City of New York

OFFICE OF THE COMPTROLLER

Scott M. Stringer
COMPTROLLER

AUDITS AND SPECIAL REPORTS

IT AUDIT

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Deputy Comptroller for Audit

Audit Report on the Department of Education's Implementation of High Speed Internet Connectivity in New York City Public Middle Schools

SI16-082A

May 19, 2017

http://comptroller.nyc.gov

THE CITY OF NEW YORK
OFFICE OF THE COMPTROLLER
SCOTT M. STRINGER

May 19, 2017

To the Residents of the City of New York:

My office has audited the New York City Department of Education's (DOE's) implementation of high speed internet connectivity in public middle schools to determine whether it was on schedule and meeting its intended goals.

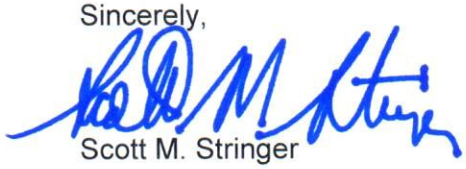
We found that every New York City public middle school had fiber optic connections to support high speed internet. However, we also found that during its broadband upgrade initiative, DOE failed to put adequate controls and oversight in place to ensure that the system-wide upgrade was completed properly, within budget, with appropriate documentation, and with adequate managerial oversight. DOE lacked documentation of the execution and cost of the broadband upgrade. During the audit, DOE represented that it did not have any project plans, implementation schedules, and progress reports to document the steps taken, rate of progress and total cost of the upgrade initiative from its inception in 2007 through its completion in 2016. Without such records, we are unable to determine whether DOE's implementation of high speed internet connectivity for middle schools was completed on schedule and within budget.

In addition to these findings, we conducted a user satisfaction survey. In response to that survey, 33 percent of the responding middle school principals and staff reported that they were not satisfied with the current internet service, 45 percent stated that the speed of the internet service in the middle schools did not meet their instructional needs, and 25 percent responded that the internet service availability in their schools was inadequate.

The audit made nine recommendations, including that DOE should maintain a project governance structure for information technology projects and ensure that its Enterprise Project Management Office follows proper project management standards and methodologies for all current and future IT projects. In addition, the audit recommends that DOE should develop a formal records retention policy and schedule that ensures the future availability of necessary records for as long as they are needed. The audit further recommends that DOE should ensure that school Principals and their designated Single Points of Contact are aware of how to effectively request a bandwidth upgrade, and what the criteria are for receiving one.

The results of the audit have been discussed with DOE officials, and their comments have been considered in preparing this report. Their complete written response is attached to this report. If you have any questions concerning this report, please e-mail my Audit Bureau at audit@comptroller.nyc.gov.

Sincerely,



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SI16-082A

EXECUTIVE SUMMARY

We audited the New York City (the City) Department of Education's (DOE's) implementation of high speed internet connectivity in public middle schools to determine whether it was on schedule and meeting its intended goals. DOE provides primary and secondary education to over one million students from pre-kindergarten through grade 12 in over 1,800 schools in 32 school districts and employs approximately 75,000 teachers. As of May 2016, 503 of DOE's schools were reported to be providing educational services to middle school students (students in 6th through 8th grades). As its principal mission, DOE prepares students to meet grade-level standards in reading, writing and math, and prepares high school students to pass Regents exams and to meet graduation requirements.

According to DOE, it began to upgrade the broadband technology in the schools in 2007. At that time, the agency commenced the process of installing fiber optic cabling, connections, and network components required to support higher data rates. DOE's goal was to provide high speed internet connectivity and install wireless technology in all of the City's public schools and thereby deliver improved connectivity and performance, enhanced access, capacity, and security.

Audit Findings and Conclusions

Our audit found that every New York City public middle school had fiber optic connections to support high speed internet. However, we also found that during its broadband upgrade initiative, DOE failed to put adequate controls and oversight in place to ensure that the system-wide upgrade was completed properly, within budget, with appropriate documentation, and with adequate managerial oversight. DOE lacked documentation of the execution and cost of the broadband upgrade. During the audit, DOE represented that it did not have *any* project plans, implementation schedules, and progress reports to document the steps taken, rate of progress and total cost of the upgrade initiative from its inception in 2007 through its completion in 2016. Without such records, we are unable to determine whether DOE's implementation of high speed internet connectivity for middle schools was completed on schedule and within budget.

In addition to these findings, we conducted a User Satisfaction Survey. In response to that survey, 33 percent of the responding middle school Principals and staff reported that they were not satisfied with the current internet service, 45 percent stated that the speed of the internet service in the middle schools did not meet their instructional needs, and 25 percent responded that the internet service availability in their schools was inadequate.

Audit Recommendations

To address these issues, we made nine recommendations, including that DOE should:

- Maintain a project governance structure for information technology (IT) projects and ensure that its Enterprise Project Management Office (EPMO) follows proper project management standards and methodologies for all current and future IT projects.
- Maintain a system for archiving standard project documents and artifacts.
- Develop a formal records retention policy and schedule that ensures the future availability of necessary records for as long as they are needed.
- Develop and maintain written Network Operations Center (NOC) policies and procedures for assigning and adjusting school bandwidth.
- Ensure that the users' concerns identified in the User Satisfaction Survey and comments that we provided to DOE are appropriately addressed and that the annual survey sent to Principals includes questions concerning user satisfaction with high speed internet connectivity.
- As part of the bandwidth utilization process, consider whether low utilization might be caused by users' experiencing delays, slowness, and unreliability of their schools' high speed internet connectivity. The criteria for a bandwidth upgrade should also take into account school staff input and not rely solely on bandwidth utilization reports.
- Proactively partner with schools to offer technology reviews to ensure that DOE staff better understand their requirements, offer appropriate technical solutions, estimate proper bandwidth provisioning, and ensure that schools have adequate technology available to accomplish their instructional goals.
- Ensure that school Principals and their designated Single Points of Contact (SPOCs) are aware of how to effectively request a bandwidth upgrade, and what the criteria are for receiving one.
- Provide additional resources to DOE's technology divisions to improve communication, strengthen the quality of customer service, and increase customer satisfaction.

Agency Response

In its written audit response, DOE summarized its efforts and the progress it has made to meet the "demand for bandwidth [that] continues to exceed supply." DOE additionally claimed that it has already implemented most of the audit recommendations "before the audit." However, DOE's response fails to address the hundreds of millions of dollars it spent for the broadband upgrade without having adequate controls in place to ensure that the upgrade was completed properly, on time, adequately documented, and within budget. DOE explained its failure to produce requested basic documentation such as project plans, implementation schedules, and progress reports by

contending that “there was no overarching ‘initiative for middle schools’. Rather a series of activities, underwritten by various funding sources, was undertaken separately over time to address bandwidth needs for all DOE schools, not middle schools in isolation.” However, this response does not address one of the audit’s central findings – that DOE failed to appropriately plan, monitor, document, and manage its broadband initiative. Had it done so, it would have been able to produce the basic project data requested by the auditors, whether or not the upgrade was organized by building or by school. Indeed, DOE’s response highlights the fact that when it undertook the initiative to bring high speed connectivity to all DOE schools, it did not have a comprehensive plan, uniform minimum controls, standards for documentation, or central oversight.

DOE further noted that its Division of Instructional and Information Technology (DIIT) “has created a dedicated Enterprise Project Management Office (EPMO), which includes an IT Governance Officer.” Under the new structure, EMPO “Portfolio Managers, are charged with ensuring that projects follow new, standards-based policies and procedures and maintaining a records system for archiving standard project documents.” While we noted in the audit report that the EPMO was established to create central oversight of IT projects, we also noted that the EPMO was never given oversight of the middle school broadband upgrades. As a result, there was never central planning and oversight of the broadband upgrade initiative, and DOE had no assurance that acceptable methodologies were utilized in the upgrades, that the implementations were properly documented, or that relevant documents were retained in accordance with appropriate document retention policies.

Finally, rather than pledging to follow-up on the concerns raised by DOE staff in the audit’s User Satisfaction Survey, DOE rejects the notion that its communication with staff could be improved. Rather, it contends, with no proof or logical reasoning, that “school-based respondents were confused by the phrasing of the auditors’ User Satisfaction Survey question about bandwidth upgrades.” We find DOE’s response to be unpersuasive. We remind DOE that the auditors submitted the User Satisfaction Survey to DOE’s Deputy Auditor General prior to its distribution for review and approval and the Deputy Auditor General specifically approved its contents after making a few modifications. In addition, the User Satisfaction Survey was sent to all New York City public middle school Principals and SPOCs, the individuals who are responsible for the day-to-day information technology activities in the schools and are exactly the people who would have the knowledge of what is working and what is not working in the schools. Thus, we find DOE’s contention that the Principals and SPOCs were confused by the survey implausible and we urge DOE to seriously consider and respond to the information provided by its own staff in response to the survey.

AUDIT REPORT

Background

DOE provides primary and secondary education to over one million students from pre-kindergarten through grade 12, in over 1,800 schools, located in 32 school districts. DOE employs approximately 75,000 teachers. In May 2016, DOE reported that it was providing educational services to middle school students—students in 6th through 8th grades—in 503 schools.[1] As its principal mission, DOE prepares students to meet grade-level standards in reading, writing and math. DOE also prepares high school students to pass Regents exams and to meet graduation requirements.

One of DOE's key goals is to ensure that its schools have high speed internet (broadband) connectivity that can support fast and consistent internet service to ensure the provision of high quality educational services and to support school functions. According to the Federal Communications Commission's (FCC's) National Broadband Plan issued in March 2010, "broadband can enable improvements in public education through e-learning and online content, which can provide more personalized learning opportunities for students."[2]

DOE's DIIT supports the City's schools by overseeing and supporting technology infrastructure, architecture, security, and the scalability of DOE's IT networks. DIIT also provides guidance on social media use, establishes technology policy, and maintains the privacy of personally identifiable information. In March 2009, DIIT established its NOC, which is responsible for managing and maintaining network health and ensuring optimal bandwidth utilization. The NOC uses multiple procedures to detect potential IT infrastructure failures and is staffed with network analysts, technology specialists, and engineers capable of assisting with all critical IT infrastructure issues.

