



CAUTION AHEAD

Overdue Investments for New York's Aging Infrastructure

While Superstorm Sandy focused much-needed attention on key pieces of New York City's infrastructure, the city faces a number of other infrastructure vulnerabilities that have little to do with storm-preparedness—from aging water mains and deteriorating roads to crumbling public schools. If left unchecked, they could wreak havoc on the city's economy and quality of life.

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CAUTION AHEAD

FOLLOWING THE DEVASTATION OF SUPERSTORM SANDY IN OCTOBER 2012, NEW YORK CITY'S essential infrastructure needs were made a top policy priority for the first time in decades. The scale and severity of the storm prompted numerous studies to assess the damage and led policymakers to take steps to shore up the city's coastal infrastructure weaknesses. Although that work remains imperative, New York City faces a number of other infrastructure vulnerabilities that have little to do with storm preparedness or resiliency. If left unchecked, they could wreak as much havoc on the city's economy, competitiveness and quality of life as the next big storm.

New York City's core infrastructure is in dramatically better shape than it was in the 1980s, when the city closed the Williamsburg Bridge for fear of collapse, track fires were a regular occurrence in the subway system and the Brooklyn Bridge, FDR Drive and West Side Highway all experienced structural failures. Yet, as we detail in this report, much of the city's roads, bridges, subways, water mains, sewer systems, school buildings and other public buildings are more than 50 years old, and many critical components are past their useful life and highly susceptible to breaks and malfunctions.

Over 1,000 miles of New York City water mains are more than 100 years old, leading to frequent and disruptive breaks. More than 160 bridges across the five boroughs were built over a century ago, and in 2012 47 bridges were deemed both structurally deficient *and* fracture critical, a designation engineers use for bridges that have little structural redundancy, making them prone to failure and collapse. The subway's aging signaling system—with 269 miles of mainline signals exceeding their 50-year useful life—slows the movement of trains and forces maintenance workers to build their own replacement parts because manufacturers no longer make them. Additionally, more than 200 of the city's public school buildings were built before 1920.

Simply put, too much of the city's essential infrastructure remains stuck in the 20th Century—a problem for a city positioning itself to compete with other global cities in today's 21st Century economy.

While the Bloomberg administration increased capital spending significantly and made great strides on a number of important fronts, it put more emphasis on new construction than bringing older assets into a state of good repair. The city Department of Transportation (DOT) fell behind on street repaving, for instance, while the Department of Environmental Protection (DEP) lost ground on its own water main replacement targets—even as the city funded the first new water tunnel in nearly a century. Although the School Construction Authority dramatically increased the number of public school seats, the maintenance and repair of many older buildings suffered during this period.

This report finds that city agencies and authorities will have to invest approximately \$47.3 billion to maintain the safety and functioning of New York's infrastructure—leaving a \$34.2 billion capital funding gap at the city, Port Authority¹, New York City Transit, Housing Authority and CUNY over the next five years. This funding gap includes only the replacement and repair of existing infrastructure—not new structures or increased capacity.²

To remain a magnet for global businesses and talent, and to ensure the high quality of life current residents have come to expect, Mayor Bill de Blasio, Governor Andrew Cuomo and other government officials will need to make investing in the city's aging infrastructure a major priority. Although it will not be easy in an era of diminished federal funds, this report outlines several achievable solutions for addressing New York's critical infrastructure needs.

This report provides a comprehensive examination of New York City's current infrastructure vulnerabilities. It goes beyond the coastal infrastructure challenges that were exposed after Super Storm Sandy and offers a new level of detail about the current state of the city's infrastructure in a broad range of critical—but often neglected—areas, including roads and bridges, subways, airports, the electricity distribution system, natural gas service pipes, water mains, sewage pipes and the broadband network. Additionally, the report takes a close look at the state of New York's civic infrastructure, including parks, schools, homeless shelters, CUNY facilities, public hospitals, libraries, public housing and courthouses. Based on extensive data analysis and interviews with more than 100 infrastructure experts in New York and around the nation, the report also puts forth a number of recommendations on what city and state officials can do to address the infrastructure deficiencies outlined in the report.

Much of New York City's skeletal infrastructure dates from the first part of the 20th century. As a result, many structures have been in continual service for over half a century. The average age of New York City's 6,400 miles of sewage mains is approximately 84 years, for example. Its 6,800 miles of water mains are approximately 69 years old, and its 6,300 miles of gas mains are 56 years old. Over 41 percent of city bridges were built before 1950.

"In some cases, the infrastructure in New York is so old we don't even know where it is under the street," notes city planner and historian Alexan-

der Garvin. "There can be a water main break in lower Manhattan and our engineers won't be able to find it."

Many of the city's gas, steam, sewer and water lines are made of old and outmoded materials like unlined cast iron, making them highly susceptible to leaks and breaks. Largely because of leaks, over 2 percent of the gas Con Edison sends to customers every year never makes it to its final destination.³ The difference between the amount of water that enters the city's water delivery system and the amount consumed by customers is a staggering 24 percent, about double the 10 to 15 percent industry standard.

Since 1998, New York has experienced at least 400 water main breaks in all but one year; in 2013, there were 403. Although most of the breaks are minor, serious ruptures are an annual occurrence. Already this year, a major water main break on 13th Street in Manhattan flooded the street and nearby subways.⁴ (In 2013, a similar incident paralyzed the subways at 23rd Street in south Midtown⁵ and, in 2012, a major break occurred near Penn Station.⁶)

"We're probably going to see more water mains that burst because of fatigue cracks," notes Sam Schwartz, a renowned transportation engineer and former New York City traffic commissioner.

The city's 1,445 bridges and 19,000 lane miles of roads and highways also concern engineers. Eleven percent of New York City bridges—162 in all—have been deemed structurally deficient, and 47 bridges have been found to be both structur-

WHAT IS INFRASTRUCTURE?

In this report, we use the word "infrastructure" loosely to cover traditional, horizontal systems such as roads, sewage system and electrical grid as well as vertical assets used by the New York City Housing Authority (NYCHA), City University of New York (CUNY) and the public hospitals. The management and maintenance of these systems is divided among a number of public and private entities, including state and city agencies, public authorities and private, regulated companies. Funding sources vary depending on the system, with large portions of money coming from federal tax revenues (e.g. public housing), city and state government tax revenues (e.g. public schools) and individual consumers (electricity, broadband, transit and water).

“In some cases, the infrastructure in New York is so old we don’t even know where it is under the street ... there can be a water main break in lower Manhattan and our engineers won’t be able to find it.”

ally deficient and fracture critical. The bridges in this latter category not only suffer from significant distress, they lack sufficient redundancy to withstand that distress. According to engineers, if a single span, beam or joint of such a bridge fails, the whole thing could come tumbling down.

Meanwhile, the city DOT has deemed 30.4 percent of the city’s roads to be in “fair” or “poor” condition, up from 15.7 percent in 2000. Roughly 43 percent of all roads in Manhattan are considered substandard, followed by Staten Island (40 percent), the Bronx (34 percent), Queens (31 percent) and Brooklyn (28 percent). This is cause for concern: The longer the pavement goes without rehabilitation, the faster it begins to deteriorate and the more costly it becomes to fix.

“Arguably city streets are in the worst shape of any of our transportation infrastructure—and that says a lot,” says Elliot Sander, former executive director of the Metropolitan Transportation Authority (MTA) and current president and CEO of the HAKS Group, a construction management firm. “While a lot of resurfacing our streets has been done, they need to be fully reconstructed on a much wider scale, rather than just having asphalt poured on top as a patch. The resurfacing program is helpful, but it is basically an over-used Band-Aid, which anyone who uses the city’s streets can attest to.”

The city’s transit infrastructure has undoubtedly come a long way since the 1980s when subways broke down at a much higher rate than they do now, but the MTA’s 659 track miles of subway demand substantial attention, particularly with antiquated subway stations and outmoded signals that regulate the movement and spacing of trains. Of the system’s 728 miles of mainline signals, 269

have exceeded their 50-year useful life and 26 percent are more than 70 years old.⁷

With over 2,600 buildings bigger than 10,000 square feet, New York City is one of the largest landlords in the world. And as with the city’s horizontal infrastructure, a large percentage of these buildings suffer from old age and serious physical defects. For example, with over 370 of the city’s 12,000 public school buildings predating the Great Depression, temperamental heating and cooling systems, leaky roofs, and broken elevators are common. Citywide, 36 different building exteriors, 4 electrical systems and 69 mechanical systems are in need of immediate preventative maintenance.

