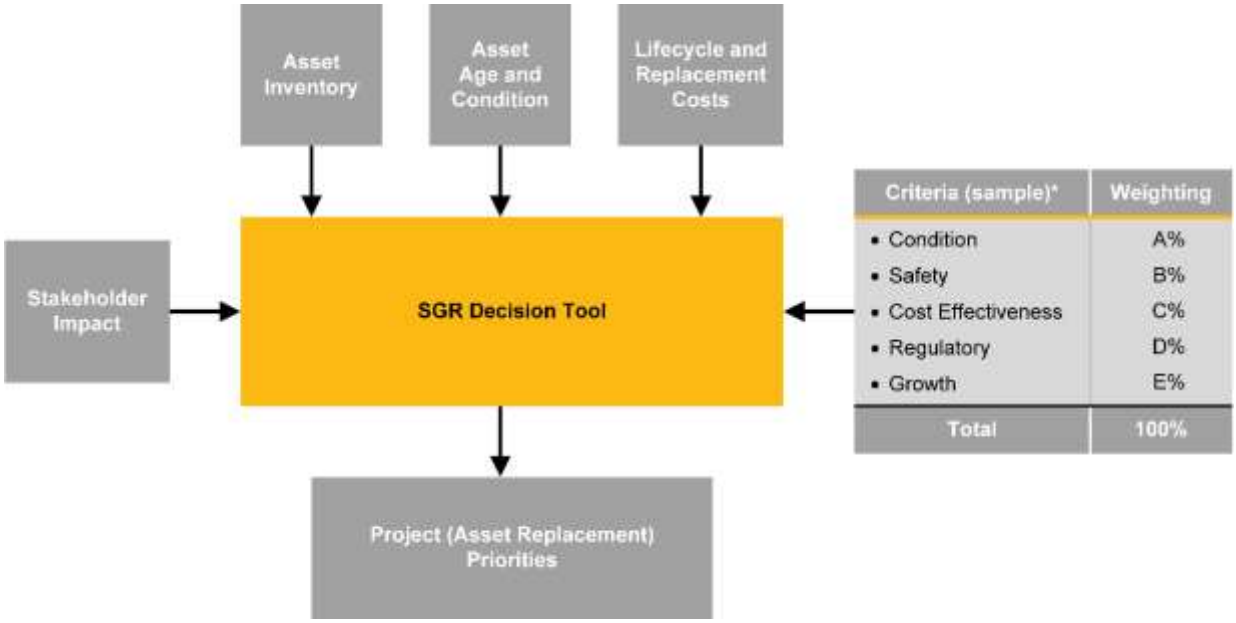
Condition

During the process of preparing capital plans, the MTA often must adjust, evaluate, prioritize, and analyze impacts of various capital decisions (e.g., funding constraints, different macro level policies). The MTA and agencies currently use a series of manual processes and Microsoft Excel workbooks to capture asset inventory datasets and investment strategy data. From a planning standpoint, these manual processes create challenges to evaluate and rank project priorities, assess SGR backlogs, evaluate impacts of evolving funding impacts/constraints, and perform scenario analysis.

MTA and its agencies follow TAM requirements for investment prioritization. Each agency uses its asset inventory, asset condition, asset strategies, and future plans to develop a priority list of projects for the TYN and Five-Year Plan. Agency governing boards review and approve these priorities. However, we find that the documentation and rationale to support the objective prioritization of projects can be improved and an SGR decision-support tool is one option to support such improvement.

The MTA has recognized the limitation of its current manual processes. Part of our scope of work was for us to evaluate the MTA's efforts related to a State of Good Repair (SGR) decision-support tool. As shown in **Exhibit 21**, an SGR decision-support tool provides the opportunity for an agency to rank order proposed projects using a quantitative, objective, multi-factor methodology. An agency uses a set of objective criteria (weighted), as approved by stakeholders, to determine each project's priority score.

Exhibit 21
Sample Elements of Decision Support Tool



** Others could include criticality, mobility, economic impact, social equity, environmental effects, and policy support.*

The MTA is in the early stages of developing an SGR decision-support tool, making it difficult for us to fully assess whether the MTA will be successful with its implementation. We found that the MTA engaged a consultant in mid-2019 to assist with developing the SGR tool. This consultant already had performed similar successful SGR decision-support tool projects for two other comparable agencies to MTA. The consultant's scope of work primarily requires assembling asset inventory data in sufficient detail for the SGR tool; using an off-the-shelf tool to perform service type or asset class analyses (e.g., asset value, backlog, needs, performance measures, impact on condition of not funding SGR backlog, sensitivity analyses, and reporting); and introducing maintenance cost data to understand cost of disinvestment of selected assets and the impact on operating costs. The consultant will develop the tool using Microsoft Dashboard (cloud-based).

Through discussions with MTA management, and the consultant, we determined that the MTA is currently in the process of capturing agency asset inventories, developing a project prioritization process, and building asset replacement unit costs. The vision is for the SGR tool to show the adequacy of the figures presented in the 2020-24 Five-Year Capital Plan. For each asset in the inventory, the SGR tool should compute a priority score. The tool also should calculate the consequence of asset failure. Eventually as EAM is developed, the EAM data will feed data into the SGR decision-support tool. At the time of this writing, the consultant intended on "stress testing" the tool's utility against the 2020-24 Five-Year Capital Plan project data.

In our review of other comparable agencies, we noted that other agencies have had some success with implementing an SGR decision-support tool. For example:

- One agency we surveyed replaced a qualitative approach with a quantitative approach to evaluate and prioritize asset needs. They use an advisory committee (CPAC) to determine objective criteria to use. The use of four prioritization criteria to evaluate each project, including asset condition, safety and security, service delivery, and ridership impact. Each of these four factors is weighted to determine a priority score for each asset. Assets are prioritized for replacement/repair based on their priority score.
- One agency we surveyed uses an analytical model that allows the agency to estimate asset rehabilitation and replacement needs and prioritize capital spending for transit infrastructure projects. Given a budget limit, this agency evaluates asset rehabilitation and replacement projects based on certain features and then prioritizes them through an ongoing process that strives to balance capital needs across the entire range of transit services. The approach focuses on three major attributes of each project: asset's age as a percentage of its useful life (which is considered a proxy for service quality), operational impact (yes/no value), and cost-effectiveness. Next, considering the budget limit, the system simulates projects and prioritizes them through scoring and ranking by using a weighted scoring method, which is based on the user-defined weights for the three aforementioned factors. Since in each year the approach only simulates a selection of projects for analysis, the unfunded projects become candidates for the next year.

Criteria

We benchmarked SGR decision-support tool efforts of other comparable agencies surveyed.

The TAM planning process requires a description of analytical processes or decision-support tools that a provider uses to estimate capital investment needs over time and develop its investment prioritization.

Additionally, a provider's project based prioritization of investments, developed in accordance with Section 625.33 must be included in the TAM.

Cause

The MTA and agencies rely heavily on field experience and use legacy manual practices to prepare the TYN and Five-Year Plan and transitioning to use of an SGR decision-support tool is in the early development phase.

Effect

From these manual processes, and without use of an SGR decision-support tool, we found it difficult to determine the basis for agency-level project prioritization.

Recommendation

The MTA's existing business processes are described in the TAM Plan, but through comparison of MTA practices to SGR decision-support tools deployed at benchmarked agencies we have two recommendations:

6a. The MTA should employ an SGR decision-support tool to use for an objective, data driven, risk-based project selection methodology (e.g., as employed by two other agencies we surveyed). The MTA should complete its SGR decision-support tool within the next two years. The SGR Tool will allow MTA to "automatically" run scenarios by including:

- Pre-determined condition settings and measures of SGR
- Costs of asset renewal and replacement, and
- A programming logic that makes "funding decisions" based on the weighting of several project factors.

6b. The MTA should seek opportunities to show near-term progress on the SGR decision-support tool initiative. For example, the MTA should pilot its use at a single agency.

Management Response

Management agrees. The complex inventories and condition assessments that the MTA has used in its capital planning processes have met the FTA's Transit Assessment Management requirements. But as technology continues to evolve and offer more sophisticated solutions, the MTA is incorporating new, leading-edge tools to improve our capital planning processes.

- The MTA expects to make its State of Good Repair (SGR) database decision support tool--which will assist in capital planning by helping to prioritize projects based on objective criteria--operational and available for agency use by the end of 2020. As this is the MTA's initial entrance in this form of capital planning, future uses may evolve from this experience.

- This Decision Support Tool will allow the MTA to run scenarios on the potential impacts of various parameters on asset investment and State of Good Repair (SGR) backlog. Parameters could be adjusted to help indicate optimal funding levels and to portray for decision-makers long-term trends. Lastly, the new Decision Support Tool will allow the MTA to develop data-driven five-year plans in the future by illustrating the connection between asset condition inventory and investment.

Finding #7*:* The MTA can improve the transparency of performance measures and dashboarding to more closely monitor Five-Year Plan and project outcomes

Non-compliance Conclusion: *N/A*
Internal Control Conclusion: *Deficiency*

Condition

We are unclear as to which specific performance measures the MTA will use to measure ongoing progress and successful completion of the 2020-24 Five-Year Capital Plan. Out of the approximately $145 billion that MTA budgeted in capital investments since it began Five-Year Capital Planning in 1982, the MTA has committed $131 billion and thus not committed approximately $14 billion (9 percent) of its budgets (the MTA has a significant body of work in procurement at this time that will utilize much of this $14 billion).