DIIT noted in its *Five Year Information Technology Strategic Plan* for Fiscal Years 2010-2014 (issued in 2009) that just a few years earlier, students primarily used wired desktop computers to access the internet. However, over a relatively short time the demand for wireless technology in schools grew significantly due to the use of a myriad of wireless platforms, including laptops, tablets, smartphones, and eBook readers. As the demand for and use of wireless devices expanded, the increased network traffic eventually overwhelmed DOE's former Frame Relay technology, which had a maximum bandwidth (data rate) of 1.5 megabits per second (Mbps).[3]

According to DOE, it began to address its need to upgrade its broadband technology in 2007.[4] Among other actions, the agency commenced the installation of the fiber optic cabling, connections, and network components required to support higher data rates. DOE's goal was to provide high speed internet connectivity and wireless technology in all of the City's public schools.

[1] The 503 schools include schools that only teach middle school grades, schools that teach both middle school grades and other grades, and middle schools that are co-located in buildings with other schools that teach other grades.

[2] The FCC is the United States government's primary authority for communications laws, regulation and technological innovation.

[3] Frame Relay is a packet-switching telecommunication service designed for cost-efficient data transmission for intermittent traffic between LANs and between endpoints in wide area networks (WANs).

[4] The fiber optic cabling upgrades were necessary due to the schools' previous bandwidth capacity of 1.5 Mbps. In July 2010 the FCC defined high speed internet service as having actual download speeds (data retrieved from the internet) of at least 4 Mbps and actual upload speeds (data sent across the internet) of at least 1 Mbps. In January 2015, the FCC's high speed internet benchmark increased to actual download speeds of at least 25 Mbps and actual upload speeds of at least 3 Mbps. We used the July 2010 FCC standard to define high speed internet service because it was in effect at the time this audit was initiated.

By doing so, DOE sought to deliver improved connectivity and performance through enhanced access, capacity, and security.

DOE did not provide the auditors with any dollar amounts budgeted or expended from the onset of the broadband initiative in 2007 through 2009. However, for Fiscal Years 2010 through 2014, DOE's executive budget reflects that $926.8 million was budgeted for technology enhancements, including broadband upgrades and wireless access to *all* school buildings. That figure was not broken down by school category, such as elementary schools or middle schools, but was broken down as follows in Table I below.

> ***Agency Response:*** "The DOE provided to the Comptroller network infrastructure upgrade information for each school building that had a middle school grades in it from 2010 to present, including the dates of actual cutovers from frame relay to fiber circuit, the costs of circuit provisioning, and the name of entities performing the installations."
>
> ***Auditor Comment:*** DOE's response fails to mention that it did *not* provide any dollar amounts budgeted or expended for the installations for the years 2007 to 2009. Moreover, with regard to the information DOE did provide for 2010 forward, it only provided a spreadsheet of costs for circuit provisioning that identified the names of entities performing the installation for only 254 of the 503 middle schools and of those 254 schools, DOE provided cost information for only 87 schools. Finally, as DOE implicitly acknowledges in its response, it was entirely unable to provide the total dollar amount expended for the broadband upgrade initiative for public middle schools from 2007 through completion of the initiative in 2016.

Table I

Fiscal 2010-2014 Five-Year Capital Plan Technology Enhancements Summary[5]

Enhancements	Amount Budgeted (in millions)
Classroom Hardware and Installation	$345.0
School Building and Classroom Connectivity Cabling Schools' Bandwidth Upgrade	$243.8
Schools Unified Communication Infrastructure	Contained in the categories above
School Network Equipment and Common Area Wiring, MDF/IDF Upgrade Security	$90.8
Wireless Technology Upgrade	$103.8
School Application: Teacher/Student Class Relationship (Identity Management)	$27.7
Learning Systems/Platforms	$43.5
Business and Operations Applications	$72.2
TOTAL	**$926.8**

[5] Source: *Building on Success FY 2010- 2014 Five-Year Capital Plan, Proposed 2013 Amendment*, provided by DOE.

For the next five-year period, DOE's Fiscal Years 2015-2019 capital funding plan called for an additional $650 million to be used to sustain high speed internet connectivity and increase the capacity and ability of each classroom.[6]

According to DOE officials, $347.6 million of the $926.8 million budgeted for Fiscal Years 2010-2014 was earmarked for broadband connectivity in all of DOE's school facilities. That figure for all schools included $243.8 million for the *School Building and Classroom Connectivity Cabling Schools' Bandwidth Upgrade* and $103.8 million for the *Wireless Technology Upgrade.* However, DOE could not provide the total dollar amount budgeted or the total dollar amount expended for the broadband initiative for middle schools from 2007 through completion of the initiative in 2016.

> ***Agency Response:*** "The auditors also claim 'that *newly-supplied* information indicates that $347.6 million was earmarked to upgrade all schools.' We'd like to point out that that information was provided to the audit team during the course of the audit and is publicly accessible."
>
> ***Auditor Comment:*** Although the auditors requested the total dollar amount budgeted or expended to upgrade all middle schools throughout the audit, DOE never provided the total amounts. Therefore, in the preliminary draft report of this audit, we cited the *City Council's Report on the Fiscal Year 2015 Executive Budget for the Department of Education and School Construction Authority* (see footnote number 6 below) that reported that $926 million was budgeted for technology enhancements and an additional $650 million was budgeted to sustain high speed internet. At the exit conference, DOE argued that only a portion of the $926 million was actually budgeted for broadband upgrades and thereafter provided the breakdown as seen in Table I, which identified that $347.6 million of the $926 million was used to upgrade all schools.

To assist in the implementation of multiple IT projects, including the broadband upgrade, DOE established an Enterprise Project Management Office (EPMO) in 2011 for the purpose of overseeing new technology projects and ongoing technology projects that were less than 50 percent complete at the time the EPMO was created. After DOE established the EPMO in 2011, it took the next two and a half years to assess DOE's needs and prepare for full operations.[7] It was not until January 2013 that the EPMO started to bring individual initiatives under its oversight and control in an effort to ensure governance for current and future projects.

In connection with its establishment of the EPMO, DOE selected the Project Management Body of Knowledge Guide as its standard for managing projects. The Project Management Body of Knowledge Guide, issued by the Project Management Institute, is recognized by the American National Standards Institute as a standard for project management in business and government.[8] It offers a roadmap for governance through the establishment of a Project Management Office (called the EPMO by DOE), a management structure that standardizes the project-related governance processes and facilitates the sharing of resources, methodologies, tools, and techniques.

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[6] *City Council's Report on the Fiscal Year 2015 Executive Budget for the Department of Education and School Construction Authority.*

[7] According to DOE, the timeline for the EPMO to begin full operations was 30 months. The first 6 months were focused on assessing the organization for its readiness and capacities. The next 6 months were spent developing plans for transformation and improvement. The final 18 months were spent executing on the foundations needed to support such a large organization.

[8] The Project Management Institute is considered the leading not-for-profit professional membership association for the project management profession.

Objectives

The objectives of this audit were to determine whether DOE's implementation of high speed internet connectivity in the City's public middle schools was on schedule and meeting its intended goals.

Scope and Methodology Statement

We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient and appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives. This audit was conducted in accordance with the audit responsibilities of the City Comptroller as set forth in Chapter 5, §93, of the New York City Charter.

The scope of this audit was from January 1, 2013 to June 30, 2016. Please refer to the Detailed Scope and Methodology at the end of this report for the specific procedures and tests that were conducted.

Discussion of Audit Results

The matters covered in this report were discussed with DOE officials during and at the conclusion of this audit. A preliminary draft report was sent to DOE and was discussed at an exit conference on February 28, 2017. On April 5, 2017, we submitted a draft report to DOE with a request for comments. We received a written response from DOE on April 19, 2017.

In its audit response, DOE summarized its efforts and the progress it has made to meet the "demand for bandwidth [that] continues to exceed supply." Further, DOE claimed that the specific audit recommendations had virtually all been implemented "before the audit." However, DOE's response fails to acknowledge that it spent untold millions of dollars for the broadband upgrade initiative without having adequate controls in place to ensure that the upgrade was completed properly, on time, adequately documented, and within budget. Instead, DOE stated that "there was no overarching 'initiative for middle schools'. Rather a series of activities, underwritten by various funding sources, was undertaken separately over time to address bandwidth needs for all DOE schools, not middle schools in isolation." However, this response misses one of the audit's central findings – that DOE failed to appropriately plan, monitor, document, and manage its broadband initiative. Had it done so, it would have been able to produce the basic project data requested by the auditors, whether or not the upgrade was organized by building or by school. Indeed, DOE's response highlights the fact that when it undertook the initiative to bring high speed connectivity to all DOE schools, it did not have a comprehensive plan, uniform minimum controls, standards for documentation, or central oversight.

DOE further pointed out that DIIT "has created a dedicated Enterprise Project Management Office (EPMO), which includes an IT Governance Officer. The EPMO's Portfolio Managers, are charged with ensuring that projects follow new, standards-based policies and procedures and maintaining a records system for archiving standard project documents." While we noted in the audit report that the EPMO was established to create central oversight of IT projects, we also noted that the EPMO was never given oversight of the middle school broadband upgrades because the work on the upgrades was more than 50 percent complete when the EPMO began taking responsibility

for ongoing IT work. As a result, there was never central planning and oversight of the broadband upgrade initiative, and DOE had no assurance that acceptable methodologies were utilized in the upgrades, that the implementations were properly documented, or that relevant documents were retained in accordance with appropriate document retention policies.