Similarly daunting capital challenges exist at many of the city’s 24 CUNY campuses, where the average building is 52 years old.

NYCHA’s physical needs were in the spotlight in the wake of Super Storm Sandy when tens of thousands of residents spent weeks without heat or running water. But NYCHA’s problems go beyond storm resiliency. With an average age of nearly 50 years and a long history of underfunding, the majority of the authority’s 2,600 buildings suffer from serious physical distress. A staggering 1,500 or 58 percent do not comply with the Department of Building’s façade standards, as detailed in Local Law 11. Extreme temperatures, collapsed ceilings and persistent mold have left nearly 800 units vacant and uninhabitable—and 319 of these have been empty for over seven years.

In addition, the average public hospital in the city is 57 years old, over half of the clinics operated by the city’s Department of Health and Mental Hygiene were built before 1950, 61 percent of city-owned courthouses were constructed prior to

1940, and the 55 shelters operated by the city's Department of Homeless Services are more than 70 years old, on average.

Bringing all these physical assets into a state of good repair will require a nearly unprecedented investment by the city, state and federal governments. According to the city's Asset Information Management System (AIMS) report, just 18 city agencies have \$6.3 billion⁸ worth of so-called state of good repair needs over the next four years, including \$3.2 billion at DOT, \$1.3 billion at the Department of Education (DOE), \$471 million at the Department of Parks, and \$282 million at the Health and Hospitals Corporation (HHC). In a recent building condition assessment survey, CUNY itemized \$2.5 billion in immediate capital needs, 11 times more than what is outlined in the city's FY2014 AIMS report. And, in their five-year capital plans, NYCHA, New York City Transit and the Port Authority identified \$15.5 billion, \$16.3 billion and \$6.8 billion⁹ in state of good repair needs, respectively.

That comes to a total cost of \$47.3 billion over the next four to five years. And this only reflects repairing and maintaining current infrastructure—not needed service expansions such as building new sewers or bus rapid transit lines.

The enormous backlog of needs goes back decades and is partly attributable to the lack of adequate investment over many years. Between 2002 and 2013, Mayor Michael Bloomberg increased city capital spending significantly over what the three previous mayors spent during their tenures. At the DEP, the construction of Water Tunnel 3 was reinvigorated after years of neglect, and the School Construction Authority expanded public schools by 126,000 seats. Major new parks were built and the number 7 train will be extended to the far west side of Manhattan using city capital dollars.

Still, when it came to maintaining existing assets, a number of New York City agencies lost ground during the Bloomberg administration. According to AIMS, between Fiscal Year 2009 and Fiscal Year 2014, capital needs at the Department of Correction grew by 181 percent, at HHC by 72 percent, DOE by 71 percent and the Department

of Homeless Services by 47 percent. According to its own assessment, CUNY's backlog of needs went from \$1.7 billion in 2007 to \$2.5 billion in 2012, a 47 percent jump.

Though DOT capital needs increased by a more modest 8 percent over the last five years, the agency has resurfaced an average of only 852 lane miles of road a year since 2000, even though an estimated 1,000 lane miles fall out of good repair every year. Similarly, to stave off water main breaks, experts believe that the DEP should follow a 100-year replacement cycle, which would mean replacing the equivalent of 68 miles of water mains every year. But the agency has failed to reach this target a single time over the last decade.

There is a huge gap across the board between the backlog of the city's capital needs and funding levels. Based on accumulated funding gaps and shortfalls in upcoming capital plans, unmet "state of good repair" needs will reach \$34.2 billion over the next five years. This includes deferred capital maintenance at the New York City Transit Authority (\$10.5 billion)¹⁰ and CUNY (\$2.5 billion) and projected shortfalls at NYCHA (\$14 billion), Port Authority (\$3.9 billion) and 18 city agencies (\$3.3 billion).

To overcome this enormous backlog, the report urges Mayor de Blasio to make a significant new infrastructure investment and refocus the city's capital spending on state of good repair needs. Ramping up the city's investment will not be easy without additional resources from Albany and Washington, something that seems unlikely at the moment given the paralysis in Congress. But the report suggests that a major public works program to tackle the city's aging infrastructure could be one of the most effective ways to create middle-income jobs in the five boroughs, a clear policy goal of the de Blasio administration.

The report recommends several possibilities for new dedicated revenue sources to pay for infrastructure projects—including a Surface Water Management Fee, tolls on the East River bridges and a residential parking permit program—as well as new mechanisms to capture the value created by infrastructure projects. It calls on city and state officials to end the practice of diverting ex-

isting dedicated revenue streams from the transit system, airports and the water system.

To ensure that the city's limited capital dollars go farther, state and city officials will also need to reduce the cost of construction on capital projects. Public sector construction projects in New York cost more and take longer than equivalent work in the private sector; they also tend to cost significantly more than equivalent work by public sector agencies in other cities. For instance, in 2012 replacing or repairing public school electrical and mechanical systems in New York City cost 67 percent more than in Denver, 46 percent more than in Seattle and 18 percent more than in Chicago.¹¹ In Tokyo the cost of building a new subway line is approximately \$448 million per mile; in Paris, it is roughly \$368 million per mile. By comparison, New York's Second Avenue subway and 7 train extension have each cost the MTA well over \$2 billion per mile.¹²

The report recommends a number of changes to state and city contracting laws and practices that could bring down construction costs.

The massive scale of infrastructure needs also requires a more comprehensive capital planning process. While the Office of Management and Budget (OMB) commissions the Asset Information Management System report, some experts say that its assessments are often cursory and it excludes huge portions of the city's assets such as water mains, treatment plants and sewer pipes. Rather than basing capital allocations on the needs outlined in the report, OMB has tended to base funding levels on a mixture of precedent, persuasion and debt capacity.

"The city needs more sophisticated and practical long-term planning," says Stephen Berger, former executive director of the Emergency Control Board and an expert on capital budgeting.

There also must be more coordination between capital and maintenance spending. When buildings are not maintained properly on a day-to-day basis—when the snow isn't cleared off the roof and routine malfunctions are not taken care of in a timely fashion—properties become distressed and capital costs increase.

Coming to terms with New York's huge state of good repair needs is an immense challenge, but the city's health, quality of life and economic competitiveness depends on it. "If New York City wants to maintain its presence in the world, among other leading global cities, we have no choice but to maintain this infrastructure," says Mary Ann Tighe, New York Tri-State Region CEO for real estate firm CBRE. "We're selling talent above all in New York. But the talent won't come here without a strong infrastructure and environment."

"It's an issue of competitiveness and livability," adds Elliot Sander. "If our infrastructure is not advanced to an acceptable level and then maintained, these systems will degrade. We know from the 1980s that these systems will fall apart. It came very close to killing the city and region. You probably need to double the investment to both bring all the elements up to a state of good repair and to deal with the added demand from the growth we have had, and then put it on a regular replacement cycle. We also need to get more for our money. It will be difficult to do all of this financially and politically. But if we continue on the current course, it is likely New York will be substantially diminished as a global leader, with enormous environmental, social, political, and financial implications that far outweigh the cost."

This report is intended to prompt a serious discussion among community leaders and the general public that the infrastructure vulnerabilities discussed here must be addressed if New York City is to remain a dominant global urban destination. While the report is a deep dive into the state of disrepair of the backbone infrastructure of what makes New York work, it is not a substitute for the study and documentation of the respective expertise of each of the discussed infrastructure systems. Our study is intended to shine a light on what their needs truly are.

OVERVIEW

- ▶ While Super Storm Sandy focused much-needed attention on key pieces of New York City's infrastructure, the city faces a number of other infrastructure vulnerabilities that have little to do with storm-preparedness—from aging water mains and deteriorating roads to crumbling public schools. If left unchecked, they could wreak havoc on the city's economy and quality of life.
- ▶ New York City is one of the world's most important global cities in the 21st Century, but much of its infrastructure remains a relic of the early 20th Century.
- ▶ To remain economically competitive and ensure the high quality of life New Yorkers have come to expect, New York City and State policymakers will have to find ways to meet these important infrastructure needs.
- ▶ To address mounting infrastructure gaps, the city will have to identify new sources of funding for critical capital projects, find ways to reduce construction costs and improve the planning process for infrastructure spending.