Criteria

The MTA Board and stakeholders desire timely delivery by MTA and agencies on the capital programs and transparent and meaningful reporting of Five-Year Plan progress.

Cause

The MTA internally captures multiple ways to report Five-Year Plan progress including funds committed, funds expended, and completed projects, but this information is not provided in periodic written reports and included on an ongoing basis on the Dashboard.

Effect

Without clear initial measurement expectations, and transparent measures of Five-Year Capital Plan performance, the MTA will be challenged to explain to its stakeholders how it is performing against the original plan.

Recommendation

7a. MTA should prepare formal written quarterly reports going forward on delivery progress of the 5 Year Plan. MTA should define and include transparent measures that capture the effectiveness in MTA's delivery of the 5 Year Plan (both number and dollar value of projects delivered). The MTA Capital Dashboard should provide a macro-level view of the progress that MTA is making toward completion of the 2020-24 Five-Year Capital Plan as well as prior plans. The MTA should provide definitions for what constitutes progress (i.e., funds committed, funds expended, and/or projects completed).

The MTA should continue to report this delivery progress data on the dashboard for each year over the Five-Year Plan with explanations/context for projects remaining to be completed. This will provide a basis for explaining the timing associated with completing the plan. For example, this context will allow the MTA to convey that some projects with beginning dates in the later stages of the Five-Year plan cycle will appropriately be completed beyond the Five-Year timeframe. Note that the 2015-2019 capital program started 1 1/2 years late and the MTA is only 3 1/2 years into the current program.

7b. MTA also should expand use of key performance indicators (KPIs) to report on specific project performance outcomes (e.g., % of projects within X% of initial budget at completion). High level MTA dashboards should reflect the position of each project relative to the original budget and the most recently amended budget to provide accurate portrayals of the project's lifecycle performance with clear reasons for changes over the project lifecycle.

MTA should consider use of earned value management (EVM) tools and data to show the overall integrated impact of project cost and schedule at various stages throughout the stage-gate process.

EVM is a management tool used to evaluate project progress to date in a format that allows management to understand a project's current progress relative to its expected progress factoring in both cost and schedule. The Project Management Institute differentiate this from other management tools as follows: "Earned Value Management, unlike in traditional management, has three data sources:

- budget (or planned) value of work scheduled
- actual value of work completed
- "earned value" of the physical work completed.

Using earned value, a manager uses these three data sources to compare the planned value of work scheduled with the "earned value" of physical work completed and the actual value of work completed."

Management Response

The MTA agrees on the importance of providing performance indicators that summarize our progress against the five-year capital plan. The MTA has a variety of mechanisms for reporting on capital projects and is currently working on both short-term and long-term improvements to our Capital Program Dashboard, which is currently updated quarterly and can be utilized to generate written reports to stakeholders and the public.

- The MTA will develop a new set of metrics that is easier to understand to report on the capital program both project by project and at the macro-level. We will be building on the MTA's current project tracker to make it more comprehensive (include more projects), consistent (the project descriptions today vary in structure and level of detail), updated (several of the pages there are outdated) and user friendly These metrics will be appropriate to the project and program life-cycle, helping stakeholders understand the program and project development and implementation.
- Improvements in project tracking include the mapping of all capital projects on a GIS map that allows for interactive queries of capital work that fosters better understanding of capital project delivery plans from both the customer and MTA perspectives.

Finding #*8:* There are some limitations in MTA capital planning review and approval processes

Non-compliance Conclusion: *N/A*
Internal Control Conclusion: *Deficiency*

Condition

Through our review of the Capital Planning process (Twenty-Year Needs Assessment and 5 Year Capital Planning), Crowe noted the following issues related to review and approval processes:

Twenty-Year Needs

Up until now, the TYN has not gone through a formal final review and approval process. NYS Public Authorities law, section 1269-c, enacted in April 2019 requires the MTA to prepare a 20-year needs assessment. However this requirement is not yet effective and therefore the MTA is not subject to submit a TYN. Additionally, the current TYN is considered "unpublished" at this time.

Five-Year Capital Plan
MTA instructions for the 20-24 program required projects expected to be awarded in the first 6 to 9 months of a Capital Program to be eligible for coverage under a federal award. At this time, Crowe is unable to determine compliance with this internal policy because MTA's cycle for nominating commitments in the first 6-9 months begins in December.

Board Review and Public Comment
The TYN and 5YP capital planning process do not provide adequate timelines for Board and public participation/comment.

We found other comparative agencies schedule more robust opportunities for Board/public review and comment. For example, one agency surveyed allows for public comment on the CIP with public engagement and this agency uses an online comment tool to allow the public to provide input/suggestions on potential transportation projects.

Criteria

MTA Instructions for the TYN and 5YP specify the schedule and approval requirements (refer to Section B-Schedule For Development and Submission).

Cause

The MTA often is under schedule pressure to provide plan TYN and Five-Year Plan updates over the course of a relatively tight schedule. Procedures in place do not allow for review of the Plans prior to their approval and adoption. In addition, timelines have not been adhered to in order to allow for sufficient time to conduct reviews, document changes and seek Board and public input.

Effect

There may not be adequate time for the Board and public to provide thoughtful input into the TYN and 5 Year Plan.

Recommendation

8a. MTA should make the following changes to the capital planning process to address concerns raised above:

- Establish personnel or a governing body to be charged with final review and approval of the Twenty-Year Needs Assessment
- Remove or revise the project nomination cycle policy as compliance has been deemed impossible given the current process
- Provide draft TYN and 5 Year Plan documents to the Board and public 45 days in advance of planned completion. Provide an opportunity for the public to submit comment in written form on the TYN and Five-Year Plan. The MTA should adjust the plan schedules accordingly to allow for this additional review time.

Management Response

As a public authority, the MTA is subject to a number of review processes, including capital programs that must be approved by the MTA Board and the New York State Capital Program Review Board. In addition, the MTA engages in extensive discussions with local elected officials, community members, advocacy and business group representatives about the region's transit priorities in developing the proposed 2020-2024 Capital Program. NYCT's Fast Forward plan, Metro-North's Way Ahead plan, and LIRR's Forward plan—all released in 2018—included extensive public engagement, and provided the material basis for the proposed 2020-2024 Capital Program released in 2019. The MTA agrees there could be improvements to this process.

- The MTA is now required under a recent revision to the Public Authorities Law to submit to the NY State Capital Program Review Board a Twenty-Year Needs for 2025-2044 for review on or before October 1, 2023. The MTA will ensure that this deadline is met.
- Streamlining the project nomination cycle policy will be easier as the MTA unifies the development of its five-year plans. The new requirement that the TYN be submitted 12 months ahead of the five-year plan will also allow for the timely development, submittal and incorporation of bundles of projects into the capital plan with delineation of strategies and benefits. It is anticipated that this will smooth out the plan development and project nomination process for the MTA's 2025-2029 Five-Year Capital Plan.
- The MTA will continue to engage with external stakeholders, solicit their input for project strategies and prioritization, and continue efforts to make documents available to the public in advance of Board meetings to allow for more effective public comment.

Finding #*9:* MTA and agencies do not have comprehensive and fully documented capital planning policies and procedures

Non-compliance Conclusion: *N/A*
Internal Control Conclusion: *Significant Deficiency*

Condition

MTA HQ and agencies have some documented capital planning policies and procedures; however, the MTA and agencies do not have a full set of policies and procedures they use to guide the Twenty-Year Needs Assessment and the 5 Year Capital Plan processes. MTA HQ provides agencies with instructions that document agency roles in development of the TYN and the 5 Year Capital Plan, however, there are limited formal policy/procedure documents at the MTA HQ and agency level.

MTA HQ has not established policies and procedures for the entire capital planning process and how decisions will be made throughout the process. MTA does not have a framework or clear criteria for programming projects in the annual capital budget for fiscal year 2020 to reinforce that capital investment decisions are made using a sound and transparent process.

Agencies do not have their own comprehensive policies and procedures for measuring asset condition, compiling information on asset condition into the asset inventories, and for developing investment strategies and project priorities. Much of the information on these processes is not formally documented and resides with personnel who prepare the various documents for the agency.

MTA also does not have comprehensive asset management policies or procedures that outline asset acquisition, maintenance, disposition, and inventorying. MTA provided some agency level memorandums (dating back to 1992) as supporting documentation for asset management. However, this documentation did not adequately detail the process at the level expected from a standard operating procedure (SOP).

Criteria

The Committee of Sponsoring Organizations of the Treadway Commission (COSO) internal control standards identify the importance of organizations developing policies and procedures to facilitate retention and sharing of organizational knowledge. Leading practices also recommend that organizations have defined processes for ranking and selecting projects for capital funding.

Cause

Comprehensive written policies and procedures have not been considered a priority. With resource constraints, the MTA and agencies have not had the capacity to complete comprehensive policies and procedures.

Effect

As a result of MTA not having comprehensive written, documented policies and procedures for its capital planning process, it is unclear how important parts of the process will work and what forms the basis for MTA's investment decisions. MTA has outlined some high-level policies for the capital planning process and prepared guidance for certain parts of the process. Without documented policies and procedures, including those for ranking and selecting projects, MTA's stakeholders may not have reasonable assurance that the process is objective and unbiased. There is a risk of inconsistent or inaccurate results or omissions due to lack of clarity in roles, responsibilities, and expectations. There also is the potential that assets may not be properly managed from an acquisition, maintenance, disposition, and inventorying perspective.