Finally, rather than pledging to follow-up on the concerns raised by DOE staff in the audit's User Satisfaction Survey, DOE rejects the notion that its communication with staff could be improved. Rather, it contends, with no proof or logical reasoning, that "school-based respondents were confused by the phrasing of the auditors' User Satisfaction Survey question about bandwidth upgrades." We find DOE's response to be unpersuasive. We remind DOE that the auditors submitted the User Satisfaction Survey to DOE's Deputy Auditor General prior to its distribution for review and approval and the Deputy Auditor General specifically approved its contents after making a few modifications. In addition, the User Satisfaction Survey was sent to all New York City public middle school Principals and SPOCs. The Principals and the SPOCS are the schools' administrators who are responsible for the day-to-day information technology activities in the schools and are exactly the people who would have the knowledge of what is working and what is not working in the schools. Thus, we find DOE's contention that the Principals and SPOCs were confused by the survey implausible and we urge DOE to seriously consider and respond to the information provided by its own staff in response to the survey.

The full text if the DOE response is included as an addendum to this report.

FINDINGS AND RECOMMENDATIONS

Our audit tests provided sufficient evidence to support DOE's representations that in 2016, high speed internet connectivity was available in all City middle schools.[9] However, we also found that DOE failed to put adequate controls in place to ensure that the broadband upgrade was completed properly, on time, adequately documented, and within budget. In particular, DOE lacked back-up documentation that detailed the implementation components and the total costs of the upgrade. During the audit, DOE represented that it did not have *any* project plans, implementation schedules, and progress reports to document the progress and cost of the upgrade initiative from its inception in 2007 through its completion in 2016. Although DOE informed us that such information is available for other IT projects put under the oversight of the EPMO as of 2013, the broadband initiative was never put under the EPMO's oversight because the initiative was more than 50 percent complete by the time the EPMO was ready to assume responsibility for ongoing IT initiatives.

After the exit conference, DOE provided a breakdown of the almost $1 billion budgeted for technology enhancements for Fiscal Years 2010 through 2014.[10] That newly-supplied information indicates that $347.6 million was earmarked to upgrade all schools. However, DOE could not provide the additional dollar amounts that were budgeted for school upgrades from 2007 through 2009. Without such records, we are unable to determine whether DOE middle schools' implementation of high speed internet connectivity was completed within budget because there is no record of the overall sum budgeted for the initiative. Moreover, DOE failed to maintain project plans, implementation schedules and progress reports, along with other records and supporting documentation of what its vendors did to upgrade broadband access at its schools. Additionally, DOE could not identify who performed the specific installations, when they occurred or the associated costs for all the middle school upgrades. Accordingly, absent such records, we cannot be assured that all of the expenditures on the upgrade for middle schools were reasonable and necessary.

Further, we found that while DOE's implementation of high speed internet has allowed for initial increases in bandwidth from 1.5 Mbps to 10 Mbps (more in some cases),[11] distinct areas of dissatisfaction with the quality of the service provided have been identified among the users. Based on a User Satisfaction Survey we conducted as part of the audit, we found that 33 percent of the respondents reported that they are not satisfied with the current internet service. Forty-five percent of the survey respondents indicated that overall the *speed* of internet service in the middle schools was not meeting their instructional needs, and 25 percent of the middle schools in our survey responded that the *availability* of internet service, i.e., their ability to access the internet, was not meeting their instructional needs.

In addition, our User Satisfaction Survey revealed that some schools were not aware that they could request a bandwidth upgrade or were unaware of the process for doing so. Further, during our field visits, Principals and IT liaisons at the schools (called SPOCs) mentioned that after experiencing internet issues, some teachers refrained from using the technology.[12] The counterproductive effect of the teachers' refraining from using the technology is that the resulting

[9] According to DOE, the one middle school that had not been provided with high speed internet access by DOE is in a privately-owned building where internet connectivity is provided by the landlord under the lease agreement.
[10] That information related to the $926.8 million budgeted for technology enhancements for the Fiscal Years 2010-2014.
[11] Initial allocated bandwidth capacity was 10, 20, 30, or 40 Mbps.
[12] A SPOC is designated by the school Principal to act as middle person between school staff and DIIT's technical support. Also, the SPOC assists the Principal with the school's technology issues. The SPOC can be the Principal, a teacher and any other staff assigned to that role or an outside professional hired for that role.

non-use depresses the school's usage data, which in turn has a negative impact on DOE's review and consideration of any request by the school for a bandwidth increase.

These matters are discussed in greater detail in the following sections of this report.

High Speed Internet Connectivity Exists in Middle Schools

On June 3, 2014, DOE reported to the City Council that all of DOE's "school buildings currently have broadband connectivity and wireless access."[13] DOE officials later stated as of 2016 that the agency had successfully transitioned from its outdated Frame Relay technology to an Ethernet Virtual Private Line (EVPL) technology, which has provided a minimum of 10 Mbps over each data circuit. The transition increased school bandwidth more than six fold, and provided high speed internet to City schools at a rate that more than doubled the FCC's definition. The results of our audit observations, analyses, and tests conducted between March 2016 and June 2016 provided sufficient evidence to support DOE's representation that as of those dates, DOE's middle schools were equipped with fiber optic connections sufficient to support high speed internet.

Specifically, in order to evaluate whether high speed internet exists in the City's public middle schools, we visited 12 sampled schools between March 2016 and June 2016 and interviewed the Principals and the schools' designated SPOCs. Through those interviews, we confirmed that each school had high speed internet connectivity. During our field visits, we also inspected each school's main distribution frame (MDF)[14] and verified that the network components complied with the "core network component implementations for standard school sites" as specified in the *DIIT Standards for Networking New School/Building Network Infrastructure*, which expressly sets forth the required fiber optic cabling and connections. Also, we observed real-time bandwidth utilization generated by Cacti (DOE's tool for managing networks and bandwidth utilization).

We further observed that each of the sampled 12 schools had a minimum of 10 Mbps of bandwidth provisioned for their use, meeting DOE's baseline measure for each school. That minimum bandwidth provision exceeded the FCC's high speed internet criteria of 4 Mbps in effect at the time our audit was initiated. Moreover, our review of the NOC's bandwidth utilization reports for 28 randomly sampled middle school buildings found that those buildings are also equipped with high speed internet. Based on these results, we are reasonably assured that DOE has completed its implementation of a fiber optic infrastructure to support high speed internet in most of the City's public middle schools.

Lack of Governance in Project Management

Our audit found that, over the multiple years during which DOE implemented its broadband upgrades in the City's public middle schools, it failed to put an adequate governance structure in place to oversee and manage the upgrade initiative. As a result, we could not ensure that funds were properly spent and that desired outcomes were achieved on time and within budget.

Specifically, due to the lack of records, we could not ascertain how much was budgeted or spent on broadband upgrades at the middle schools. DOE reported that from 2010 through 2014, it budgeted $347.6 million to upgrade *all* the schools, including middle schools. DOE did not provide any amounts budgeted for 2007 through 2009 or total costs for the entire initiative. Although DIIT's EPMO was established in 2011 to create central oversight, it never was made responsible

[13] City Council Report on the Fiscal Year 2015 Executive Budget for the Department of Education and School Construction Authority.
[14] An MDF is a communications room where the major network equipment is housed.

for the middle school broadband upgrades because the high speed internet connectivity work in DOE's schools was more than 50 percent complete by the time the EPMO was ready to assume responsibility for ongoing IT work. As a result, there was no central oversight of the initiative, and DOE had no assurance that acceptable methodologies were utilized in the upgrades, that the implementations were properly documented, or that relevant documents were retained in accordance with appropriate document retention policies.

Pursuant to the Project Management Body of Knowledge guide adopted by DOE as its IT project management standard in 2011, a project management office should be established to standardize a project's governance processes, and to facilitate the sharing of resources, methodologies, tools, and techniques. Project governance is important because it enables organizations to consistently manage projects and optimize outcomes.

A primary function of a project management office is to support project managers by:

- Managing shared resources across all projects administered by the office;
- Identifying and developing project management methodologies, best practices, and standards, training and oversight;
- Developing and managing project policies, procedures, templates, and other shared documentation; and
- Coordinating communication across the projects.

DOE officials stated that prior to 2014, IT projects were managed independently by Project Managers, using IBM's decentralized "tactical execution" project management approach. Under that approach, no consideration was given to risk or budget and no standard documentation existed. DOE opted to follow the IBM approach because IBM was chosen to upgrade the broadband at some of the schools, according to DOE.

As noted, after DOE established the EPMO in 2011, it took the next two and a half years to assess DOE's needs and prepare for full operations, and so it was not until January 2014 that the EPMO started to bring individual infrastructure initiatives under its oversight and control in an effort to ensure governance for current and future projects. But even after establishing the EPMO, DOE decided to bring only new initiatives and projects that were less than 50 percent complete under EPMO control. DOE stated that "as a consequence of that decision there was no effort made to address project and other deficiencies for those infrastructure initiatives that completed or were substantially under way prior to January 2014." Accordingly, because the high speed internet connectivity work in the middle schools and other DOE schools was more than 50 percent complete, it was not placed under EPMO control.

Lacking a central oversight function during the broadband upgrades, DOE failed to put adequate controls and oversight in place. The absence of necessary oversight and controls during the broadband upgrade led to a lack of documentation, accountability, and transparency. Furthermore, it placed DOE at heightened risk for theft, fraud, waste, and abuse.[15]

[15] For example, DOE contractor Willard Lanham, a/k/a "Ross Lanham" was convicted of a $1.7 million theft and mail fraud in connection with his contract to assist in DOE's cabling and wireless upgrade and in September 2012 was sentenced to 37 months in prison.

Lack of Project Documentation

In its installation of high speed internet connectivity in middle schools, DOE failed to maintain project plans, implementation schedules, and progress reports, along with other records and supporting documentation of what its vendors did to upgrade broadband access at its schools. Additionally, DOE could not identify who performed the specific installations, when they occurred or the associated costs for all the middle school upgrades. Without such information we were limited in our ability to determine the level of oversight DOE had exercised over this implementation initiative. Moreover, DOE could not provide any written operational policies and procedures governing its Network Operations Center, including written policies and procedures for assigning and adjusting school bandwidth.