MOUNTING CAPITAL NEEDS

- ▶ The cost of simply repairing or replacing existing infrastructure across the five boroughs is estimated to be \$47.3 billion. This figure does not include the cost of expansion projects, such as new parks or schools. It also excludes the DEP, whose needs are well into the tens of billions of dollars.
- ▶ City agencies with significant capital needs for maintaining the safety and functioning of existing infrastructure include the Department of Transportation (\$3.2 billion), Department of Education (\$1.3 billion), Parks Department (\$471 million), Department of Correction (\$293 million) and the Health and Hospitals Corp. (\$282 million).
- ▶ State of Good Repair needs are even more significant at other governmental entities in the city, such as the New York City Transit division of the MTA (\$16.3 billion), the New York City Housing Authority (\$15.5 billion), the Port Authority (\$6.8 billion) and CUNY (\$2.5 billion).
- ▶ Based on accumulated funding gaps and shortfalls in upcoming capital plans, the state of good repair funding gap will reach \$34.2 billion over the next five years.
- ▶ At several agencies, less than 20 percent of the documented capital needs have been funded. This includes just 17 percent at the Department of Education (\$224 million of the \$1.3 billion), 17 percent at the Parks Department (\$81 million out of \$471 million) and 15 percent at the Department of Correction (\$45 million out of \$293 million).

STREETS & HIGHWAYS

- ▶ The number of city streets with a pavement rating of "good" fell from 84.3 percent in 2000 to 69.6 percent in 2013.
- ▶ NYC DOT sets a goal of resurfacing approximately 1,000 lane miles of streets each year, but the agency has fallen short of that target on all but three occasions since Fiscal Year 2000 (FY2009, FY2011 and FY2012). During this period, it resurfaced an average of only 852 lane miles per year.
- ▶ City roads outlive their useful life by 20 percent on average before being resurfaced or reconstructed.
- ▶ Less than 60 percent of streets in Manhattan (57.3 percent) and Staten Island (59.9 percent) received a "good" rating for pavement conditions, compared to 72.8 percent in Brooklyn, 70.3 percent in Queens and 66.0 percent in the Bronx.
- ▶ Of all city neighborhoods, West Harlem/Morningside Heights has the worst pavement conditions, with just 34.1 percent of streets in "good" condition. Six of the 10 neighborhoods with the worst pavement conditions are in Manhattan.
- ▶ The average highway in the five boroughs does not receive a "good" rating. On a 10-point scale where a 9 or 10 is excellent, 7 or 8 is good, 6 is fair and 1-5 is poor, the city's overall highway condition rating was just 6.58 in 2012.
- ▶ Highway conditions in the city have declined, from an overall surface rating of 6.74 in 2008 to 6.58 in 2012. Conditions have deteriorated in every borough except Brooklyn.
- ▶ Five of the highways with the lowest surface rating are in Queens: Route 25A, Route 24, the Shore Front Parkway, Cross Bay Parkway and Jackie Robinson Parkway.

BRIDGES

- ▶ The city's 1,445 bridges are 63 years old on average, with 165 of them built more than a century ago.
- ▶ The oldest bridges are in the Bronx and Manhattan, where the average age is 72 years.
- ▶ In 2012, 162 bridges across the city—or 11 percent of the total—were structurally deficient.
- ▶ Of all the boroughs, the Bronx was home to the highest share of "structurally deficient" bridges in 2012, with 16 percent of its bridges deemed structurally deficient. Brooklyn (14 percent) had the next highest share of structurally deficient bridges, followed by Manhattan (13 percent), Queens (9 percent) and Staten Island (2 percent).
- ▶ At least 47 bridges in New York City were "fracture critical" and "structurally deficient" in 2012. This included 16 in the Bronx, 14 in Manhattan and 10 in Brooklyn.

SUBWAYS

- ▶ New York's subway signaling system is old and obsolete. Of the 728 miles of mainline signals, 269 have exceeded their 50-year useful life—26 percent are more than 70 years old and 11 percent are between 50 and 69 years old.
- ▶ New York's 13 subway shops and repair yards are 90 years old, on average. The East New York facility, originally built in 1880 as a horse and carriage depot, still relies completely on hand-thrown switches. Fifty-four percent of the components at these repair facilities have exceeded their useful life.

AIRPORTS

- ▶ LaGuardia's main terminal is 50 years old and in terrible condition, while two of JFK's six terminals have stood for over four decades.
- ▶ JFK's air cargo facilities are 40 years old on average, with 63 percent of cargo space considered "non-viable," or unfit for modern screening, storage and distribution.

UNDERGROUND INFRASTRUCTURE

- ▶ New York City's 6,800 miles of water mains are 69 years old, on average.
- ▶ 2,200 miles of the water mains—roughly a third of the city's total—are made of unlined cast iron that was laid before 1930. Another 2,400 miles are cement lined cast iron installed between 1930 and 1969. Both materials are inferior to the flexible ductile iron used today and are susceptible to internal corrosion and prone to leak.
- ▶ In 2013, there were 403 water main breaks across the city. This is up from 370 in 2012, but down significantly from a decade ago, when there were more than 500 water main breaks a year.
- ▶ The difference between the amount of water that enters the city's water delivery system and the amount consumed by customers is 24 percent, about double the 10 to 15 percent industry standard.
- ▶ The average age of New York City's 6,400 miles of sewage mains is approximately 84 years. More than 1,100 miles are over 100 years old and two thirds were installed prior to 1940.
- ▶ New York's 6,300 miles of gas mains are 56 years old, on average.
- ▶ 68 percent of the city's steam mains and services are over 40 years old.

GOVERNMENT IT

- ▶ Mainframes operated by the city's Department of Information Technology and Telecommunications currently run approximately 170 applications on DB2 and ADABAS, database management systems released in 1983 and 1970, respectively.

SCHOOLS

- ▶ 209 of the city's 1,177 school buildings were built prior to 1920.
- ▶ The average school building in the five boroughs was constructed in 1948. Of the 1,200 school buildings in the DOE portfolio, 170 are more than a century old and 370 predate the Great Depression.
- ▶ Brooklyn's schools are the oldest in the city. The average age is over 70 years old and 77 of them have been standing for more than a century.

PUBLIC HOUSING

- ▶ More than 75 percent of NYCHA's residential buildings are over 40 years old and 531 have been around since at least 1950.
- ▶ Of NYCHA's 2,600 buildings, 1,500 do not comply with Local Law 11 standards for exterior and façade conditions.
- ▶ A Physical Needs Assessment commissioned by NYCHA in 2011 found that façade repairs would require \$621 million immediately and \$6.7 billion over the next five years, far greater than the \$580 million allotted. This is in addition to the \$7.6 billion needed to rehabilitate apartments, \$1.2 billion for mechanical systems, \$893 million for building grounds and \$217 million for electrical equipment

OTHER PUBLIC BUILDINGS

- ▶ The 55 shelters operated by the Department of Homeless Services are more than 70 years old, on average.
- ▶ Sixty-one percent of city-owned courthouses were erected before 1940.
- ▶ The average city hospital is 57 years old.
- ▶ The average building on CUNY's 24 campuses is 53 years old, and 69 of them were constructed more than 75 years ago.
- ▶ Half of the clinics operated by the city's Department of Health and Mental Hygiene were built prior to 1950.
- ▶ The average complex on Rikers Island is 44 years old, while the city's borough detention centers are 47 years old on average.
- ▶ Seven of the 25 oldest and six of the most visited parks in the nation are in New York City

The following is a summary of the report's recommendations.

A far more detailed recommendations section begins on page 56.