Recommendation

9a. MTA should develop comprehensive policies and procedures for the 5 Year Capital Plan and Twenty-Year Needs Assessment processes. Policies and procedures should follow a consistent format, reflect key stakeholder inputs, and provide detailed descriptions of all process steps.

9b. MTA also should develop and update policies and procedures for the acquisition, maintenance, disposition, and inventorying of assets both at the agency and organizational levels.

Management Response

We agree that there is room for improvement in terms of breadth and ensuring policies and procedures are comprehensive yet easy to follow. The consolidation of the MTA's capital planning functions into the new Construction & Development unit provides an unprecedented opportunity to completely redefine business processes and documentation.

- As examples, the MTA is now developing new standards and processes for planning studies; standardizing the approach and requirements for the documents needed to get projects contracted out; defining different design-build paths for different projects; improving tracking systems to monitor project schedules and budgets; and developing new procedures for coordinating outages.

5. Appendices

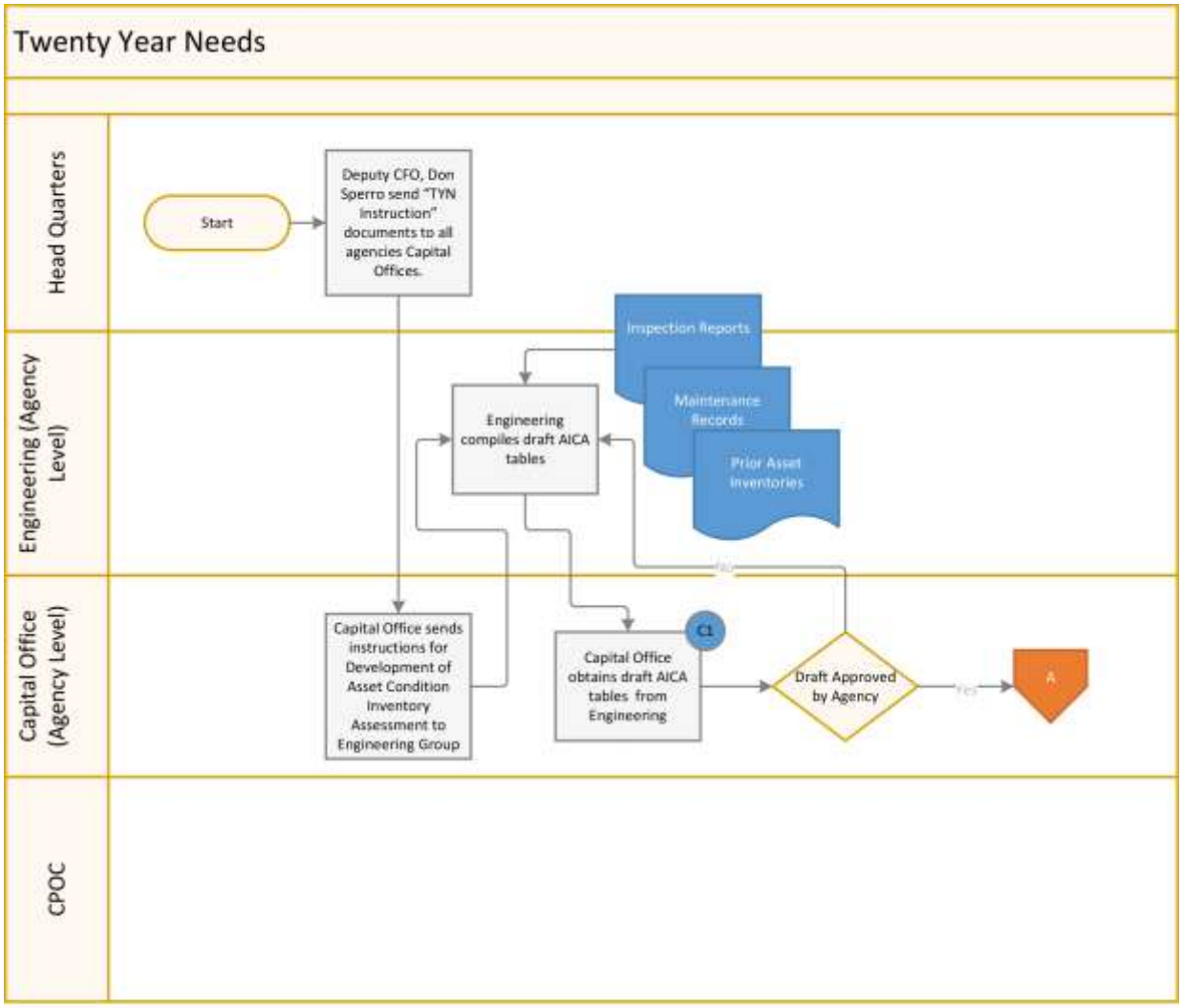
Appendix A. Authorizing Legislation (1279-f)

Below we provide Section 1279-f of the New York Public Authorities Law that provided the basis for this audit.

> *As required by Section 1279-f of New York Public Authorities Law: The MTA "shall contract with a certified public accounting firm for the provision of an independent, comprehensive, forensic audit of the authority. Such audit shall be performed in accordance with generally accepted government auditing standards. Such audit shall include, but is not limited to a complete and thorough examination and detailed accounting of the authority's capital elements, broken down by agency, including, but not limited to: rolling stock and omnibuses, passenger stations, track, line equipment, line structures, signals and communications, power equipment and substations, shops, yards, maintenance facilities, depots and terminals, service vehicles, security systems, electrification extensions, and unspecified, miscellaneous and emergency."*
>
> *The authority shall also contract with a financial advisory firm with a national practice for the provisions of a review of: (a) any fraud, waste, abuse, or conflicts of interest occurring within any department, division, or office of the authority, its subsidiaries, affiliates, and subsidiaries of affiliates; (b) any duplication of functions or duties between the departments, divisions or office of the authority, its subsidiaries, affiliates, and subsidiaries of affiliates; (c) options for potential cost efficiencies and savings that could be achieved through changes in internal controls and management reforms, functional and process streamlining, internal procurement process reforms; (d) the two thousand fifteen to two thousand nineteen capital plan for cost overages and duplication; (e) the development of standardized performance metrics for planning, design, approvals, change orders, project management and delivery; and (f) cash flow and accounting of expenditures of the authority, its subsidiaries, affiliates, and subsidiaries of affiliates for the preceding three fiscal years.*

Appendix B. Process Flow Diagrams

Exhibit B
TYN-1



C1 Capital Office reviews the Asset Inventory provided by Engineering for accuracy and make ratings adjustment if assets are slated for confirmed future projects. .

C2 HQ reviews the Asset Inventory Condition Assessment with a mix of qualitative and quantitative analysis. The extent of the review is up to the HQ reviewer but generally includes assessment for completion, alignment with previously submitted AICA tables, trend analysis, and search for obvious errors

C3 HQ reviews the Investment Strategy with a mix of qualitative and quantitative analysis. The extent of the review is up to the HQ reviewer but generally includes assessment for alignment with AICA tables, alignment with MTA initiatives, ridership impacts

Exhibit B *(continued)*
TYN-2

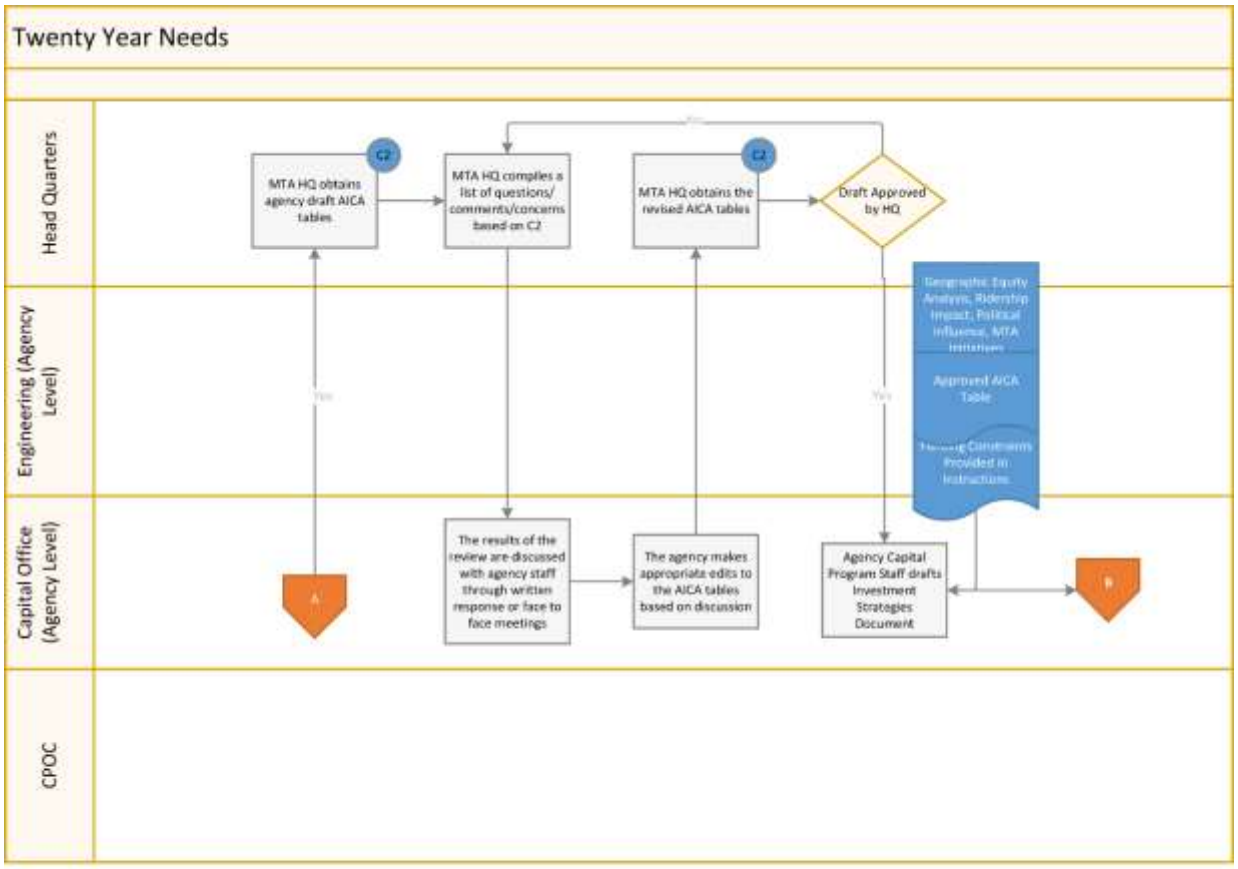


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Exhibit B *(continued)*
TYN-3