Maintaining documentation for all projects implemented with public funds and especially for projects of the magnitude and expense associated with DOE's upgrade of its broadband infrastructure is essential to ensuring accountability and transparency and to minimizing fraud, waste and abuse. Comptroller's Directive #1, §5.0, states:

> All transactions and significant events need to be clearly documented and the documentation readily available for use or examination. Internal controls should be documented in management administrative policies or operating manuals. All documentation should be properly managed and maintained in accordance with updated records retention schedules.

As reflected in DOE's 2007 annual response to the Comptroller's Office under Directive #1 where it claimed "partial" compliance with the Directive's requirements for system documentation, DOE was aware that it should have maintained written documentation.

DOE officials stated that the agency never established an actual schedule for the system-wide rollout of high speed internet connectivity at individual schools because the timing of the implementation was dependent on funding availability. The officials also stated that priorities were determined based on the funding programs utilized, Deputy Chancellors' guidance, and the capital funding availability of individual projects. To explain the overall lack of project documentation, DOE officials provided a written memorandum stating: "DIIT did not have a formal process that dictated or classified records needed to be retained." Further, DOE officials stated that DOE does not have a written records retention policy applicable to the implementation of high speed internet connectivity. However, they noted that since the establishment of its EPMO in July of 2011, DIIT has "put into place a records system for the archiving of standard project documents and artifacts."

Without adequate documentation, DOE has no assurance that its projects are being managed effectively. Because DOE failed to maintain project documentation, we were unable to determine how much of the Fiscal Year 2010-2014 Capital Plan budget actually went into high speed internet implementation, and whether the work was performed according to contract specifications, and on budget. This lack of accountability and transparency in the projects' management increased the risk of fraud, waste, and abuse.

Recommendations

DOE should:

1. Maintain a project governance structure for IT projects and ensure that its EPMO follows proper project management standards and methodologies for all current and future IT projects.

Agency Response: "The DOE implemented the recommendation before the audit.

"Since the DOE's Division on Instructional Information and Technology's ("DIIT") establishment of the Enterprise Project Management Office (EPMO) in 2011, that office has become an effective PMBOK-based Project Management and Governance organization. It continues to improve on Project Management Life Cycle and Governance standards, methods, process, policy, and artifacts."

Auditor Comment: As discussed in the report, DOE did not have an EPMO to ensure that proper project management standards and methodologies were followed for the broadband upgrade initiative. Although we did not review the IT projects that are currently under the EPMO controls, we are glad to see that DOE established a project governance structure and has made the changes to ensure proper controls are in place.

2. Maintain a system for the archiving standard project documents and artifacts.

Agency Response: "DIIT implemented a solution that meets the recommendation as described in our response to Recommendation 1."

Auditor Comment: The implemented solution for archiving standard project documents and artifacts was not applied to the high speed internet connectivity initiative. As a result no documentation was provided by DOE regarding the multi-year, multi-million dollar information technology initiative that was the focus of our audit.

3. Develop a formal records retention policy and schedule that ensures the future availability of necessary records for as long as they are needed.

Agency Response: "DIIT implemented a solution that meets the recommendation as described in our response to Recommendation 1.

"Additionally, in collaboration with the DOE's Office of Legal Services and other stakeholders, DIIT is evaluating whether an enterprise records management solution is practical."

Auditor Comment: The implemented record-retention solution was not applied to the high speed internet connectivity initiative. As a result during our audit, DOE did not provide any project plans, implementation schedules, and progress reports. Furthermore, DOE lacked back-up documentation that detailed the implementation components.

4. Develop and maintain written NOC policies and procedures for assigning and adjusting school bandwidth.

Agency Response: "DIIT implemented solutions to address the recommendation before the audit.

"The NOC has a procedure for assigning and adjusting school bandwidth that includes determining if the underlying problem is a bandwidth issue, or something else. Additionally, the NOC's decision-making process includes recommended communication with school personnel, including technology Single Points of Contact (SPOCs)."

Auditor Comment: DOE's response fails to address the fact that it does not have written policies and procedures for assigning and adjusting school bandwidth. In fact, during the audit, DOE officials stated that the process to communicate such policies and procedures is not through a written procedure rather it "is socialized for new staff as part of onboarding and training activities." Therefore, we reiterate our recommendation that DOE should develop and maintain written NOC policies and procedures for assigning and adjusting school bandwidth.

User Satisfaction Survey

The experiences and concerns of the users are vital to determining whether the high speed broadband access to the internet is meeting the schools' needs. To better understand the users' experiences, we conducted a User Satisfaction Survey as part of the audit through which we solicited observations from each middle school. We directed surveys to the Principals and SPOCs (953 individuals) at each of 503 middle schools on May 25, 2016 and received 440 valid responses as of June 20, 2016 from 397 (79 percent) of those 503 middle schools.[16] Our User Satisfaction Survey revealed the following:

- Respondents from 33 percent of the middle schools were not satisfied with the current internet service. (See Appendix I, Chart I.)
- Respondents from 45 percent of middle schools reported that overall, the speed of the internet service was not meeting their instructional needs. (See Appendix I, Chart II.)
- Respondents from 25 percent of middle schools reported that overall, the internet service availability was not meeting their instructional needs. (See Appendix I, Chart III.)
- Respondents from 55 percent of middle schools reported having difficulties with streaming videos through the internet during class. (See Appendix I, Chart IV.)
- Respondents from 62 percent of middle schools reported that they are not aware of the school infrastructure dashboard for viewing school network status, including bandwidth utilization.[17] (See Appendix I for Chart V.)

  Agency Response: "We maintain that school-based respondents were confused by the phrasing of the auditors' User Satisfaction Survey question about bandwidth upgrade. Schools would have responded differently if the survey had asked, 'Do you know where to report IT problems?'"

[16] We received 605 responses as of June 20, 2016. We determined that 440 of them were valid after removing 13 duplicate and 146 blank response forms, 4 internal-testing responses and 2 report-generated headers for a total of 165 invalid responses.
[17] Infrastructure dashboard is a webpage available to schools' Principals and SPOCs where they can view their own school bandwidth capacity, bandwidth utilization, and devices connected to the internet.

Auditor Comment: We are puzzled by DOE's response since the User Satisfaction Survey was sent to DOE's Deputy Auditor General for review prior to the survey being distributed. The Deputy Auditor General approved the survey questions after making some revisions. Moreover, the survey was only sent to school Principals and SPOCs who are most likely to deal with their school's technology issues. Furthermore, 69 percent of middle schools reported that they contact the helpdesk when the internet is down. Therefore, we consider that DOE survey respondents are knowledgeable on who to report IT problems. DOE's response does not address the problems our survey highlighted instead it attempts to obfuscate the issues. Accordingly, we find DOE's contention that the Principals and SPOCs were confused by the survey implausible and we urge DOE to seriously consider and respond to the information provided by its own staff in response to the survey.

The last question of the User Satisfaction Survey asked respondents for comments or suggestions about the internet service. Out of the 440 valid responses received, 339 respondents provided comments and/or suggestions. We grouped their comments into the following five major categories: Lack of Speed; Insufficient Bandwidth; Wireless Issues; Connectivity Issues; and Other. The following table shows the five major categories, number of comments and corresponding percentages:

Table II

User Satisfaction Survey Comments and Suggestions
Top 5 Categories

Category	# of Comments	Percentage
Lack of Speed	109	32%
Insufficient Bandwidth	97	29%
Wireless Issues	34	10%
Connectivity Issues	38	11%
Other	61	18%
TOTAL	**339**	**100%**

Comments from the User Satisfaction Survey included: "Our schools would benefit from a band-width increase. We piloted STATE online-testing yesterday and it was an ordeal just to have 30 students on the laptops to take the exam. They constantly got 'kicked-off.'" Another respondent stated: "Internet service can barely be used when there are many rooms on the same floors on internet at the same time. We need more bandwidth." Still another respondent commented: "Our internet service is slow, I would like our internet service improved. Please upgrade our current bandwidth."

Recommendation

DOE should:

5. Ensure that the users' concerns identified in the User Satisfaction Survey and comments that we provided to DOE are appropriately addressed and that the annual survey sent to Principals includes questions concerning user satisfaction with high speed internet connectivity.

Agency Response: "DIIT implemented solutions to address the recommendation before the audit.

"DIIT proactively engages and partners with schools using tools and resources to ensure effective technology use by students and teachers. The NOC and Borough Technology Management (BTM) staff conduct investigations to identify and resolve reported technical problem. Proactively, BTM staff provide consultation to assist school leaders with managing their technology and creating strategies for meeting the instructional needs of students and staff. Results from these activities and conversations also inform decisions and strategies made by DIIT managers.

"DOE annually sends a survey to schools that includes questions DIIT deems relevant to users' satisfaction with school-based technology. Responses to this survey inform certain decisions and strategies made by DIIT managers."

Auditor Comment: The annual survey sent to schools by DOE only asks one question regarding satisfaction with DOE's support on technical issues and, therefore, does not address the recommendation. Therefore, we reiterate our recommendation that that the annual survey sent to Principals includes questions concerning user satisfaction with high speed internet connectivity.

Limited Criteria Used for Granting Bandwidth Upgrades

NOC engineers consider high bandwidth utilization to be prime evidence of whether a school qualifies for an upgrade, and those upgrades can be crucially important. However, during our field visits to a sample of 12 schools, Principals and SPOCs reported that issues such as delay/slowness and unpredictable lack of connectivity caused teachers to refrain from using the technology so as not to waste valuable teaching time. Under such a circumstance, when users refrain from attempting to access the system because of connectivity problems, the evidence of bandwidth utilization that NOC would look for to determine that a school qualifies for an upgrade is not produced. Thus, although the school may need greater bandwidth to satisfy the additional demand for internet access by the teachers who refrain from using the technology, that demand is not reflected in the school's bandwidth utilization and as a result may not be considered by NOC as evidence of the school's need for a bandwidth upgrade.