INCREASING INFRASTRUCTURE INVESTMENTS

- ▶ Make investing in NYC's aging infrastructure a key part of the de Blasio administration's plans to create middle-income jobs
- ▶ Refocus capital spending on state of good repair needs
- ▶ Identify new dedicated revenue sources to pay for infrastructure projects—and stop diverting money from existing "dedicated" funding streams
- ▶ Implement East River tolls or congestion fees
- ▶ Introduce a Surface Water Management Fee to incentivize capture of rainwater before it enters sewers
- ▶ Create new mechanisms to capture value from infrastructure projects
- ▶ More federal support
- ▶ A lift from Albany
- ▶ Stop diverting airport revenue
- ▶ Create an infrastructure bank to help select and finance projects with high strategic and economic potential

BRINGING DOWN INFRASTRUCTURE COSTS

- ▶ Authorize Design-Build and public-private partnerships
- ▶ Avoid "Low Bids" from unqualified contractors
- ▶ Reduce the time to design and approve construction contracts

- ▶ Renew Project Labor Agreements

- ▶ Repeal the Scaffold Law

IMPROVING INFRASTRUCTURE PLANNING

- ▶ Create a more effective capital planning process
- ▶ Establish a more accurate and thorough survey of the city's infrastructure assets and their state of good repair
- ▶ Better align infrastructure investments with economic development goals
- ▶ Take a census of underground utilities

DEVELOPING INFRASTRUCTURE INNOVATIONS

- ▶ Expand the MTA's Small Business Mentoring Program
- ▶ Invest in real-time bridge sensor technologies
- ▶ Lease space on city street lights, traffic signals and pay phones for telecom company cell sites
- ▶ Reassign agency tech engineers to DoITT

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Overdue Investments for New
York's Aging Infrastructure

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\$47.3B

minimum cost of simply
repairing or replacing existing
NYC infrastructure

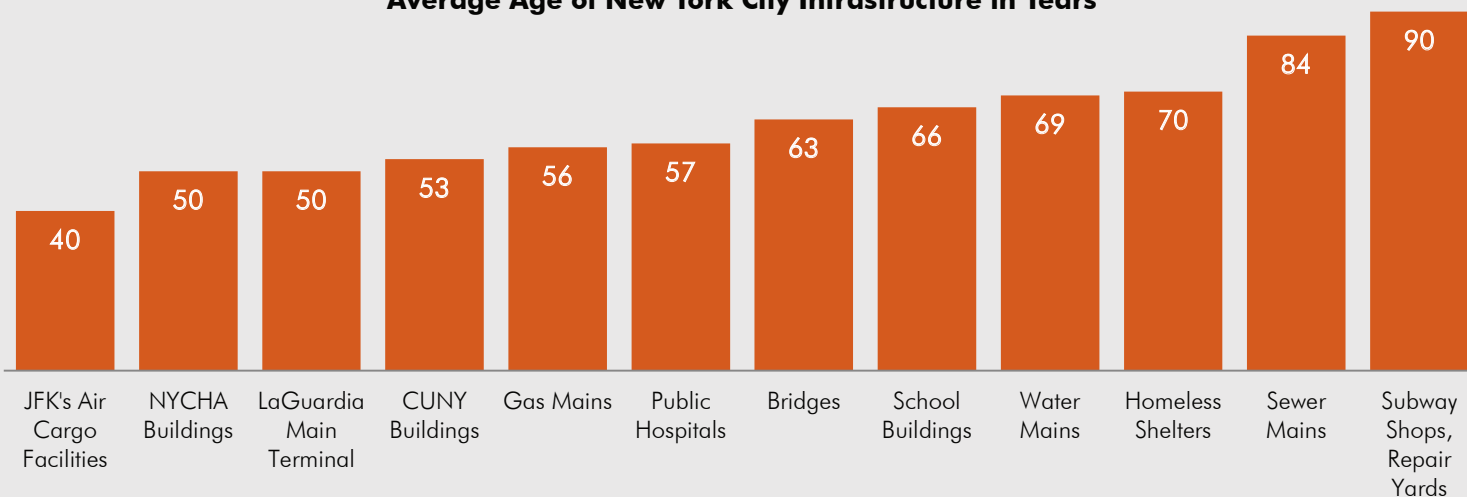
\$34.2B

NYC's state of good repair funding
gap over the next five years

53%

increase in NYC building
construction costs since 2000

Average Age of New York City Infrastructure in Years



30.4%

NYC roads in "fair" or
"poor" condition, up
from 15.7% in 2000

2.7mil

cars drive over the 47
NYC bridges rated both
fracture critical and
structurally deficient
each day

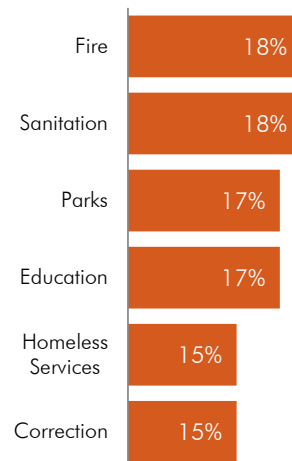
63%

of JFK's air cargo facilities
unfit for modern screening,
storage, distribution

58%

of NYCHA buildings don't
comply with Local Law 11
standards for exterior and
façade conditions

% of NYC Agency Capital
Needs Currently Funded



403

number of NYC water
main breaks in 2013,
up from 370 in 2012

66%

of the PlaNYC water
main replacement target
has not been met

60%

of Con Edison gas mains
made of unprotected steel
steel or cast iron, an
outdated and leak-prone
material

37%

of NYC's subway signals
have exceeded their
useful life

The Century Club

Percentage of New York City infrastructure that is 100+ years old

18%

of DHS shelters

17%

of courthouses

15%

of water mains

15%

of DOE's
school buildings

15%

of subway shops
and yards

12%

of CUNY buildings

11%

of bridges

MOBILITY

Whether New Yorkers travel by car, subway or plane, they confront aging and decaying systems that limit mobility and undermine the city's economy

More than anything else, New York City's transportation infrastructure—its roads, highways, bridges and subways—ties a collection of peninsulas and islands into a single city. Its airports serve as important gateways to the world at a time of increasing global economic interdependence. But unlike many of its counterparts in the global economy, New York's core transportation infrastructure is old and outdated.

Even as officials look to buses and bikes to create a multimodal transit network, city roads outlive their useful life by 20 percent on average before being resurfaced or reconstructed. The city's 1,445 bridges are 63 years old on average, with 162 of them deemed structurally deficient and 47 falling into an even more dangerous category of being fracture critical and structurally deficient. Meanwhile, even as subway ridership

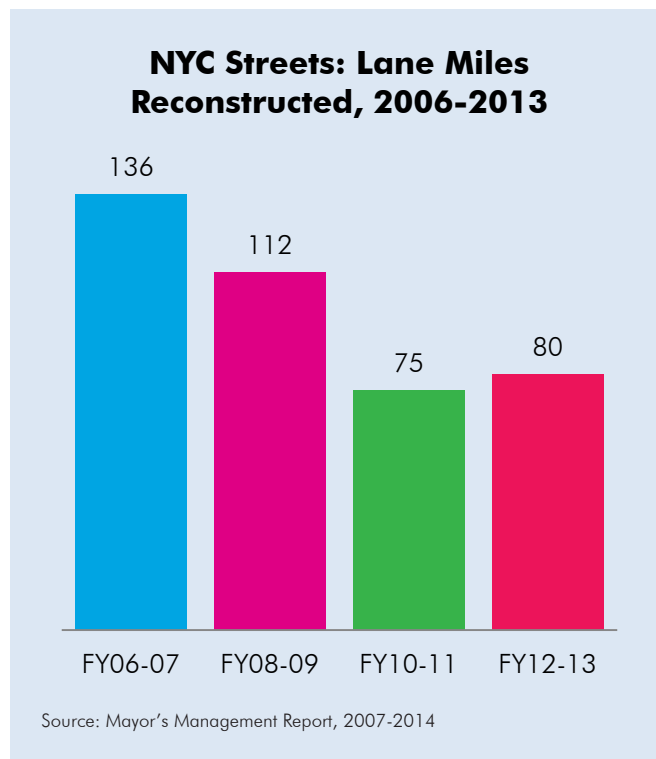
has increased dramatically over the last decade (weekend ridership is at an all-time high), an antiquated signaling system and inadequate subway stations inhibit capacity and contribute to delays. Major terminals at LaGuardia and, to a lesser extent, JFK airports are in poor condition and struggle to accommodate dramatically increased passenger traffic.

Streets

New York City's streets do far more than carry automobile traffic. Roads help buses, bicycles and pedestrians navigate the city, provide a protective layer over fragile utility mains and guide rainwater to catch basins. Yet, in recent years, city streets have been deteriorating. Indeed, the number of city streets with a pavement rating of "good" fell from 84.3 percent in 2000 to 69.6 percent in 2013.¹³

The city's Department of Transportation is charged with maintaining streets throughout the five boroughs, but in recent years it has struggled to keep up. With a useful life of 17 to 18 years,¹⁴ approximately 1,000 lane miles out of the total 18,242¹⁵ fall out of good repair every year. But while the DOT sets a goal of resurfacing 1,000 lane miles each year, the agency has fallen short of that target on all but three occasions since Fiscal Year 2000 (FY2009, FY2011 and FY2012). During this period, it resurfaced an average of only 852 lane miles per year.