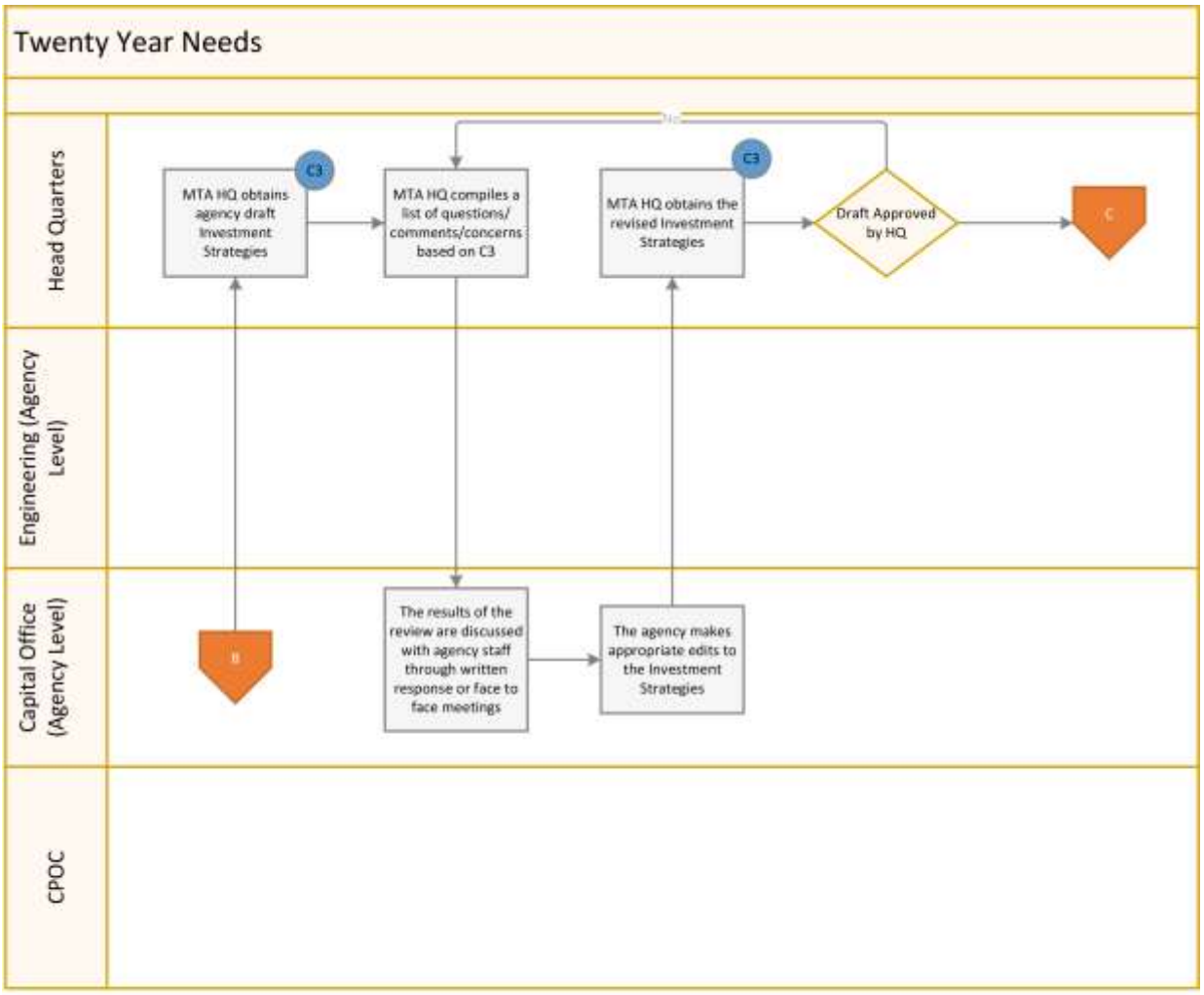

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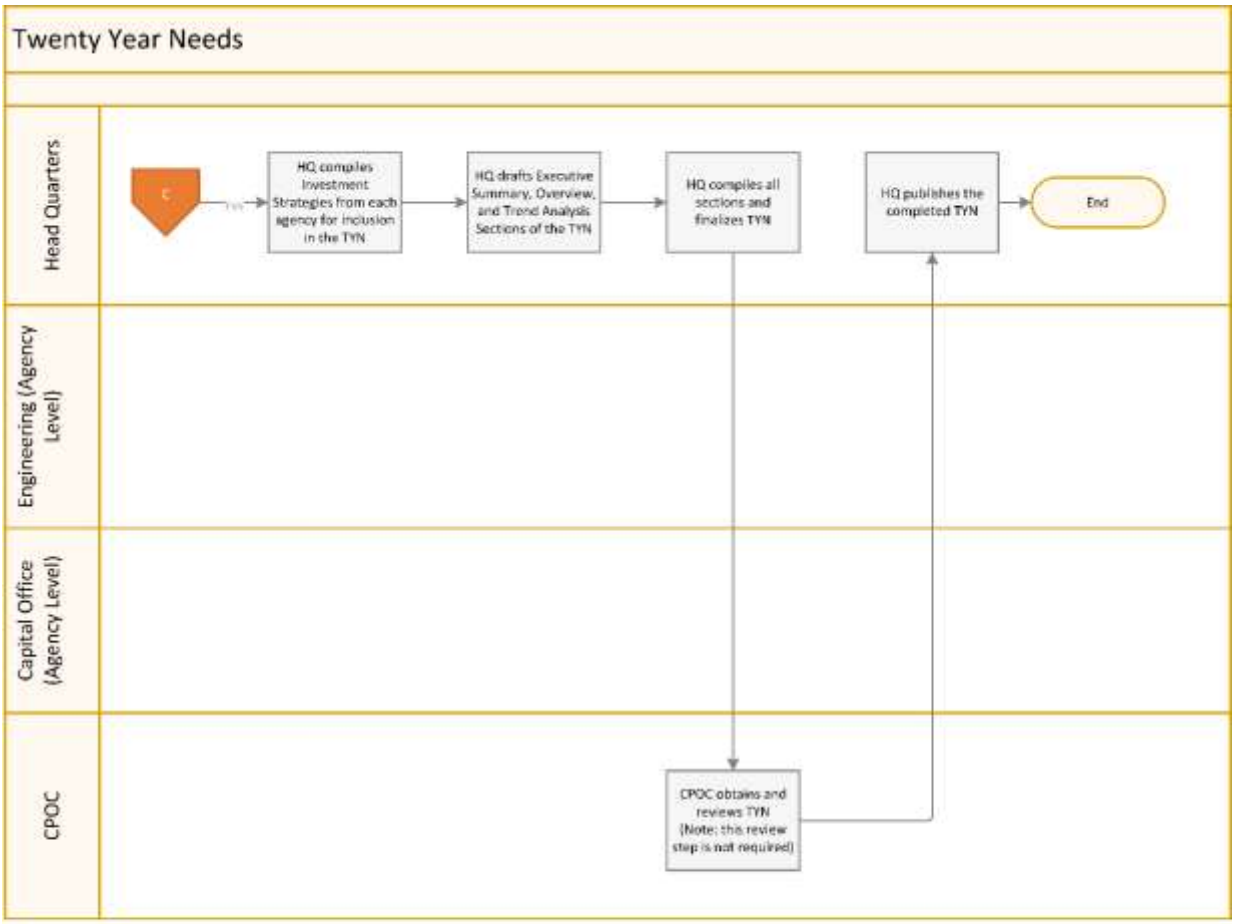
Exhibit B *(continued)*
TYN-4[20]