Schools currently request bandwidth upgrades through the DOE helpdesk's "Magic Ticket" system. The requests are forwarded to a NOC engineer for review, and during the upgrade process, a NOC engineer:

- Reviews real-time and historical bandwidth utilization reports to preliminarily determine whether traffic is consistently exceeding the allocated bandwidth;

- Reviews and analyzes network traffic for anomalies that could negatively impact bandwidth usage;
- Looks at "top talkers" on the network to determine who is consuming most of the bandwidth;
- Checks the functionality of wireless access points; and
- Investigates the nature of the network traffic to ensure there is no abuse of internet usage.

Once the NOC engineer determines that network traffic is consistently exceeding the allocated bandwidth, the school's bandwidth is increased (see Appendix II for complete bandwidth upgrade process flow). If teachers refrain from using the internet, however, no evidence is produced that demonstrates the school's requirement for increased capacity. Although a drop in bandwidth utilization impacts negatively on a school's request for a bandwidth upgrade, DOE stated that it does not consider low bandwidth utilization by itself to be indicative of a problem. However, to the extent that school staff avoids use of the internet due to bandwidth problems such as those they cited in response to our survey, that behavioral response could undercut a school's ability to successfully obtain a needed bandwidth upgrade. Thus, we urge DOE to take this bandwidth usage anomaly into account when considering a school's need for a bandwidth upgrade.

Recommendations

DOE should:

6. As part of the bandwidth utilization process, consider whether low utilization might be caused by users' experiencing delay, slowness, and unreliability of their schools' high speed internet connectivity. The criteria for a bandwidth upgrade should also take into account school staff input and not rely solely on bandwidth utilization reports.

Agency Response: "DIIT implemented solutions to address the recommendation before the audit. Please refer to our response to Recommendation 4."

Auditor Comment: Even though there is a process for obtaining a bandwidth upgrade, DOE did not provide written policies and procedures for adjusting school bandwidth. Moreover, our interviews with school Principals and SPOCs indicated that issues such as delay/slowness and unpredictable lack of internet connectivity caused teachers to refrain from using the technology so as not to waste valuable teaching time. Refraining from using the internet can have a negative impact in obtaining a bandwidth upgrade. Therefore school staff input is a necessary factor in deciding whether a school should get a bandwidth upgrade.

7. Proactively partner with schools to offer technology reviews to ensure that DOE staff better understand their requirements, offer appropriate technical solutions, estimate proper bandwidth provisioning, and ensure that schools have adequate technology available to accomplish their instructional goals.

Agency Response: "DIIT implemented solutions to address parts of the recommendation before the audit.

"As in our response to Recommendation 5, DIIT proactively engages and partners with schools to the full extent that existing resources support to ensure effective technology use by students and teachers.

"In addition to the school-based dashboards, several innovative tools created by DIIT managers allow school staff access to technical information and training, generally as their time allows and at their own pace."

Auditor Comment: Interviews with school Principals and SPOCs and responses to our User Satisfaction Survey show that currently implemented solutions need improvement. Also, as mentioned in the report, 62 percent of survey respondents indicated that they were not aware of the school infrastructure dashboard for viewing school network status, including bandwidth utilization.

Improve Communication and Support to Schools

DOE provides technology support to its middle schools via an active helpdesk and DIIT's Service Delivery and End-User Support Teams. However, based on the results of our User Satisfaction Survey, most of the respondents are not aware of many aspects of bandwidth utilization. Specifically, 55 percent of respondents indicated that they were not aware that they could request a bandwidth increase; 69 percent of respondents indicated that they did not know the process for requesting a bandwidth increase; and 62 percent of respondents indicated that they were not aware of the school infrastructure dashboard for viewing school network status, including bandwidth utilization.

According to DOE, its DIIT Service Delivery and End-User Support Team includes three levels of personnel: (1) Borough Technology Directors (BTDs); (2) Borough Technology Managers (BTMs); and (3) Field Service Technicians (FSTs). Borough Technology Directors manage helpdesk tickets across the board for their respective boroughs. They act as direct contact for school Principals and SPOCs on IT issues and concerns. The BTDs also provide consulting services and serves on steering committees to determine long-term technology planning goals for the schools in their boroughs. Moreover, the BTDs oversee the day-to-day work of the BTMs and FSTs.

BTMs supervise, coordinate and serve as direct contact for FSTs and provide consultant services to support administrative and instructional requests for technical planning and procurement of equipment activities. In addition, the BTMs serve as project leaders in support of IT aspects of new school openings. Finally, FSTs provide support for network connectivity issues, and for technical consultation that can enhance the school instructional plan.

Even under optimal conditions, DIITs Service Delivery and End-User Support Teams have a relatively small staff charged with broad responsibilities. Citywide they number 70 personnel, according to DOE; five are BTDs; five are BTMs; and 60 are FSTs. The 60 FSTs are responsible for responding to technology issues in over 1,800 schools, and they support over 800,000 network devices. The ratio of FSTs to schools is approximately 1 FST per 30 schools. We believe these numbers have a direct correlation with those responses to our User Satisfaction Survey that reflect the schools lack of awareness of the process for requesting bandwidth upgrades.

In addition, although the SPOCs are not an official part of DIIT's support teams, DOE said they are present in 90 percent of all schools. SPOCs are intended to be a school's first line of defense in solving technology issues. A SPOC is designated by the school Principal to act as a liaison

between school staff and DIIT's technical support and assist the Principal with the school's technology issues. The SPOC position can be held by the Principal, a teacher and any other staff assigned to that role or an outside professional hired for that role. DOE stated that it provides SPOCs with a variety of tools and resources to help them resolve school technology issues. Specifically, DOE offers SPOC-specific training, maintains an intranet site devoted to information and resources for SPOCs called "The Sandbox," publishes a monthly SPOC newsletter, and coordinates an annual technology summit.[18] However, SPOCs that are also Principals, teachers or other staff may not be able to devote as much time as an outside professional to training, as well as helping the school with its technology needs.

Finally, our User Satisfaction Survey indicated that although 129 respondents had requested bandwidth upgrades, 38 of them reported they had not received such upgrades. When we asked DOE why those 38 respondents did not receive the requested bandwidth upgrades, the Department responded that some of the upgrades had been provided, some did not meet criteria, two requests were pending, and that it had no record of requests from 16 of the 38 schools.[19] The absence of such records may suggest that those schools used channels other than the DOE helpdesk's "Magic Ticket" system to request upgrades and were unaware that such requests would not be processed, and it may also indicate that some schools do not know the process for requesting a bandwidth upgrade.

DOE needs to improve communication between schools and the department's support team, given that some schools do not know they can request a bandwidth increase, do not understand the bandwidth increase request process, do not know about or utilize the school's infrastructure dashboard, and do not use proper channels when requesting a bandwidth increase.

Recommendations

DOE should:

8. Ensure school Principals and their designated SPOCs are aware of how to effectively request a bandwidth upgrade, and what the criteria are for receiving one.

Agency Response: "DIIT implemented the recommendation before the audit.

"As explained in the cover letter and response to Recommendations 5, 6, and 7; our existing process (schools report latency issues to the Help Desk, and they are investigated by Help Desk staff and escalated as necessary to the NOC for further investigation and resolution) is communicated to schools and we'll continue to work to share it with school staff."

Auditor Comment: Interviews with school Principals and SPOCs and responses to our User Satisfaction Survey show that the implemented solutions need improvement. As stated in the report, 55 percent of survey respondents indicated that they were not aware that they could request a bandwidth increase and 69 percent of survey respondents indicated that they did not know the process for requesting a bandwidth increase. We reiterate our recommendation that DOE improve communication between schools and the department's support team, given that some schools do not know the bandwidth upgrade process.

[18] Sandbox is a NYCDOE intranet website with various links and articles specifically related to instructional technology.
[19] DOE responded that 17 of the 38 schools did receive upgrades; 3 schools did not meet the upgrade criteria; 2 schools were pending; and it had no record of requests from 16 schools (for a total of 38).

9. Provide additional resources to DOE's technology division to improve communication, strengthen the quality of customer service, and increase customer satisfaction.

Agency Response: "The DOE will take this recommendation under advisement."

DETAILED SCOPE AND METHODOLOGY

We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient and appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives. This audit was conducted in accordance with the audit responsibilities of the City Comptroller as set forth in Chapter 5, §93, of the New York City Charter.

The scope of this audit was from January 2013 to June 2016. We conducted fieldwork from November 2015 to November 2016. To achieve our audit objectives, we:

- Interviewed various DOE officials, including those from the NOC Unit, EPMO personnel, Chief Technology Officer and various school Principals and SPOCs;
- Requested all technical specs, network diagrams, project timelines, copies of any plans, and implementation schedules for NYC public middle schools to determine whether all NYC public middle schools have high speed internet connectivity;
- Requested all high speed internet connectivity policies, procedures, rules, and technology schedules to determine whether DOE policies and procedures provide adequate controls over high speed internet connectivity;
- Requested a complete list of all freestanding middle schools to determine and test whether NYC middle schools have high speed internet connectivity and that high speed internet service is meeting the schools' needs for instructional purposes;
- Requested a complete list of all freestanding middle schools bandwidth provision before and after a high speed internet connectivity upgrade to determine whether the implementation of high speed internet connectivity is on schedule and meeting the instructional needs of NYC middle schools;
- Requested all middle schools high speed internet contracts to determine whether NYC middle schools internet connectivity implementation is on schedule and meeting its goals;
- Requested DOE criteria for adjusting middle schools bandwidth provisions and for allowing schools to exceed the allocated bandwidth to determine whether DOE has adequate policies and procedures for monitoring and increasing middle schools bandwidth provisions;
- Requested Network Operations Center policies/criterions for monitoring and detecting schools' internet issues or network infrastructure failures to determine whether the NOC has adequate monitoring tools in place to detect and repair internet connectivity issues;
- Requested a list of all freestanding and co-located middle schools for field visits. DOE provided a list of 138 freestanding and co-located middle schools. However, these 138 schools are housed in 112 buildings. We randomly selected 28 (25%) of the 112 middle school buildings to review and analyze bandwidth provision and utilization reports. Out of the 28 randomly sampled schools, we selected 12 schools to visit (we conducted our field

visits between March 2016 and June 2016) and test the internet connectivity to determine whether high speed internet connectivity exists; [20]