"In the early 2000s, the street budget was an easy thing to cut and we ended up resurfacing a lot fewer streets for many years," says Eric Beaton, New York City Department of Transportation (DOT) director of Transit Development. "That's a deficit we're still trying to dig out of, and it will last for many more years." The city would need to resurface 3,067 miles this year to make up for the accumulated deficit from 2000 to 2013. Not only



30.4%

of NYC roads in "fair" or "poor" condition, up from 15.7% in 2000

Road Conditions by Borough

Borough	% of Street Lanes in "Poor" or "Fair" Condition
Manhattan	42.7%
Staten Island	40.1%
Bronx	34.0%
Queens	29.7%
Brooklyn	27.2%

Source: Mayor's Management Report, 2013

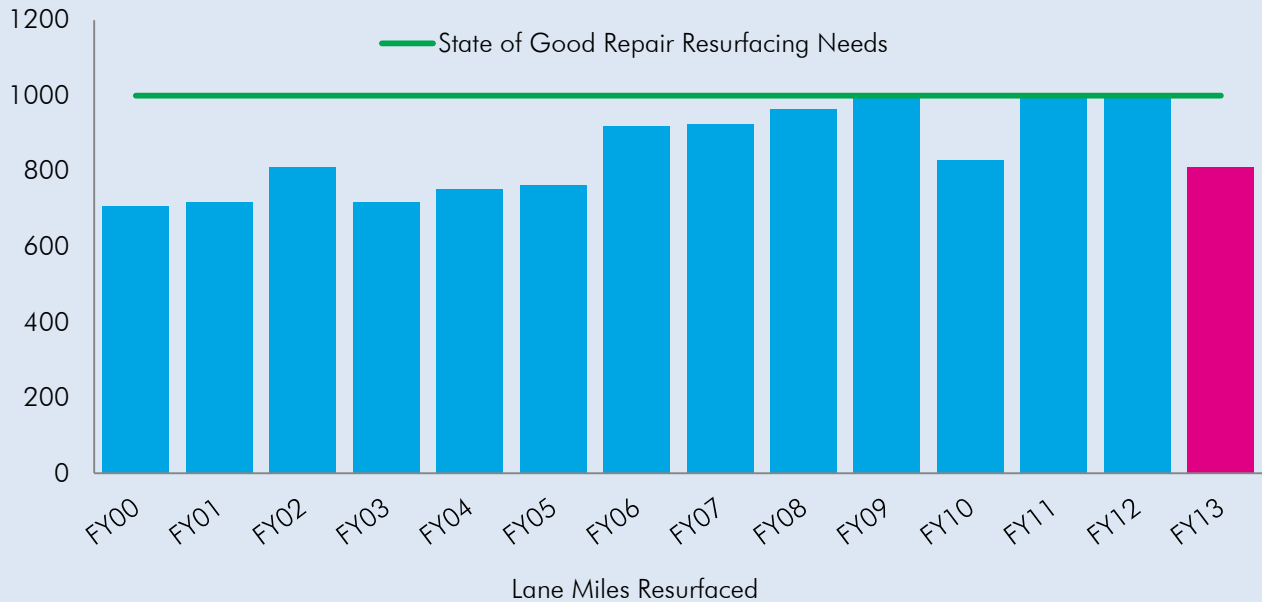
Worst Street Conditions in NYC, By Community Board

Community Board	% of Street Lanes in "Poor" or "Fair" Condition
Manhattan 9	65.9%
Manhattan 11	53.0%
Manhattan 1	48.8%
Manhattan 3	46.4%
Manhattan 8	43.4%
Staten Island 2	43.4%
Brooklyn 13	43.2%
Bronx 10	42.6%
Manhattan 6	42.0%
Queens 2	40.7%

Source: Mayor's Management Report, 2013

The Resurfacing Gap

NYC DOT sets a goal of resurfacing 1,000 lane miles a year that fall into disrepair, but it has only met that target three times since 2000.



Source: Mayor's Management Report, 2001-2014

would this overwhelm DOT's resources, the frequency of street closures would strangle the circulation of traffic.

Simply resurfacing the street, however, is often inadequate. New York's well-trafficked roads are subject to significant wear and tear. Deterioration can reach below the road surface and affect the base structure. When this foundation is damaged, new asphalt will not last as long as it would otherwise, necessitating more frequent paving. And while a solid base will absorb the vibrations of street traffic, a damaged foundation leaves the utility mains it houses susceptible to the thumping of large vehicles.

To repair the foundation requires replacing the roadway down to a foot or more below the street's surface and usually includes reconstruction of the curbs and sidewalks as well.¹⁶ Yet street reconstructions, fundamental to the long-term health of city streets, have steadily declined in recent years. From 2006 to 2007, DOT reconstructed 136 lane miles. In the last two years, only 80 miles were reconstructed.¹⁷

While streets are in disrepair throughout New York, the problem is worse in certain boroughs and neighborhoods. Every year, in preparation for the Mayor's Management Report, street conditions are assessed, and individual blocks receive a rating of *good*, *fair* or *poor* based on the quality of the pavement. While 73 percent of Brooklyn streets received the highest rating of "good" in FY 2012, in Manhattan and Staten Island less than 60 percent of the streets were "good."¹⁸

Ratings at the community board level provide further evidence of these disparities. Of the 10 community board districts with the worst pavement conditions, six are in Manhattan. A staggering 65.9 percent of streets in West Harlem/Morningside Heights (Community Board 9) are in fair to poor condition. This is considerably higher than the community district with the next worst rating: Manhattan Community Board 11, where 53 percent of streets are in fair to poor condition.¹⁹

Highways

Highways are critical to the functioning of the city. Thousands of tons of air cargo arriving at

JFK are distributed via the Van Wyck Expressway every year. Millions of pounds of fish, produce and meat are delivered to Hunts Point and then to grocery stores across the five boroughs via the Bruckner Expressway. Visitors from Long Island, New Jersey and New England use the city's interstates, parkways and expressways to visit its museums and theaters, shop in the city's stores and cheer in its sporting arenas.

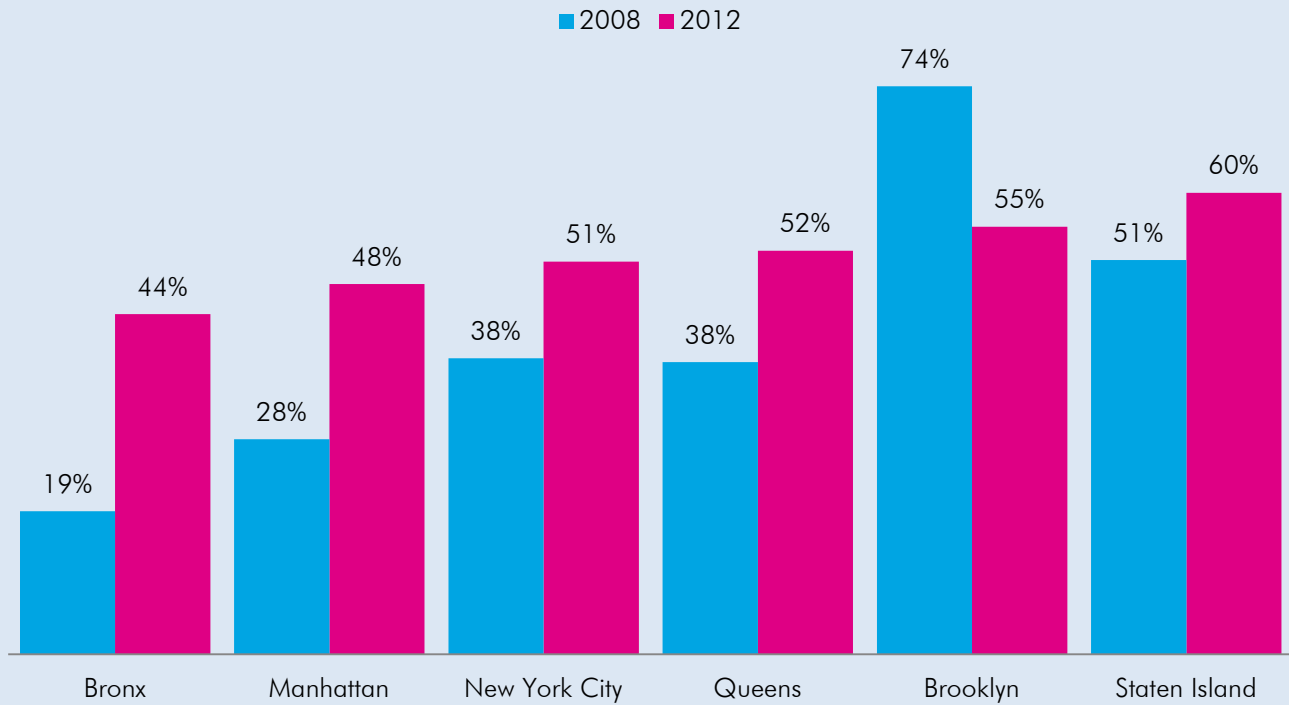
While the city DOT is responsible for the local streets, highways fall under the purview of the state. Though supervision is different, the results are the same: deteriorating conditions and a number of highways in disrepair.