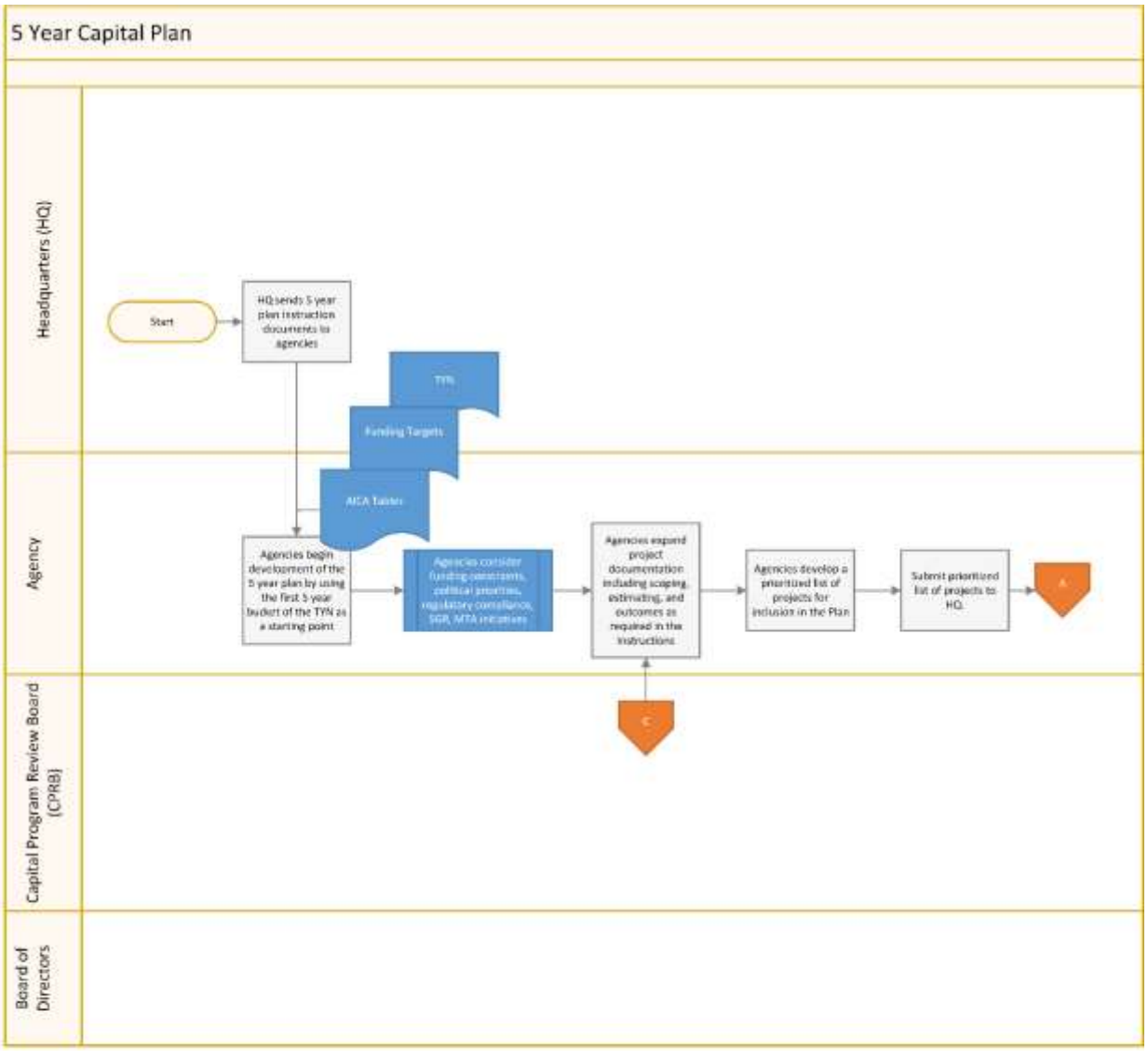
C1 Capital Office reviews the Asset Inventory provided by Engineering for accuracy and make ratings adjustment if assets are slated for confirmed future projects. .

C2 HQ reviews the Asset Inventory Condition Assessment with a mix of qualitative and quantitative analysis. The extent of the review is up to the HQ reviewer but generally includes assessment for completion, alignment with previously submitted AICA tables, trend analysis, and search for obvious errors

C3 HQ reviews the Investment Strategy with a mix of qualitative and quantitative analysis. The extent of the review is up to the HQ reviewer but generally includes assessment for alignment with AICA tables, alignment with MTA initiatives, ridership impacts

[20] It is not a requirement that the CPOC review the TYN.

Exhibit B *(continued)*
5YP-1



C1 The Capital Program Staff present an overview of the proposed Capital Plan to the Board of Directors. The BOD is given opportunity to ask questions and provide commentary. The board then approves or rejects the Capital Plan

C2 CPRB has final approval power over the Capital Plan. After being presented the proposed Capital Plan, CPRB has 90 days to respond with concerns or disapprovals. If they do not respond after 90 days, the plan is deemed approved.

H1 HQ reviews the submitted list of projects for alignment with MTA initiatives, alignment with current funding targets, validity of project scopes and business cases