- Visited twelve schools from the randomly selected 28 freestanding middle schools to determine and test whether internet connectivity implementation was on schedule and meeting the schools' instructional needs. Also, to determine whether high speed internet connectivity exists;

- Requested, for 28 randomly selected schools, a list of computer lab room schedules, a list of classes, after school programs, night classes, weekend classes, and software or educational programs that use the internet to determine at which particular time is the internet used the most;

- Reviewed and analyzed 138 freestanding and co-located middle schools helpdesk tickets logs for the period from October 2015 to January 2016, which provided information on schools' internet connectivity issues to determine whether internet connectivity is operational and meeting the schools' instructional needs;

- Reviewed and analyzed a weekly report of the randomly selected 28 schools bandwidth usage for the period from September 2015 to December 2015 to determine internet usage demand levels and internet traffic patterns in the selected sample schools;

- Reviewed and analyzed a monthly report of the randomly selected 28 schools bandwidth usage for the period from February 1, 2016 to February 29, 2016 to determine internet usage demand levels and internet traffic patterns in the selected sample schools;

- Reviewed and analyzed a yearly report of the randomly selected 28 schools bandwidth usage for the 2014 and 2015 years to determine internet usage demand levels and internet traffic patterns in the selected sample schools;

- Reviewed and analyzed four bandwidth upgrade tickets to determine the process and requirements for bandwidth upgrades for middle schools;

- Requested a complete list of all middle schools to be used for our User Satisfaction Survey. A list of middle schools with Principal and SPOC email addresses was provided on May 23, 2016. The list has 602 records. Each record lists the Principal and SPOC for the school. The list contained duplicate records. After removing duplicate entries, the total number of middle schools is 503. The total number of email addresses for Principals and SPOCs in the list is 953;

- Emailed a User Satisfaction Survey to all middle schools' Principals, SPOCs and alternate technology staff (953 total) to determine whether high speed internet connectivity is meeting the schools' instructional needs;

- Examined and analyzed the User Satisfaction Survey. The survey indicated that 129 respondents requested bandwidth upgrades. According to the survey, 38 out of 129 respondents did not received an upgrade. We requested and reviewed documentation

[20] Originally we randomly selected 10 schools to visit. However, the 10 randomly selected schools had a bandwidth provision that ranges from 10 to 30 Mbps. The list of 138 schools provided had schools with a bandwidth provision of 40 and 50 Mbps. For completeness and overall roundness we randomly selected two additional schools to visit that had a bandwidth provision of 40/50 Mbps for a total of 12 visited schools.

clarifying why the 38 middle schools did not receive the upgrade to determine whether DOE is following its bandwidth upgrade practice;

- Reviewed and analyzed DOE's help desk process flowchart to gain a better understanding of the help desk and functions;
- Mapped the bandwidth upgrade decisions against schools zip code to determine whether there is any indication or evidence that suggests certain communities are receiving preference on bandwidth upgrades; and
- Reviewed the project management body of knowledge guide to determine if DIIT EPMO has a formal standard and methodology for governance and project management.

NYC Department of Education Middle Schools High Speed Internet Connectivity

User Satisfaction Survey Charts (Questions 33, 34, 35, 49, and 51)

Chart I

Responses to Question 33: "Are you satisfied with your current internet service?"

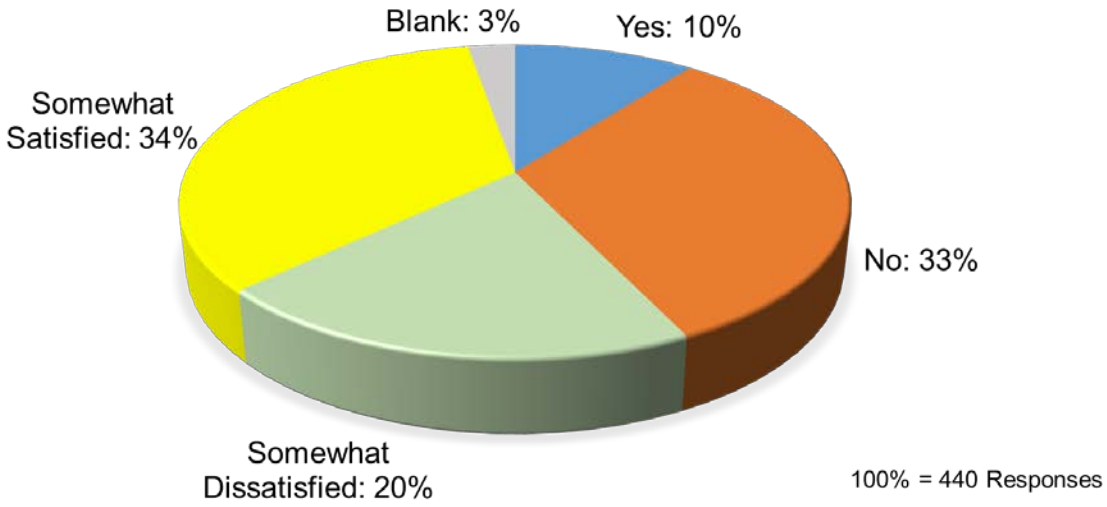


Chart II

Responses to Question 34: "Overall, is the internet service meeting your instructional needs in terms of speed?"

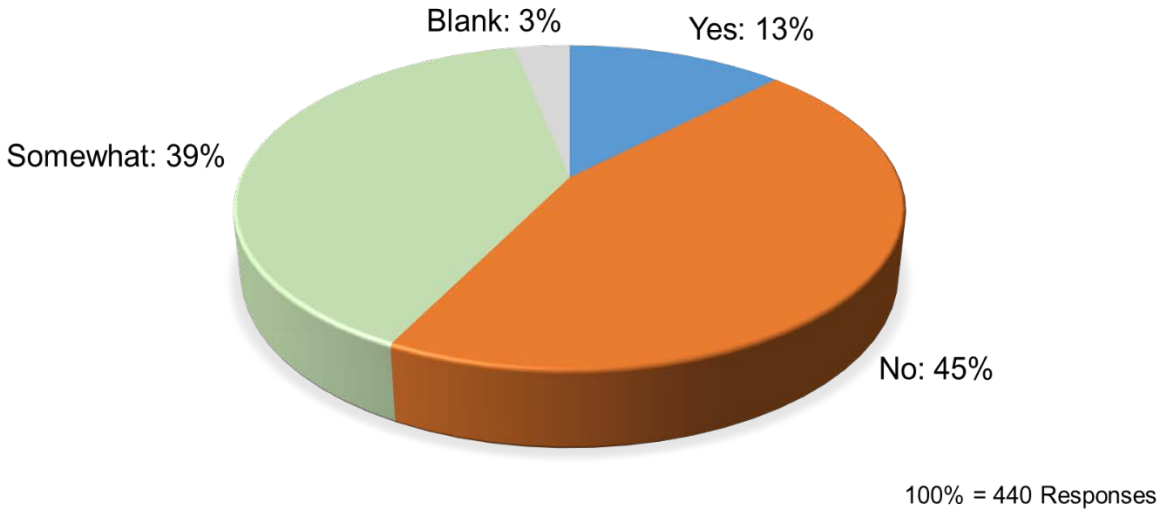
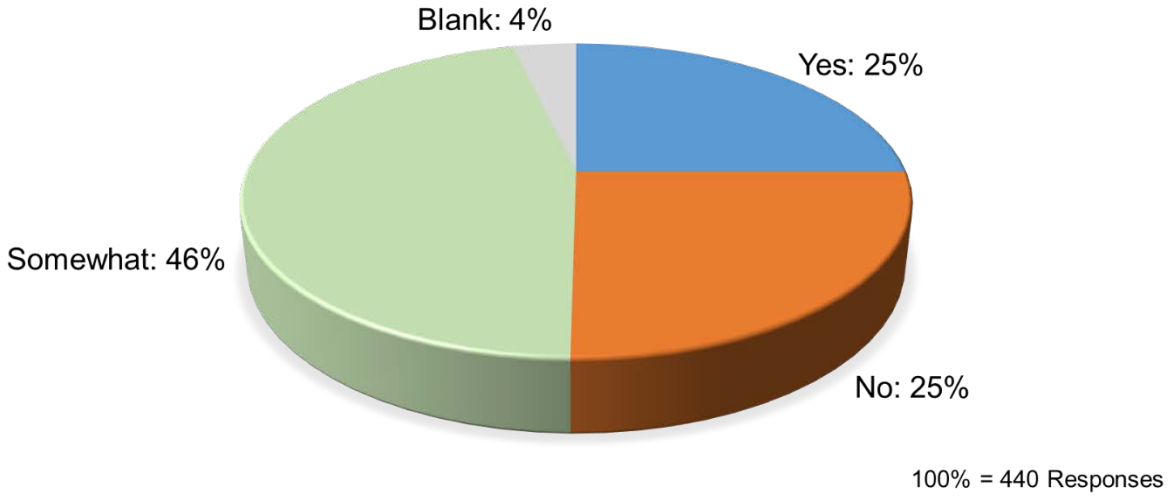


Chart III

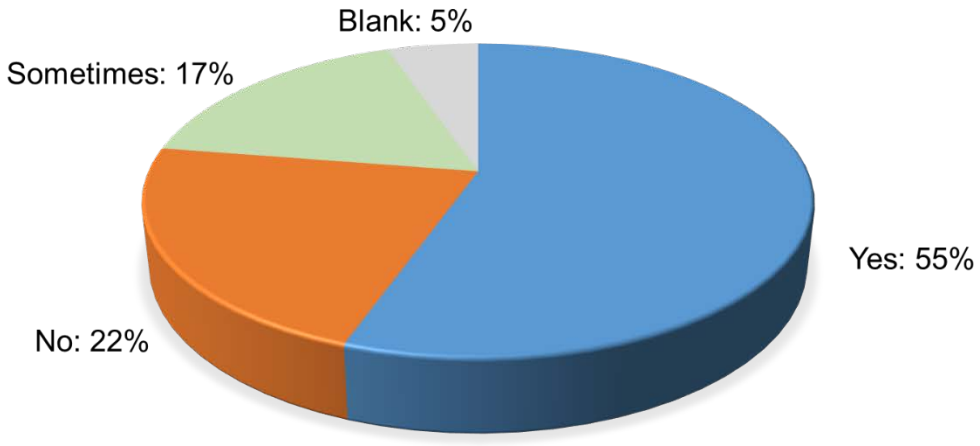
Responses to Question 35: "Overall, is the internet service meeting your instructional needs in terms of availability?"