Each year, the state DOT inspects New York City's 306 miles of highway and rates pavement conditions on a 10-point scale, where 6 is considered "fair" with "surface distress clearly visible" and 5 is considered "poor" where "distress is frequent and severe." Overall, highway maintenance has declined in the city, with 51 percent rated "fair" or "poor" in 2012 compared to 38 percent in 2008. Conditions have declined in every borough except Brooklyn. Bronx's highways experienced the greatest deterioration, with highway surfaces rated "fair" or "poor" jumping from 18 percent in 2008 to 44 percent in 2012. It was followed by Manhattan (28 percent to 48 percent), Queens (38 percent to 52 percent) and Staten Island (51 percent to 60 percent).

Perhaps the most glaring problem in the city's highway network is the Gowanus Expressway. Completed in 1941, the crumbling elevated expressway is functionally obsolete. "The Gowanus [Expressway] is one roadway that forever has needed to be replaced," says Christopher McBride, community transportation specialist with AAA New York. "It is just being patched together. ... The operations are totally inadequate for the traffic it carries. It was designed for a different era with different traffic volumes and patterns."

According to McBride, the Gowanus is not the only city highway that has severely deteriorated. "FDR Drive is really in terrible shape. There are sections of it that need to be rebuilt. It is beyond potholes--it looks like you should have a tank to go over it," says McBride. "The Cross Bronx Ex-

Highway Lanes Rated "Fair" or "Poor," by Borough



Source: NYS Dept. of Transportation, "Pavement Data Report Region 11," 2012. Based on a 10-point scale, where 1-5 is considered "poor," 6 is "fair," 7-8 is "good" and 9-10 "excellent."

NYC Highways With the Lowest Surface Rating

Route	Borough	Mileage	Surface Rating
Route 25A	Queens	12.42	6.0
Korean War Veterans Parkway	Staten Island	4.63	6.0
Moshulu Parkway	Bronx	3.11	6.0
Pelham Parkway	Bronx	2.28	6.0
Route 24	Queens	1.92	6.0
Shore Front Parkway	Queens	1.58	6.0
Cross Bay Parkway	Queens	0.33	6.0
Jackie Robinson Parkway	Queens	4.9	5.8
Route 22	Bronx	0.36	5.0

Source: NYS Dept. of Transportation, "Pavement Data Report Region 11," 2012. Based on a 10-point scale, where 1-5 is considered "poor," 6 is "fair," 7-8 is "good" and 9-10 "excellent."

pressway is totally overloaded. You have sub-standard shoulders, on and off ramps that are too short. It is a nightmare.”

While several factors—including inclement weather, increased traffic volume and heavier vehicles—can affect highway conditions, reduced funding is paramount. In recent years, the New York State DOT has shifted its priorities from highways to bridges, according to Rick Bennett, the agency’s statewide pavement manager. “Because the bridge needs are greater than the pavement needs,” he says, “bridges are getting a larger share of the funding—especially in the city.”

According to Bennett, the state DOT follows a systematic pavement strategy. Once the pavement rating falls to a six, the road will be resurfaced. Using this as a guideline, a number of New York’s highways are clearly overdue for repair. Five of the worst maintained highways are in Queens: Route 25A, Route 24, the Shore Front Parkway, Cross Bay Parkway and the Jackie Robinson Parkway.

Bridges

New York’s 1,445 bridges stitch the city together, carrying vehicles, bicycles and pedestrians not only over waterways, but train tracks, neighborhoods, highways and roads. Ownership and over-

sight of these bridges is divided among the state DOT, city DOT, Port Authority, MTA and a number of other agencies and authorities. But there is one common thread: A significant percentage of them are extremely old and many are in poor condition.

Forty-one percent of the city’s bridges were built prior to 1950. One hundred and sixty-five have stood for over a century. The oldest are in the Bronx and Manhattan, where the average age is 72 years. Not surprisingly, bridges in these two boroughs are also in the worst state of repair. “Within our transportation network, the worst state of good repair is our bridges,” says Jack Schmidt, director of transportation planning at the New York City Department of City Planning.

According to the Federal Highway Administration, a bridge is “structurally deficient if significant load-carrying elements are found to be in poor condition due to deterioration or damage.” In 2012, 162 of the city’s 1,445 bridges—or 11 percent—were structurally deficient. Of all the boroughs, the Bronx was home to the highest share of structurally deficient bridges, with 52 in all representing 16 percent of its total. Fourteen percent of Brooklyn’s bridges were structurally deficient as were 13 percent in Manhattan, 9 percent in Queens and 2 percent in Staten Island.

New York City DOT, which must often coordinate with state highway and environmental agencies located in Albany, has the highest percentage of structurally deficient bridges.

Inspections performed by the New York State DOT employ a more rigorous assessment than the federal government. Inspectors evaluate the condition of up to 47 structural elements to reach a comprehensive score ranging from 1 to 7. A rating below 5 is considered “deficient,” indicating the bridge requires corrective maintenance or rehabilitation to be fully functional. In 2012, the average bridge in New York City had a condition rating of 4.98. Of the city’s 1,445 bridges, 852 were deficient

New York City Bridge Ratings, 2012				
	Average Year Built	Average Condition Rating	# Structurally Deficient	% Structurally Deficient
Bronx	1942	4.8	52	16%
Brooklyn	1947	5.1	33	14%
Manhattan	1942	4.7	31	13%
Queens	1960	5.1	43	9%
Staten Island	1963	5.2	3	2%
Total	1951	5.0	162	11%

Source: NYS Dept. of Transportation, “New York State Highway Bridge Data 2014”

according to state standards and in need of rehabilitation. Manhattan’s bridges scored a lowly 4.66 on average followed by the Bronx (4.81), Brooklyn (5.08), Queens (5.12) and Staten Island (5.22).

Even the city’s most prominent bridges urgently need repair. Suspender ropes on the George Washington Bridge, the world’s busiest motor vehicle bridge, are original equipment dating back to 1931. The average age of replacement for suspender ropes is 70 years, making these a dozen years overdue. According to inspections by the Port Authority, which manages the bridge, many of the ropes show evidence of corrosion and reduced strength.²⁰ According to the Port Authority’s latest ten-year capital plan, released in early 2014, all the ropes will not be replaced until the end of 2024.²¹

Structural issues also plague several bridges along highways, particularly the Brooklyn-Queens Expressway. The city’s longest bridge, an elevated section of the BQE, carries cars over the Gowanus Canal and the Red Hook neighborhood. According to one prominent engineer, “patch work is being done but there are no plans for a complete rehabilitation which is sorely needed.” Similarly, along the “triple-cantilevered” section of the BQE below the Brooklyn Heights Promenade, the “steel within the structure has not been inspected in 60 years.” Loss of any section of the BQE would result in incalculable costs, diverting trucks to city streets and likely adding casualties.

While the city and state manage dozens of old bridges across the five boroughs, newer bridges also pose problems. In the 1950s and 1960s, the introduction of the computer allowed engineers to make more precise calculations and so forego the duplication of parts. It turns out, however, that so-called “unnecessary duplication” becomes extremely important as bridges age. As a result, while most older bridges hover around 4, the safety factor on most of these newer bridges is 2. If you add corrosion, the bridge can degrade and become a “fracture critical bridge.” If these bridges then lose just one connection, one joint, one span, one beam, explains Sam Schwartz, CEO of Samuel Schwartz Engineering, the bridge falls down.

47

bridges in New York City were both fracture critical and structurally deficient in 2012

2.7 mil

cars drive every day on the 47 New York City bridges that were both fracture critical and structurally deficient

Bridge Condition, by Owner

Owner	Average Year Built	# Structurally Deficient	% Structurally Deficient
NYCDOT	1934	85	14.2%
NYS DOT	1965	64	10.5%
MTA	1952	11	10.1%
PA	1965	2	1.8%

Source: NYS Dept. of Transportation, “New York State Highway Bridge Data 2014”

At least 47 bridges in New York City were both fracture critical *and* structurally deficient in 2012. This includes 16 in the Bronx, 14 in Manhattan and 10 in Brooklyn. The daily traffic volume on these 47 bridges is 2.7 million cars; eight carry more than 120,000 cars per day.