Exhibit B *(continued)*
5YP-2

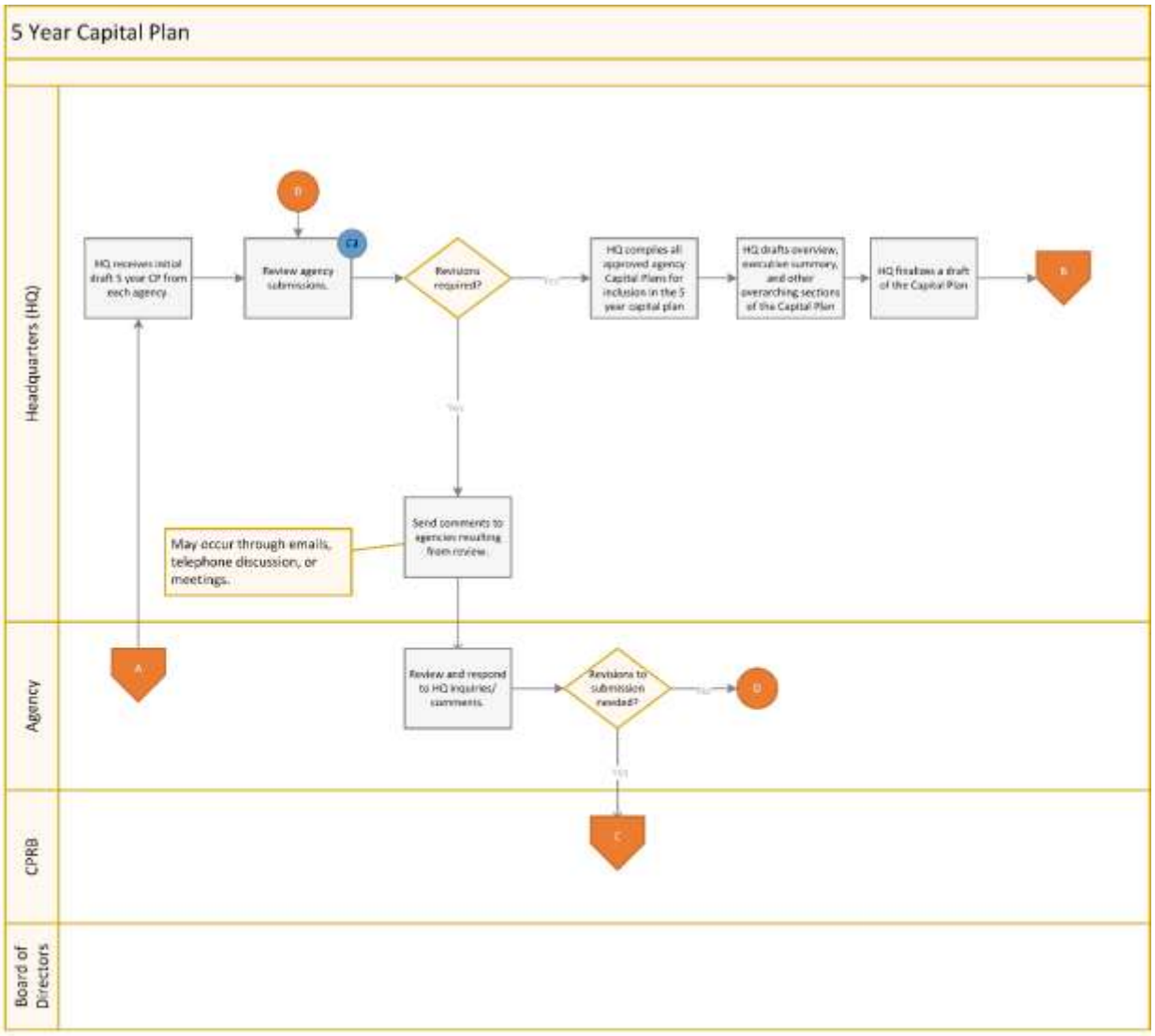


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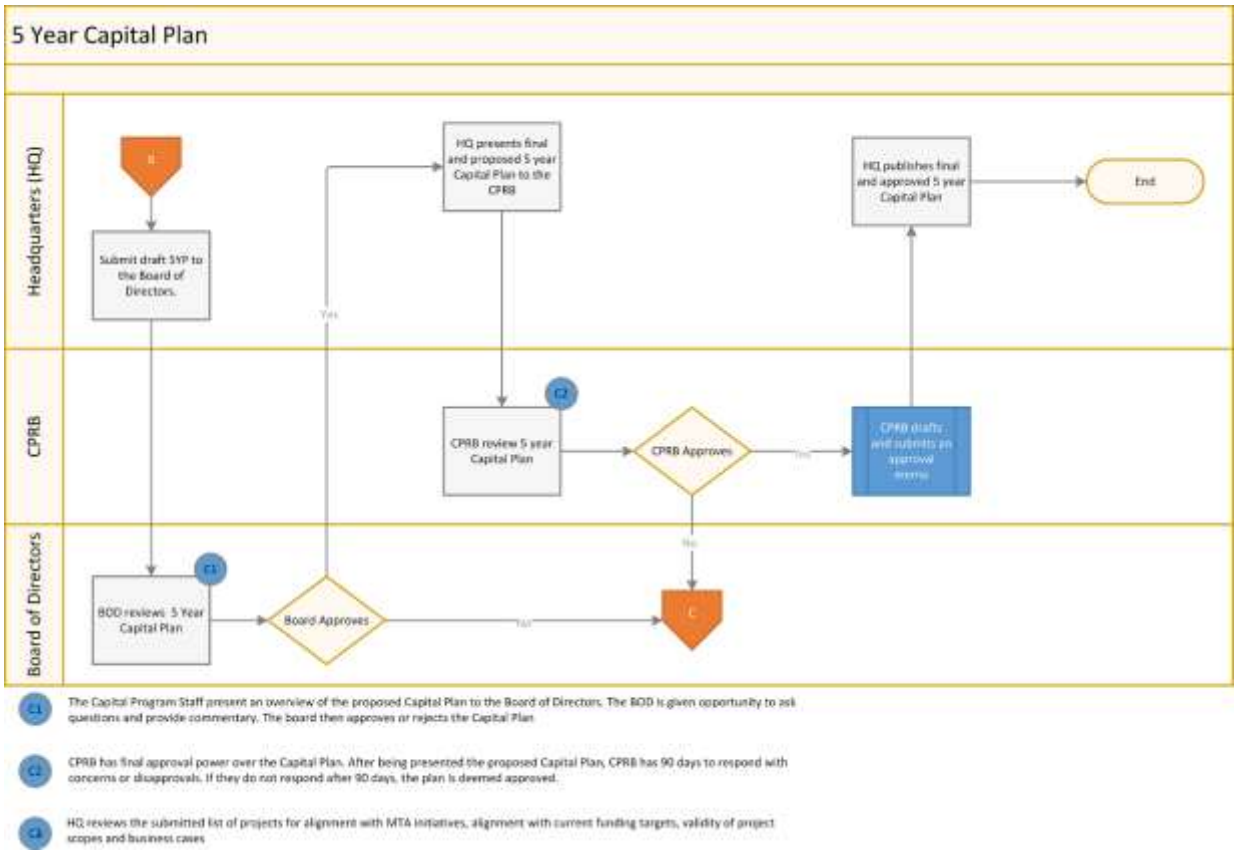
Exhibit B *(continued)*
5YP-3



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C4 HQ reviews the submitted list of projects for alignment with MTA initiatives, alignment with current funding targets, validity of project scopes and business cases

Appendix C. Audit Approach

Section 1279-f and the MTA provided specific objectives for this audit work. Below, we provide a summary of these objectives and our approach to meet these objectives as part of our testing procedures.

Objective 1. Determine whether asset conditions are accurately documented.

Approach

We obtained each agency's asset inventory and condition assessment. We reviewed the asset inventory to determine whether a condition assessment was provided for each applicable asset. We sampled a subset of assets for physical observation. We interviewed agency personnel to understand practices and controls around establishing and reporting asset condition. To determine whether there was sufficient documentation to support the agency's own condition rating, we reviewed inspection reports, maintenance records, and other records that contributed to the condition rating. We compared our determination of the condition rating, based on our physical observation, with that provided by the agency. We assessed whether the asset inspection frequency was consistent with the frequency established by the agency.

Objective 2. Determine whether MTA's condition assessment of current assets warrants the need for replacement and is based on condition standards provided by the MTA.

Approach

We obtained each agency's asset inventory and condition assessment. We reviewed the asset inventory to determine whether a condition assessment was provided for each applicable asset. We sampled a subset of assets for physical observation. We interviewed agency personnel to understand practices and controls around establishing and reporting asset condition. We documented the condition standards provided by the MTA. For assets with condition ratings of 3 or 4, we tested whether our determination of the condition rating, based on the physical observation, matched that provided by the agency and thus merited replacement/repair. For assets with condition ratings of 1 or 2, and that were included in the current 5YP for replacement/repair, we documented whether there was sufficient rationale for the agency to include these assets in the current 5YP (e.g., faster deterioration that expected).

Objective 3. Determine whether MTA's comprehensive policies and procedures are properly designed and implemented for preparation of the Five-Year Capital Plan.

Approach

We obtained and reviewed MTA policies and procedures related to preparation of the Five-Year Capital Plan (5YP). We reviewed instructions provided by MTA to agencies for preparation of the FYP. Through interviews of MTA and agency personnel, we assessed whether the current policies and procedures were sufficient to establish a repeatable and reliable 5YP. We evaluated whether sufficient and complete policies and procedures are available to provide users and stakeholders with adequate information on capital planning processes.

Objective 4. Determine whether the Five-Year Capital Plan complies with applicable laws, rules, regulations, and ordinances, as designated by the MTA and/or Public Authorities Law.

Approach

We documented applicable laws, rules, regulations, and ordinances related to the Five-Year Capital Plan. We incorporated specific requirements related to the current planning process and Five-Year Capital Plan into our workplan and through our substantive testing (sampling of projects) we obtained documentation from MTA and agencies that we used to assess MTA compliance with these laws, rules, regulations, and ordinances.

Objective 5. Determine whether MTA capital planning processes are consistent with industry leading practices using a sample of peer organizations as agreed by MTA.

Approach

We identified several peer organizations through discussions with the MTA. We developed an interview guide and conducted interviews of these agencies (see Appendix E). We also reviewed industry practices described in documents developed by the Federal Transit Administration, National Center for Transit Research, Transit Cooperative Research Organization, and US Government Accountability Office (GAO). We compared MTA capital planning processes with those of peer organizations and leading practices developed by other organizations. We noted differences and, where applicable, presented these as recommendations for consideration by the MTA.

Objective 6. Determine whether the mix of investments and cost ranges included in the 2020-24 Five-Year Capital Plan are based on the Twenty-Year Needs conditions and investment strategies.

Approach

As discussed in Section 2, Item c of this report, we sampled projects proposed in the 2020-24 Five-Year Capital Plan. For this sample of projects selected for testing, we determined whether each project had analytic support (e.g., written scope of work; master plan, proposal profile, feasibility study, or risk profile) and investment strategies that aligned with broad MTA investment strategies. We assessed whether the agency had identified the goals, alternatives, benefits, costs, operating budget impacts and long-term operating significance of the project.

Through review of the Capital Plan, we identified the mix of projects proposed per agency and the associated estimates per agency. Where possible, we benchmarked the cost ranges for various asset types to those of comparable agencies.

Objective 7. Determine whether cost overages and/or duplication of projects occurred in projects related to the 2015-19 Capital Plan and assess whether cost overages and duplications are evaluated and documented by MTA.

Approach

As discussed in Section 2, Item c of this report, we selected a sample projects from the 2015-19 Five-Year Capital Plan with cost overages and requested documentation from the MTA and agency to support the cost overage. These documents included WAR certificates submitted for funding changes, initial/proposed scopes of work, and cost estimates. We reviewed this documentation to determine whether there was sufficient support and rationale for the cost overage. We assessed the 2015-19

project mix within agencies, and across agencies, to determine to what degree if any there were projects in the 2015-19 plan that duplicated each other.

In the exhibit below, we provide a crosswalk of our objectives to the MTA's 16 scope of work tasks. The last three of 16 MTA scope of work tasks relate to reporting so they are not included in this exhibit.

Exhibit C-1
Alignment of Crowe Objectives with MTA Tasks

Crowe Audit Objective	Time Period	MTA Scope of Work Task
1. Determine whether asset conditions are accurately documented.	2020-24	1
2. Determine whether assets currently in-service or in-use warrant replacement, based on standards provided by the MTA.	2020-24	1
3. Determine whether comprehensive policies and procedures are properly designed and implemented for preparation of the Five-Year Capital Plan.	2020-24	5, 11, 13
4. Determine whether the Five-Year Capital Plan complies with applicable laws, rules, regulations, and ordinances, as designated by the MTA.	2020-24	4, 9, 10, 13
5. Determine whether MTA capital planning processes are consistent with industry best practices.	2020-24	3
6. Determine whether the mix of investments and cost ranges included in the 2020-24 Five-Year Capital Plan are based on the Twenty-Year Needs conditions and investment strategies.	2020-24	5, 6, 7, 8, 9, 10, 11, 12, 13
7. Determine if cost overages and/or duplication of projects occurred in projects related to the 2015-2019 Capital Plan and document the reasons for such overages.	2015-19	2

Appendix D. Individuals Interviewed by Crowe

Crowe interviewed a variety of personnel involved in capital planning over the course of this audit. Below is a listing of internal MTA and agency personnel we interviewed:

MTA

- Chairman and Chief Executive Officer
- Chief Financial Officer
- General Counsel
- Deputy Chief Financial Officer
- MTA Comptroller
- MTA Headquarters Director of Capital Program Management
- MTA Headquarters Director of Capital Funding Management
- Director and Program Executive, Enterprise Information and Asset Management
- Acting Director Management & Budget
- Director, Office of Construction Oversight
- Deputy Director Office of Construction Oversight

Bridges and Tunnels (B&T)

- Senior Director Planning, Innovation, and Policy Analysis
- Director, Program Operations
- Director TBTA Planning & Analysis

Long Island Rail Road (LIRR)

- Chief Planning Officer, Strategic Investments
- Chief Engineer, Program Management
- Executive Director, Management & Budget
- Director, Strategic Investments

MNR

- Deputy Director, Capital Planning and Programming
- Assistant Vice President, Capital Planning and Programming

NYCT

- Vice President of Capital Planning and Budget
- Chief, Capital Program Oversight and Performance
- Senior Vice President, Operations Support
- Assistant Chief Officer, Dept. of Subways Capital Programs
- Recovery and Resiliency Manager

MTA Capital Construction

- Chief Development Officer, President of MTA Capital Construction
- Senior Director, Alternative Project Delivery
- Vice President & Chief Financial Officer
- Vice President, Program Controls

MTA Internal Audit

- Assistant Auditor General

MTA Inspector General's Office

- Manager, Office of Inspector General

Appendix E. Peer Agency Benchmarking Profile

Crowe conducted benchmarking interviews with peer transit agencies to identify leading practices in the industry and develop actionable recommendations. Peer agencies were selected for inclusion in the survey by comparing metrics such as age, size, and complexity of the transit system. Crowe interviewed five agencies including Bay Area Rapid Transit (BART), Chicago Transit Authority (CTA), London Underground, Massachusetts Bay Transportation Authority (MBTA), and Washington Metropolitan Area Transit Authority (WMATA). Comparative metrics for these agencies is shown below.