100% = 440 Responses

Chart IV

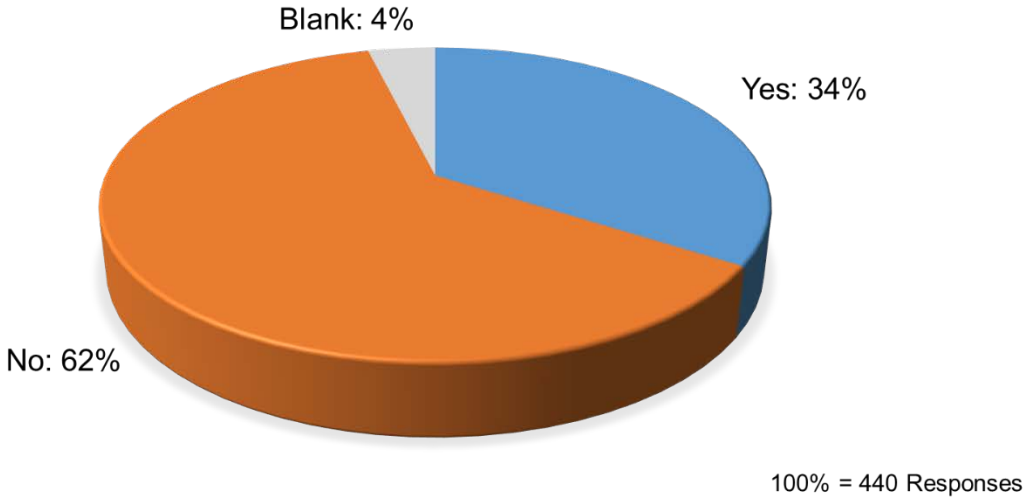
Responses to Question 49: "Have any issues with streaming videos through the internet during class been reported?"



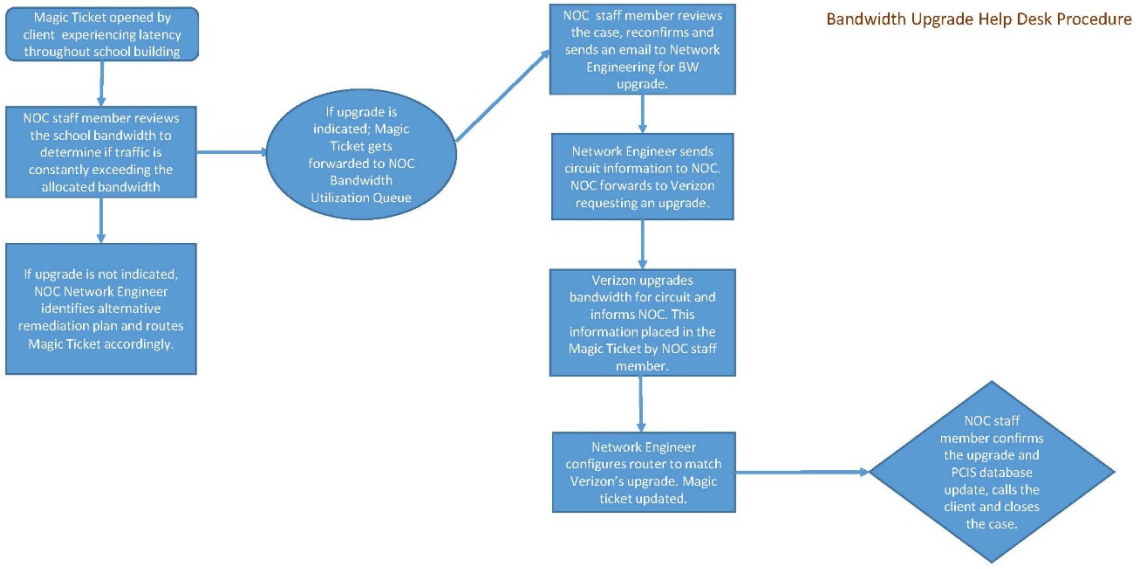
100% = 440 Responses

Chart V

Responses to Question 51: "Are you aware of the school infrastructure dashboard for viewing school network status, including bandwidth utilization?"



Bandwidth Upgrade Helpdesk Process Flow



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April 19, 2017

Marjorie Landa
Deputy Comptroller for Audit
The City of New York
Office of the Comptroller
One Centre Street, Room 1100
New York, NY 10007-2341

Re: Audit Report on the Department of Education's Implementation of High Speed Internet Connectivity in New York City Public Middle Schools

Dear Ms. Landa:

This letter and the attached Response to Recommendations (collectively, "Response") comprise the New York City Department of Education's ("DOE") formal response to the City of New York Office of the Comptroller's ("Comptroller") draft audit report titled *Audit Report on the Department of Education's Implementation of High Speed Internet Connectivity in New York City Public Middle Schools* ("Report").

Introduction

We start this Response by highlighting the Comptroller's acknowledgement that "every New York City public middle school had fiber optic connections to support high speed internet" and that the minimum provisioned internet speed exceeded the Federal Communications Commission's standard at the time the audit was initiated.

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The DOE's core mission is to improve student achievement and ensure that every child graduates from high school prepared for college, a career, and a future as a productive, critically thinking adult. That is exactly why DOE resources have been devoted to providing students and staff in all New York City public schools with technology that supports instructional applications, evaluation tools, computer laboratories, school libraries, and administrative offices. That technology is supported by the DOE Division of Instructional and Information Technology (DIIT), which monitors schools' internet usage, develops dashboards to improve the internet experience, and works with broadband service providers to ensure that service is constant.

When the Comptroller's audit was initiated in October 2015, DIIT managers already had assessed schools' technological needs and were on the verge of issuing the 2015-2020 Strategic Technology Plan[1], which contemplates the technological upgrades recommended in the Report not solely for middle schools, but for all schools system-wide. DIIT also had already expanded the scope of work that would be subject to the type of project management cited as a standard in the Report.

DIIT, further, has created a dedicated Enterprise Project Management Office (EPMO), which includes an IT Governance Officer. The EPMO's Portfolio Managers, are charged with ensuring that projects follow new, standards-based policies and procedures and maintaining a records system for archiving standard project documents. In 2015, DIIT instituted governance policies in support of all DIIT service requests and projects and implemented a Demand Management Process, the objective of which is to ensure all DIIT work is assessed, valued, managed, governed, tracked, and reported on.

Regarding the auditors' finding that, "DOE could not provide the total dollar amount budgeted or the total dollar amount expended for the broadband initiative for middle schools from 2007 through completion of the initiative in

[1] http://schools.nyc.gov/AboutUs/schools/TechPlan

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2016," DIIT continues to contend that there was no overarching "initiative for middle schools". Rather a series of activities, underwritten by various funding sources, was undertaken separately over time to address bandwidth needs for all DOE schools, not middle schools in isolation. Moreover, management of bandwidth circuit upgrades was consistent with the DOE's business rules, which approached the work on a building-by-building basis. Additionally, the DOE provided to the Comptroller network infrastructure upgrade information for each school building that had middle school grades in it from 2010 to the present, including the dates of actual cutovers from frame relay to fiber circuit, the costs of circuit provisioning, and the names of entities performing the installations.

The auditors also claim "that *newly-supplied* [emphasis added] information indicates that $347.6 million was earmarked to upgrade all schools." We'd like to point out that that information was provided to the audit team during the course of the audit and is publicly accessible.

Demand for DOE Bandwidth

At the point in time when the audit began, the DOE had already provisioned a minimum internet speed of 10Mbps (broadband speeds are measured in megabits per second) to almost every school building. Currently, our Wide Area Network circuits average 85% utilization during normal business hours and typically reach their maximum capacity for several hours each day during peak classroom hours.

DIIT works proactively with schools to assess their individual challenges and to devise strategies to improve the experience of their internet users. Those strategies may include re-configuration, strategically scheduling content downloads, and staggering usage throughout the day. Additionally, DIIT's Network Operations Center (NOC) and Borough Technology Management staff conduct investigations to identify and resolve reported technical problems. Despite these efforts, and although more than 99% of DOE buildings currently

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have new fiber-based wiring capable of carrying faster internet speeds to schools, demand for bandwidth continues to exceed supply.

The DOE network infrastructure is being used to its fullest capacity. As any increase in bandwidth will require systemic upgrades, DIIT plans to leverage funds earmarked in the FY 2015-2019 Capital Plan for the design and implementation of a new core network and a data center expansion (the "Next Generation Network" project). This expansion will provide the resiliency, flexibility, and scalability to meet the anticipated demands of bandwidth-intensive instructional applications.

Additionally, on July 1, 2016, DIIT began the School Bandwidth Upgrade Project, a 30-month effort to install a new 100 Mbps high-speed fiber optic circuit in each DOE school building. These circuits have the capacity for expansion to 1Gbps without any additional installation costs. This will enable DIIT to increase broadband provisioning based on individual schools' needs. The DOE's Network Operations Center will monitor the new circuits as they come into service using a newly designed dashboard display. Management of monthly billing will ensure orderly, compliant transition of services.

Support to Schools is Robust

The Report suggests that DOE should "improve communication between schools and the department's support team, given that some schools do not know they can request a bandwidth increase, do not understand the bandwidth increase request process, do not know about or utilize the school's infrastructure dashboard, and do not use proper channels when requesting a bandwidth increase."