Subway Signals

The MTA’s signaling system is old and obsolete. Of the 728 miles of mainline signals, 269 have exceeded their 50-year useful life. Twenty-six percent are more than 70 years old and 11 percent are between 50 and 69 years old.²⁶ The equipment is no longer manufactured, forcing the Transit Authority to build and replace parts at its own signal shop.²⁷

37%

of subway signals have exceeded their 50-year useful life

The existing signal system is partitioned into fixed blocks, permitting only one train to be in any block at a time. If a train attempts to enter an occupied block, an automatic brake is applied. While this system ensures safety, it is imprecise and inefficient. In modern “moving block” systems, sensors record the precise location of every subway car. Computers at a rail control center calculate and enforce “safe zones” around each train according to its speed and location. This system, known as Communications Based Train Control (CBTC), increases track capacity by allowing trains to run closer together and faster without compromising safety. When CBTC was installed on the L line in 2006, the MTA increased its hourly throughput from 15 to 26 trains.²⁸

Despite the obvious efficiency and safety improvement that accompany CBTC, rollout will be slow. At this time, only the L line has had a complete overhaul. Current investment along the 7 line will be a “hybrid upgrade”,²⁹ melding standard and advanced signaling technology. By the end of 2034, approximately half of the system still will use outdated fixed block signals.³⁰

The Queens Boulevard and Sixth Avenue corridor upgrades, for instance, are part of a broader strategy to modernize signal interlockings—where tracks cross or merge—without addressing the remainder of the corridor or installing CBTC until years later. Wynton Habersham, vice president of Maintenance of Way at the MTA, says this approach is not a full modernization and will provide only “very bottom-level capabilities, no automatic train scheduling or train routing and the related efficiencies until CBTC is introduced a few years down the line.”

Several factors explain the slow and limited approach to modernization. Foremost is the expense. From 2015-2034, the MTA will spend near-

MODERNIZING NEW YORK'S SUBWAY SYSTEM

Just a few decades ago, the Metropolitan Transportation Authority (MTA) was on the brink. Antiquated subway cars screeched along, while train car malfunctions and track fires plagued the system.²² In 1982, a breakdown occurred every 7,145 miles. Today, conditions are dramatically improved, with a breakdown every 162,138 miles, an astounding 2,169 percent improvement.²³

Yet for all its progress, few would confuse the New York City subway with Hong Kong, Seoul or Tokyo's sleek, technologically advanced systems. Stations feature broken tiles, leaking roofs, flaking paint and rusted beams. Nearly 300 stations lack countdown clocks that provide real-time arrival information.²⁴ And a quarter of the signaling equipment, governing the movement of trains, dates back to the 1930s.²⁵ Robert “Buzz” Paaswell, director emeritus of the University Transportation Research Center at City College, confirms that New York's subways are not world-class in the 21st century. “It's a 1980 or 1990 world-class system,” he says.

After decades of rehabilitating and replacing decaying infrastructure, the MTA capital strategy is now pivoting toward modernization. In the 2000-2009 capital budgets, 29 percent of spending went to replace cars and track, while only 15 percent was directed to modernizing signals and communications. Today, with both cars and track in a state of good repair, the funding hierarchy has reversed. In the 2010-2014 five-year capital plan, signals and communications received 29 percent, while track and railcars got 20 percent of the total budget.

Modernizing the city's public transit will not be easy. Digitizing such a colossal system demands ingenuity, coordination and significant manpower. With subways running 24 hours a day, accessing the track for repairs and replacements always disrupts travel. A slow rollout is inevitable, raising fears that the new technologies will be obsolete by the time they're finally implemented.

ly \$16 billion on signal upgrades, a historic sum.³¹ Expediting signal modernization would require a tremendous infusion of money or a significant redistribution of capital dollars among MTA subsidiaries. Even with unlimited funds, replacing signals would be exceedingly difficult and disruptive. The 7 and L trains operate on isolated lines, rarely crossing or merging with other corridors. Consequently, weekend and nighttime closures of those lines has had only a minimal impact on the system as a whole. For lines serving major Manhattan corridors, on the other hand, track access must be timed methodically and gradually to minimize disruption.

In addition to funding and track access issues, the MTA is hobbled by a dearth of qualified contractors. At the moment, only three to four contractors are available to perform signal installation and modernization work. This limits competition, increases expenses and caps the amount of signal work that can be performed at any one time. To address this constraint, the MTA recently began a mentoring program for training contractors.

Signal upgrades and the deployment of CBTC will affect every aspect of the subway system. The MTA must purchase new cars capable of communication with the rail control center. Modern trains and higher throughput will increase electricity

loads, straining an aging distribution network; 38 percent of the New York City Transit power system is in a poor state of repair with substation buildings in urgent need of investment. Finally, a larger stock of subway cars will necessitate greater capacity at rail yards and shops.

Subway Stations

The subway station is every rider's first point of contact; the initial indication of the safety, comfort, accessibility and efficiency of the entire system. In New York, this first impression is rarely a good one.

New York's subway stations are chaotic and beleaguered. Trash is sometimes strewn across the platform and between the tracks. Leaking ceilings and water-damaged walls are pervasive. Paint peels from the ceiling. Columns rust. Bottlenecks form at narrow stairwells, choking the circulation of foot traffic. "New York's subway stations are terrible," says Paaswell of the University Transportation Research Center. "They're dirty. They're dingy. They need painting. They need new architecture. They need better lighting."

These issues go beyond cosmetics or mere inconveniences. Discarded newspapers along the third rail ignite track fires.³² Garbage caught in the drains causes flooding.³³ Leaking roofs damage station equipment, particularly electronics.³⁴

NYC's Most Congested Subway Station Entryways, Riders per Entrance

Station	Borough	Line	Ridership	Entrances	Riders per Entrance
Parkchester	Bronx	6	4,687,402	1	4,687,402
Canarsie-Rockaway Pkwy	Brooklyn	L	3,920,243	1	3,920,243
8 Av	Brooklyn	N	3,559,576	1	3,559,576
72 St	Manhattan	1-2-3	13,043,031	4	3,260,758
Newkirk Plaza	Brooklyn	B-Q	3,021,079	1	3,021,079
System			1,654,582,265	1,861	889,082

Sources: MTA, "Annual Subway Ridership," 2012; NYC Open Data, "Subway Entrances," 2013

“In stations, the MTA has basically conceded that you will never get to a state of good repair ... It’s simply not possible. There are so many tens of billions of dollars of repair needs.”

While MTA officials recognize these deficiencies, in recent years they have scaled down their approach to rehabilitation. “In stations, the MTA has basically conceded that you will never get to a state of good repair,” says Jeremy Soffin, the former MTA spokesperson. “It’s simply not possible. There are so many tens of billions of dollars of repair needs.” Since 2010, the MTA has opted to replace individual components in stations rather than perform comprehensive renovations. According to officials, the old strategy proved too slow and too costly.³⁵

The new approach has its critics. While MTA considers component replacement a cost-saving measure, that may not be the case in the long run. “Say you’re replacing 10 stairs in several stations,” explains Elizabeth Keating, Executive Deputy Inspector General at the Office of the MTA Inspector General. “When you begin installation, you find that the beam you’re attaching it to is partially rotted and will likely need to be replaced in three or four years. It may be cheaper to replace the beams when you replace the stairs, but you haven’t been authorized to do so, and resources are scarce. These are the kind of trade-offs that capital program managers face. The component program is a smart strategy when there’s very little money, but it may eventually end up being more costly.”

Other concerns are aesthetic. Without a complete overhaul, stations may be functional, but will continue to look dingy. This can discourage ridership and encourage bad behavior.

Moreover, as ridership has grown over the last decade, crowding has become prevalent, with some subway stations more equipped to handle the congestion than others.³⁶ The subway’s 468 stations feature 1,861 entrances, with an average of 889,082 riders circulating through each one annually. Certain entryways are more heavily trafficked than others. The Parkchester station, for example, has only one entry point for 4.7 million annual riders—the worst bottleneck in the subway system. It is followed by the Canarsie-Rockaway Parkway, 8th Avenue (Sunset Park), 72nd St (Upper West Side) and Newkirk Plaza (Flatbush) stations.

After navigating the entryway, problems continue at the platform. MTA Chairman Thomas Prendergast has described a “number of locations” where platforms frequently become so crowded that it is “hard for the next train to discharge its passengers and get off.”³⁷ To improve circulation in the coming years, the MTA will devote \$900,000 to relocate turnstiles and introduce visual cues to more efficiently funnel traffic.³⁸ While this experimentation is certainly welcome, more fundamental engineering will also be necessary, including additional entryways, escalators, elevators and wider stairways.