Agency	Ridership (Annual)	Age	Estimated CIP Budget
Bay Area Rapid Transit	120M	47 yrs.	$22B over 15 yrs.
Chicago Transit Authority	470M	72 yrs.	$4.4B over 5 yrs.
London Underground	1.4B	86 yrs.	$12B over 5 yrs.
Massachusetts Bay Transportation Authority	353M	72 yrs.	$8B over 5 yrs.
Washington Metropolitan Area Transit Authority	180M	52 yrs.	$7B over 6 yrs.

We used a standard data collection template and compiled results for analysis and identified trends. We focused interviews on the core areas of: capital planning processes, information systems used in the process, and cost estimating practices. We discuss each of these areas in the remainder of this appendix.

i. Capital Planning Processes

Crowe structured the capital planning process section of the interviews to focus on the specific areas of long-term vision, needs identification, project development and submission, and project prioritization.

Each agency interviewed has developed a process for establishing a long-term view of capital needs and ensuring that the agency takes steps to maintain the system in a state of good repair. This process either comes in the form of long-term strategies similar to those implemented by MTA or a completely unconstrained Capital Needs Inventory (CNI) that catalogues all future capital needs. Development of planning documents with a long-term focus indicates the importance of thinking about the future and understanding how short-term investments affect the needs of the system in the future.

Needs Identification across agencies begins with assessing the current state of the assets in the system and the new needs of the community the agency services. The frequency of updates to asset inventories varies across agencies and within agencies across asset classes. The level of sophistication in the condition assessments also varies with some assessments largely useful life based and others based on updated maintenance and inspection reports.

The process for developing a short-term capital plan varies across agencies in many ways including length, time between plans, prioritization, and execution. Several process trends are summarized in the table below.

Trend	Recommendation	Outcomes
4 of 5 agencies interviewed prepare their Capital Plan on a rolling annual basis	Formalize the Capital Plan amendment process to require an annual amendment to the Capital Plan	Allows for continuous review, refinement, and adaptation of the Five-Year Capital Plan.
4 of 5 agencies interviewed utilize a standardized project submission form to be considered for inclusion in a Capital Plan	Develop a standard project form that is mandatory for inclusion in the Capital Plan	Establishes a minimum level of detail required for a project to be included in the Capital Plan. Increases comparability across projects in the project prioritization phase.
4 of 5 agencies interviewed use a standardized quantifiable project prioritization process to serve as a starting point for qualitative considerations	Develop a quantifiable project prioritization system with measurable/ assessable objective criteria	Establishes a clear set of priority projects for further analysis by Capital Planning staff.

One agency included in our survey prepares a five-year capital plan on a rolling annual basis. The key steps in the process include:

1. Analyze funding sources for the next Five-Years and project available funding over that time horizon.
2. Establish dollar value program sizes by the Project Selection Advisory Committee. Programs are department based (i.e., buses, rail, stations)
3. Project Selection Advisory Committee sets criteria for project selection.
4. Departments set additional criteria relevant to their asset class.
5. A call for projects is sent to each department and the departments submit projects using a standardized submission form.
6. Small cross functional teams are assigned to score and rank all projects in a single program using the previously established criteria.
7. Scoring provides an initial prioritization for further review and editing by management to account for agency initiatives.
8. Conduct community outreach monthly for feedback and input from the public.
9. Present to the board of directors monthly for feedback and input.
10. Consolidate feedback and information into a fully developed Capital Plan.

The process of this agency stands out in several key ways that we believe could be beneficially applied to the MTA.

- Steps 3 and 4: The agency selects and defines key criteria to be used in the selection process. This allows for easy project prioritization when it is time to make selections and also forces department staff to think critically about the needs of their department and identify criteria that will best address those needs
- Step 5: The agency utilizes a standard submission form. This provides a guaranteed minimum level of available information for evaluation and each department is able to identify which projects will need to be further developed before submission.
- Steps 6 and 7: The agency scores each project. An objective scoring system allows for each project to be evaluated fairly and provides a baseline prioritization for further discussion with management.

ii. Information Systems

The information systems section of the interview was structured to focus on the state of asset management systems related to capital planning and use of specialized tools to aid in the capital planning process.

Enterprise Asset Management (EAM) is a comprehensive asset inventory solution. Each agency interviewed indicated that they had implemented, or were in the process of implementing, a single comprehensive asset management system. Benefits of EAM include having a central repository of all capital assets, a system where the operations/maintenance and capital side of asset management can interact more effectively and provide better data management.

The FTA required each transit agency to develop a Transit Asset Management (TAM) plan beginning in 2018. A requirement of the TAM plan is to identify and utilize a tool for decision support in the capital investment process. The requirements of this tool are generic, but the industry trend is to develop a software-based decision tool. These tools are often used to generate a quantitative score for each asset in the system to aid in the prioritization of capital dollars. A total of 4 of the 5 agencies interviewed indicated they use a software-based tool. As discussed above, one agency implemented a custom criteria-based scoring system, another agency implemented a risk-based scoring system that factors the risk of an asset failing and the impact failure would have on the system, and another agency implemented a weighted average scoring system that considers multiple criteria to prioritize investments.

iii. Cost Estimating

Cost estimating practices for purposes of inclusion in a capital plan are generally high level. Several agencies use order of magnitude historical data and adjust for inflation as necessary. The level of detail in cost estimates included in a capital plan varies based on the availability of similar prior project cost data and the level of scope/design at the time of proposal. All agencies indicated that as scope was refined, and the level of design increased, the cost estimate would become significantly more accurate.

Appendix F. Prior Audits Related to MTA's Capital Program

As a part of our procedures, Crowe obtained prior audits related to MTA's capital planning program and the related management responses to prior audit findings. Crowe evaluated the findings and considered matters pertaining to the capital planning process at the MTA and corrective actions implemented, in our overall audit risk assessment to determine our methodology and approach to the audit objectives and underlying audit procedures.

We have provided a list of audits by source, either the MTA Management (MTA HQ Internal Audit), MTA Office of the Inspector General or the New York State Comptroller that we deemed to be related to the MTA's capital planning process in this Appendix. While each audit's scope was broader than the capital planning process at the MTA, there were elements of the capital planning process that were impacted. We considered these impacts as we developed our audit procedures.

Crowe performed a review of previous findings pertaining to the MTA's capital planning program. Crowe evaluated whether MTA has taken appropriate corrective action to address findings and recommendations from previous audits that were deemed significant to the audit objectives. We inquired of MTA and agency management to identify relevant audits directly related to the objectives of this audit and obtained information from MTA and agency management regarding the status of implementation of audit recommendations. We used this information in assessing risk and to determine the nature, timing and extent of the audit procedures.

Through inquiries of MTA management eight (8) audit reports pertaining to the MTA's capital planning process were identified. The audits identified included audits performed by the Internal Audit Department of the MTA, the MTA Office of Inspector General and the New York State Comptroller's Office within the past 5 years. Within those audits there were over 60 audit recommendations with some pertinence to the MTA's capital planning process. MTA or agency management provided an update on the status of corrective actions taken by management. Crowe used the applicable audit findings and recommendations to develop audit procedures particular to our audit objectives, but we did not test the implementation of the corrective actions because the audit objectives were confined to the capital planning processes of the MTA. However, during the performance of our audit procedures, Crowe noted certain circumstances similar in nature to the findings and recommendations in the previous audit report. Where such items were noted Crowe commented in Appendix F, Prior Audits Related to MTA's Capital Program.