We contend that this is a misunderstanding. Although it is the case that many school leaders do not have a fundamental understanding of how to manage their school's bandwidth, they do know that they should refer perceived internet

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connectivity issues to the DOE's Help Desk, an in-house service that garnered a 95 percent approval rating in the 2016 DOE Principals Satisfaction Survey.[2]

We maintain that school-based respondents were confused by the phrasing of the auditors' User Satisfaction Survey question about bandwidth upgrades. Schools would have responded differently if the survey had asked, "Do you know where to report IT problems?" The frequency with which schools call the Help Desk certainly illustrates that they know who to reach out to for help.

Insofar as bandwidth requirements are subject to such variables as school size, the number and age of devices, and the pedagogical and technological needs and expertise of the staff, the DOE cannot—and has not—taken a one-size-fits-all schools approach to addressing schools' needs; rather, we have employed several strategies:

Infrastructure Dashboards

To facilitate schools' observation and management of their bandwidth usage, DIIT has configured school infrastructure dashboards. These displays provide basic information about each school's internet usage on a real-time basis and are available to school staff through the DOE's administrative network. The availability of the dashboards is communicated to schools through the *Principal's Weekly* newsletter, on DIIT's intranet site, and by the technology Single Point of Contact ("SPOC") program (as discussed below). Given DIIT's outreach efforts, we cannot account for survey responses indicating that certain respondents were unfamiliar with this tool. Nonetheless, DIIT managers will explore additional means of highlighting the availability of the dashboards and the benefits schools can derive from their use.

[2] http://schools.nyc.gov/NR/rdonlyres/4B4D136B-729B-446C-9896-179EEEA24B79/0/PSSResults2016Website12222016.pdf

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Help Desk

Once a call is received by the Help Desk, assigned staff follow certain protocols to determine the cause of reported bandwidth problems and address them as warranted. It is often the case that a reported latency issue is not caused by insufficient bandwidth but by factors such as obsolete devices, high numbers of concurrent users, or inappropriate media downloads. However, if it is determined that insufficient bandwidth may be at the root of the school's internet performance complaint, a referral is made by the Help Desk to the Network Operations Center.

Network Operations Center (NOC)

The NOC, which is sited in DOE's Metrotech facility, is where DIIT monitors the DOE's technology infrastructure. Personnel assigned to the NOC, who have a background in engineering, are charged with configuring and troubleshooting bandwidth circuits on a daily basis and responding to referrals from the Help Desk.

In response to problem tickets called into the Help Desk reporting internet connectivity and/or performance issues, NOC staff:

- Review NOC bandwidth reports to determine if traffic consistently exceeds the allocated bandwidth.
- Review and analyze traffic to identify anomalies that could negatively impact bandwidth usage such as unauthorized or improperly configured user devices connected to the local school network.
- Communicate with school personnel to determine if there are local conditions that may impact bandwidth.

Based on its review, the NOC addresses identified problems within the school by sending a technician to the site to perform a network assessment (School Technology Health Check).

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Single Point of Contact Program

The DOE's Single Point of Contact program ("SPOC") was created by DIIT in 2012 for the multiple purposes of relieving technology stress at the school level; fostering efficient technology use in the classroom; and, improving DIIT customer service (as well as relationships and services provided by DIIT software and hardware vendors). The program currently numbers in excess of 1500 SPOCs who are employed in diverse school-based administrative, pedagogical, and computer technician titles (The SPOC is an unpaid role.). These individuals serve as their school's liaisons with DIIT and are provided with a variety of supports that enable them to help schools troubleshoot and correct technology problems without having to wait for help from Central DIIT.

School Tech Support Teams

Principals, SPOCs, and computer teachers offered positive feedback regarding the proactive and responsive services provided by their DIIT Borough Technology Staff during audit interviews. DIIT managers understand that the current ratio of technicians to schools may not provide an optimal level of coverage and so provide supplemental supports such as School Technology Health Checks. DIIT also shares bandwidth-management strategies with school district superintendents.

Sincerely,

Peter Quinn
Chief Information Officer

NEW YORK CITY DEPARTMENT OF EDUCATION RESPONSE TO RECOMMENDATIONS

This Response to Recommendations and the attached cover letter signed by New York City Department of Education's ("DOE") Chief Information Officer Peter Quinn, comprise the DOE's response to the City of New York Office of the Comptroller's draft audit report titled *Audit Report on the Department of Education's Implementation of High Speed Internet in New York City Public Middle Schools.* ("Report") (SI16-082A).

RECOMMENDATION 1. *DOE should maintain a project governance structure for information technology (IT) projects and ensure that its Enterprise Project Management Office (EPMO) follows proper project management standards and methodologies for all current and future IT projects.*

RESPONSE. The DOE implemented the recommendation before the audit.

Since the DOE's Division of Instructional Information and Technology's ("DIIT") establishment of the Enterprise Project Management Office (EPMO) in 2011, that office has become an effective PMBOK-based[1] Project Management and Governance organization. It continues to improve on Project Management Life Cycle and Governance standards, methods, process, policy, and artifacts.

Further, in 2015, DIIT instituted governance policies in support of all DIIT service requests and projects and implemented a Demand Management Process, the objective of which is to ensure all DIIT work is assessed, valued, managed, governed, tracked, and reported.

RECOMMENDATION 2. *DOE should maintain a system for archiving standard project documents and artifacts.*

[1] Project Management Body of Knowledge

RESPONSE. DIIT implemented a solution that meets the recommendation as described in our response to Recommendation 1.

RECOMMENDATION 3. *DOE should develop a formal records retention policy and schedule that ensures the future availability of necessary records for as long as they are needed.*

RESPONSE. DIIT implemented a solution that meets the recommendation as described in our response to Recommendation 1.

Additionally, in collaboration with the DOE's Office of Legal Services and other stakeholders, DIIT is evaluating whether an enterprise records management solution is practical.

RECOMMENDATION 4. *Develop and maintain written Network Operations Center (NOC) policies and procedures for assigning and adjusting school bandwidth.*

RESPONSE. DIIT implemented solutions to address the recommendation before the audit.

The NOC has a procedure for assigning and adjusting school bandwidth that includes determining if the underlying problem is a bandwidth issue, or something else. Additionally, the NOC's decision-making process includes recommended communication with school personnel, including technology Single Points of Contact (SPOCs).

RECOMMENDATION 5. *DOE should ensure that the users' concerns identified in the User Satisfaction Survey and comments that we provided to DOE are appropriately addressed and that the annual survey sent to principals includes questions concerning user satisfaction with high speed internet connectivity.*

RESPONSE. DIIT implemented solutions to address the recommendation before the audit.

DIIT proactively engages and partners with schools using tools and resources to ensure effective technology use by students and teachers. The NOC and Borough Technology Management (BTM) staff conduct investigations to identify and resolve reported technical problems. Proactively, BTM staff provide consultation to assist school leaders with managing their technology and creating strategies for meeting the instructional needs of students and staff. Results from these activities and conversations also inform decisions and strategies made by DIIT managers.

DOE annually sends a survey to schools that includes questions DIIT deems relevant to users' satisfaction with school-based technology. Responses to this survey inform certain decisions and strategies made by DIIT managers.

RECOMMENDATION 6. *DOE should as part of the bandwidth utilization process, consider whether low utilization might be caused by users' experiencing delays, slowness, and unreliability of their schools' high speed internet connectivity. The criteria for a bandwidth upgrade should also take into account school staff input and not rely solely on bandwidth utilization reports.*

RESPONSE. DIIT implemented solutions to address the recommendation before the audit. Please refer to our response to Recommendation 4.

RECOMMENDATION 7. *DOE should proactively partner with schools to offer technology reviews to ensure that DOE staff better understand their requirements, offer appropriate technical solutions, estimate proper bandwidth provisioning, and ensure that schools have adequate technology available to accomplish their instructional goals.*

RESPONSE. DIIT implemented solutions to address parts of the recommendation before the audit.

As in our response to Recommendation 5, DIIT proactively engages and partners with schools to the full extent that existing resources support to ensure effective technology use by students and teachers.

In addition to the school-based dashboards, several innovative tools created by DIIT managers allow school staff access to technical information and training, generally as their time allows and at their own pace.

Among them are:

- "The Sandbox" intranet website, which provides instructional and administrative tools and resources for DOE staff
    - There are specific Sandbox Intranet resources specific to managing school bandwidth
- Technical training provided by central DIIT managers to school-based staff
- Electronic newsletters such as the SPOC Newsletter and entries in Principal's Weekly
- Annual NYCDOE School Technology Summit which provides training for educators, administrators and other staff on best practices in educational technology
- Consulting services to school leaders for technology strategic planning

DIIT provides the following services via the Help Desk:

- Onsite technical support via field services
- BTM onsite consulting services
- Remote network infrastructure monitoring
- Remote desktop services to school administrators
- Connecting to vendors (ASI & Dell) to provide user device break/fix services

DIIT maintains and supports services designed and influenced by the needs and requirements of schools. Such as:

- Computer Science for All – initiative to bring computer science instruction to every elementary, middle, and high school in New York City
- iZone – established in 2010 to support personalized learning environments to accelerate college and career readiness for students
- Connect Ed Grant implementation – providing digital devices and applications to a group of high-needs schools

RECOMMENDATION 8. *DOE should ensure that school Principals and their designated Single Points of Contact (SPOCs) are aware of how to effectively request a bandwidth upgrade, and what the criteria are for receiving one.*

RESPONSE. DIIT implemented the recommendation before the audit.

As explained in the cover letter and response to Recommendations 5, 6, and 7; our existing process (schools report latency issues to the Help Desk, and they are investigated by Help Desk staff and escalated as necessary to the NOC for further investigation and resolution) is communicated to schools and we'll continue to work to share it with school staff.

RECOMMENDATION 9. *DOE should provide additional resources to DOE's technology divisions to improve communication, strengthen the quality of customer service, and increase customer satisfaction.*

RESPONSE. The DOE will take this recommendation under advisement.