The summary in this Appendix provides information about prior audits and findings related to the capital planning process at the MTA. Certain matters previously reported in audits to management of the MTA or agencies related to capital planning have been noted during our audit procedures and have been noted as findings in Crowe's Report. A summary of those matters can be found in section iii of this Appendix.

i Audit Reports

Crowe reviewed eight reports total, which were provided to Crowe by MTA Management, the Office of the Inspector General, or the State Comptroller. Below is a listing of the reports received and their respective office:

a. MTA Management (Internal Audits)
    i. Audit of Structural Inspections and Repairs (MTA-14-067)
    ii. Audit of MNR Track Inspection & Maintenance (MTA-16-012)
    iii. Long Island Rail Road – Audit of Track Inspections (MTA-16-109)
    iv. Audit of MNR Power Operations (MTA-18-104)

b. Office of the Inspector General
    i. Accuracy of Reporting on Disadvantaged Business Enterprise Participation in MTA Contracts (#15-05)

ii. Estimating Overhead and Profit on Material Equipment Costs in Change Orders (#15-20)
iii. NYCT Estimates of Change Orders (#2018-24)

c. State Comptroller
   i. Selected Aspects of Capital Program Project Management (2018-S-15)

ii. Findings, Recommendations and Corrective Actions

Crowe reviewed the reports listed above, noted the corrective actions recommended and received responses from MTA Management and the Office of the Inspector General regarding the status of the recommended corrections. See below for a summary of the prior findings, as well as generalized responses to the recommendations:

1. **MTA Management (Internal Audits)**

   MTA Management was given 40 separate recommendations over the four reports noted above. Recommendations included requiring more robust inspection standards and better strategizing around workforce needs. MTA has been in the process of implementing these recommendations starting in 2014 and is still in the process of implementing several recommendations today, according to management. See below in part iii. for our analysis of prior recommendations, and how they relate to our current findings.

2. **Office of the Inspector General**

   The Office of the Inspector General provided 15 separate recommendations over the three reports noted above. Recommendations included the use of prime contractors', timeliness of reporting, subsequent modifications of reports, and procedures surrounding cost estimates. However, Crowe noted that report NYCT Estimates of Change Orders (#2018-24) was not a formal audit, rather the report was used for discussion regarding post Hurricane Sandy procedures, and so formal implementation procedures were not adhered to. Also, OIG did not accept the recommendation to develop standard construction contract terms to be used agency-wide. OIG was in the process of implementing accepted recommendations in 2015 and 2016. See below in part iii. for our analysis of prior recommendations, and how they relate to our current findings.

3. **State Comptroller**

   The State Comptroller provided 6 separate recommendations in one report. Recommendations included creating more policies around contractors and their associated costs and workforces, correcting design errors, and performing analysis over prior data collected. Crowe noted that certain items were not accepted by MTA management, and others were noted that the agency complies with the recommendations as of 7/29/2019. See below in part iii. for our analysis of prior recommendations, and how they relate to our current findings.

iii. Follow-up on Prior Related Findings

Upon the receipt of updates to corrective actions to the recommendations, Crowe compared prior findings and recommendations with results of Crowe's audit procedures. A total of 18 prior MTA and OIG audit recommendations (none from the State Comptroller) align with Crowe's current findings, which are provided in more detail below:

1. MTA Management's Repeated Findings:
   a. Develop appropriate inspection standards to identify when conditions exist that may warrant a higher defect rating when viewed collectively rather than solely based on individual defects. Crowe noted instances during our audit procedures. (See Finding #4)
   b. Instruct inspectors on appropriately completing the inspection reports. Crowe noted some

incomplete documentation during our audit procedures. (See finding #4)

c. Retain defect source records for the required duration as instructed in NYCT's record retention policy and instruction. Crowe noted some incomplete documentation of defects during our audit procedures. (See finding #4)

d. Develop a proposal for the full roll out of the structures inspection and repairs system for the remaining types of structures. Crowe noted that policies and procedures should be more formally documented, and systems should be improved to enhance the capital planning process. (See findings #4 and #9)

e. Consider the feasibility of documenting when inspections are performed whether defects are found or not. Crowe noted some missing documentation of inspections during the performance of our procedures. (See finding #4)

f. Enforce the requirements that all inspection reports be subject to supervisory sign off to ensure that defect ratings are consistent with the private investigator (PI) descriptions. Crowe noted some inconsistencies with the conditions (defect ratings) of some assets in the agencies' records. (See finding #4)

g. Infrastructure should develop a plan for addressing Subways operating defects to supplement the repair work to be covered under the capital program. Crowe noted that there was not enough documentation to understand the link between asset conditions and the inclusion of assets in the capital plans. (See finding #3)

h. Establish a process to monitor outstanding defects to ensure that they are addressed in a timely manner. Crowe noted inconsistencies, insufficient information and lack of underlying support to support some details in agencies asset condition databases. In addition, a process to monitor outstanding defects should be established to ensure that they are timely addressed as required. (See finding #4)

i. Conduct a pilot program and use the results to determine if requiring remedial actions for conditions should not be documented on inspection reports, and justification be documented when conditions are determined to be non-reportable without remedial action. Crowe noted that there were some missing linkages in documentation on inspection reports and asset condition databases. (See finding #4)

j. Coordinate with subdivision management to ensure that inspection reports are accurate. Crowe noted inconsistencies between inspection reports and databases, therefore, we could not determine that inspection reports were reviewed for accuracy. (See finding #4)

k. Reinstruct Track supervisors to mark inspection reports with "Monthly Inspection" when they perform such inspections. Crowe noted inconsistencies in some of the inspection reports and datasets, therefore, we could not determine if inspection reports were reviewed for accuracy. (See finding #4)

l. Coordinate with subdivision management to ensure that inspection reports are complete with all required information and signatures. Crowe noted inconsistencies in some of the inspection reports and datasets, therefore, we could not determine if inspection reports were reviewed for completeness. (See finding #4)

m. Require employee ID numbers on inspection report forms. Crowe noted inconsistencies in some of the inspection reports and datasets, therefore, we could not determine if inspection reports were reviewed for completeness. (See finding #4) 37

n. Require Track Supervision to place their initials on the Supervisory Signature line to record the date of their review on the Track Inspection Card. Crowe noted inconsistencies in some of the inspection reports and datasets, therefore, we could not determine if inspection reports were reviewed for completeness. (See finding #4)

o. Consider documenting the periodic track inspection audits ensure quality, consistency and adherence to LIRR Engineering Practices required by internal procedures. Crowe noted

inconsistencies in the documentation of asset conditions. (See finding #4)

p. Comply with the inspection requirements for Annual Switch Inspections and retain the document. Crowe noted inconsistencies in the documentation of asset conditions. (See finding #4)

q. The department has strategized maintenance as fourth to the priorities of Operation response, Capital Program, and Life Safety Initiatives. Since performing the established schedules per the prescribed Standards of Maintenance will also address the Operation reliability and safety, it is recommended that required resources and monitoring be allocated to it for maintaining "State of Good Repair". Crowe noted details for asset conditions were not always sufficiently documented and the classification of assets as SGR or NR was not clearly documented. (See finding #4)

2. Office of the Inspector General

MTA Procedure PMP 207 requires that internal estimates must be prepared prior to the receipt and submittal of the general contractor’s proposal unless the proposal accompanies a contractor’s change order request. Crowe noted that there was a lack of adherence to cost estimating procedures and best practices for projects included in the MTA’s 5YP. (See finding #1)

Appendix G. Mega Project Descriptions

Exhibit G-1
MTA Mega Projects[21]

Mega Project Profile
East Side Access (ESA) – East Side Access will provide Long Island Rail Road Main and Port Washington Line customers with direct access to Midtown Manhattan's East Side at Grand Central Terminal. The connection will follow a new route from the LIRR mainline in Sunnyside, Queens into a newly constructed 5,500-foot tunnel that leads to the lower level of an existing tunnel crossing under the East River at 63rd Street. Once in Manhattan, the route then follows 5,000 feet of new tunnels under Park Avenue into a new 8 track, 4 platform, two-level LIRR terminal located below the existing lower level of Grand Central Terminal. **Current Budget: $10.335B**
Second Avenue Subway (SAS) Phase 2 – Second Ave Subway Phase 2 will extend Q train service from the existing 96th St Station to 125th St, with intermediate stops. The alignment will continue from the northern limit of the SAS Phase 1 at 105th Street, proceed north under Second Avenue, and then turn west along 125th Street, with storage tracks extending beyond 5th Avenue. SAS Phase 2 will utilize a tunnel segment built in the 1970s from 110th Street to 120th Street, which will be outfitted with tracks and other essential equipment. Three new stations will also be constructed at 106th Street, 116th Street, and 125th Street. **Budget Description:** The budget values reported here refer to the only portion of SAS Phase 2 that is budgeted in the 2015-2019 Capital Program. The full cost of the project remains to be determined and is anticipated to be budgeted across multiple capital programs. **Current Budget: $1.735 Billion**
Penn Station Access (PSA) – Penn Station Access will open a new Metro-North Railroad link directly into Penn Station New York from the New Haven Line in Westchester and the State of Connecticut. Four new Metro-North stations will be built in the Bronx-near Co-op City, Morris Park, Parkchester/Van Nest, and Hunts Point. These stations will bring increased regional accessibility by offering rail service that connects eastern Bronx communities to Manhattan and to the New York and Connecticut suburbs. In addition, the stations will provide area residents with better access to jobs, shopping and entertainment **Current Budget: $695M**
LIRR Expansion – The LIRR Expansion Project is a key element of the Governor's initiatives to transform and expand our vital regional transportation infrastructure so that we may strengthen our local economy, create jobs, enhance our environment, and protect Long Island's future. The project will construct a third track along a critical 9.8-mile section of LIRR's Main Line, between Floral Park and Hicksville Stations. The addition of a third track will increase track capacity through the corridor making it easier to run trains, which will improve service reliability and make transit more attractive. The scope of work for the Project also includes eliminating seven grade crossings (street-level train crossings), constructing up to five parking garages, constructing retaining walls, relocating utilities, fencing, improving stations and constructing new station platforms, along with measures to reduce impacts on adjacent communities such as sound attenuation barriers and landscaping. **Current Budget: $2.050 Billion**

[21] Budgets identified in this exhibit include cumulative funding from prior capital programs.