Subway Shops and Yards

The MTA’s 6,311 subway cars traveled 365 million miles last year, a long haul for some old machinery.³⁹ Subway cars are generally in good repair, and no railcar on the numbered lines is more than 30 years old. Some relics, though, remain on the tracks. These include 226 R-32 subway cars (originally built in 1964), 50 R-52 cars (1969) and 750 R-46 cars (1975). These antiquated railcars are used exclusively on the lettered lines, predominantly the A, C and E.⁴⁰

To keep these aging subway cars running requires regular maintenance. At the MTA’s shops and yards, an endless stream of trains are stored, inspected and repaired. Workers repaint seats,

wash windows, fix air condition motors, replace brakes and grind and refinish wheels.

Like the system they service, subway shops and yards are old. The 13 facilities opened nearly 90 years ago on average. Two buildings at the Concourse Yard were recently placed on the National Register of Historic Places. The East New York facility, originally built in 1880 as a horse and carriage depot, still relies completely on hand-thrown switches. The narrow aisles at the Livonia and 240th Street facilities are ill configured for modern maintenance and repair practices.⁴¹

In a recent survey of each of its capital asset categories, the MTA found its yards and shops were in the worst state of repair. Fifty-four percent of the components at these facilities exceed their useful life. Thirty-eight percent of lighting is in poor condition and does not meet current standards.⁴²

The MTA has not increased investment to address the decay at its critical maintenance facilities. Instead, capital outlays have fallen from \$455 million in the 2000-2004 capital budget to \$263 million⁴³ in the current five-year budget. If greater attention is not paid to rehabbing these facilities, subway car maintenance will suffer and train delays will become more common.

Airports

More than just important economic engines, JFK and LaGuardia airports are New York's vital gateways to the global economy. They welcome tens of millions of tourists every year and serve as jumping off points for international commerce. Yet, despite significant public and private investment, they are among the least modern airports in any major global city, and are plagued by an array of infrastructure challenges and present a less-than-optimal first image of New York.

LaGuardia's main terminal is 50 years old and in terrible condition, while two of JFK's six terminals have stood for over four decades and can barely keep up with the increased passenger traffic and larger airplanes. Meanwhile, the cargo facilities at JFK are 40 years old on average, with 63 percent of cargo space considered "non-viable," or

63%

of JFK's air cargo facilities are unfit for modern screening, storage, distribution

Age and Condition of JFK Cargo Facilities

Status	# of Buildings	Average Year Constructed	Square Feet
Total	33	1973	6,128,879
Viable	13	1994	2,258,433
Nonviable	20	1961	3,870,446

Source: NYC Economic Development Corporation & the Port Authority, "JFK Air Cargo Study," January 2013

unfit for modern screening, storage and distribution.⁴⁴

"For a world-class city," says former Deputy Mayor Stanley Grayson, "there is very little about our airports that makes us proud."

By almost any measure, LaGuardia's main terminal, dedicated in 1964, is woefully inadequate: The mechanical systems are aging, the roof leaks, and the building is not nearly big enough to handle today's larger airplanes. "It's a crap airport," says Chris Ward, the former Port Authority executive director.

The terminal's tightly packed gates cause congestion on the aprons, where planes park, refuel and board. This congestion restricts efficiency and produces frequent delays. With 28 percent of its arrivals delayed, LaGuardia ranks a lowly 48th among the country's top 50 airports. It performs slightly better on departures, with 22 percent delayed and a ranking of 38th.⁴⁵

The Port Authority has plans to knock down and replace the central terminal, and solicited proposals from private contractors in early 2012. But it did not name the finalists until July 2013,⁴⁶ and completion is not expected before 2021. Until

Until the LaGuardia central terminal is knocked down and replaced, the Port Authority must keep it on life support. “It’s like continually performing open heart surgery.”

then, the Port Authority must keep the old terminal on life support. “It’s like continually performing open heart surgery”, says Guy Zummo, senior consulting engineer at LaGuardia.

Conditions at JFK have improved over the past 10 to 15 years, thanks to the construction of new terminals for Delta, Jet Blue and American as well as an International Arrivals building. But the airport, which opened in 1948, has its own infrastructure challenges. Like LaGuardia, its gates are not sufficiently spaced for today’s larger planes, which inhibits the flow of passengers exiting and boarding the aircraft and constrains the maneuvering of planes on the apron. Partly as a result, 30 percent of arrivals and 23 percent of departures at JFK are delayed, a performance that rates even worse than LaGuardia’s.²⁷

Both JFK and LaGuardia lack modern amenities in the older terminals, where food concessions and retail areas, both major revenue generators, do not meet the needs of growing passenger traffic. The same is true of bathrooms. LaGuardia’s central terminal was designed to accommodate 8 million annual passengers. In 2012, 25.7 million passed through the airport, with a little more than half using the central terminal.⁴⁸

In a recent report, the Global Gateway Alliance, an advocacy group dedicated to addressing the problems at New York area airports, ranked the 20 largest American airports according to their amenities for passengers. This included free WiFi, cell phone reception and transit access.⁴⁹ Not surprisingly, LaGuardia finished last (though JFK was a more respectable eighth).⁵⁰ At both airports, mobile phone reception is spottier than at other airports.⁵¹ Only Los Angeles International

Airport has slower upload and download speeds than JFK and LaGuardia.

JFK’s air cargo facilities are also in need of major rehab. With an average age of 40 years, many JFK cargo buildings are simply unsuitable for modern distribution. While the airport technically has over 6 million square feet of storage space, 63 percent is considered “nonviable.”⁵²

With today’s automated sorting and storage of cargo, containers and pallets can be stacked several layers high, but most facilities at JFK have only a 14-to18 foot clearance, sacrificing millions of cubic feet of capacity and failing to provide room for high-tech screening and sorting machinery. These buildings are also not deep enough to accommodate the maneuvering of 53-foot tractor-trailers.

“The facilities are aging and functionally obsolete,” says David Hopkins, director of aviation at the New York City Economic Development Corp. “A lot is mothballed and needs to be torn down.”

JFK’s air cargo sector has also been hurt by inadequate capacity on the Van Wyck Expressway, the only highway trucks delivering freight to and from the airport can use. Years of almost constant congestion on the Van Wyck, along with the outmoded cargo facilities, have prompted several companies to switch their freight operations from JFK to other airports. From 2000 to 2013, cargo at JFK fell by 545,737 tons, the equivalent of 19,101 jobs lost.⁵³ In 2000, JFK was the third largest air cargo destination in the country. By 2010, it had fallen to seventh.⁵⁴

UTILITIES

Faced with aging pipes, outmoded technology and overburdened lines, utilities and government struggle to provide residents and businesses with the services expected in a 21st-century city

Water mains, electric feeders, fiber cables and sewage pipes are primarily underground and out of sight. If not for their monthly bills, residents would give little thought to the many companies and government agencies operating New York's vast utility infrastructure.

The New York City Department of Environmental Protection (DEP) maintains the city's water and sewage systems. Con Edison is responsible for electric distribution and steam as well as gas lines in the Bronx, Manhattan and sections of Queens. National Grid oversees the remaining gas infrastructure in Queens, Brooklyn and Staten Island. Each entity operates an old and expansive distribution network. Sixty-eight percent of the city's steam mains and services are over 40 years old. Over half of its gas mains were installed before 1960 and are made of unprotected cast iron, a corrosion prone material. As for water mains, 2,168 miles are unlined cast iron laid before 1930. A staggering two-thirds of the city's sewer pipes were built prior to 1940.

Overlapping federal and state regulations can complicate the upkeep and repair of these antiquated utility systems. From 2000 to 2010, \$13 billion of DEP's \$19 billion capital budget was devoted to meeting federal requirements.⁵⁵ While these drinking water and sewage regulations protect public health they have forced the city to take on massive projects like the Croton Watershed filtration plant and the Catskill-Delaware Watershed ultraviolet disinfection facility. This construction has put a severe burden on DEP's budget and manpower and increased its debt obligations from \$11.2 billion to \$29.3 billion between FY 2002 and FY 2010.⁵⁶

Natural Gas

Natural gas accounts for approximately 65 percent of New York City's heating needs and fu-

els 98 percent of in-city electricity generation.⁵⁷ Demand is set to grow significantly in the coming decades, in large part due to significantly cheaper prices for natural gas and the recent citywide ban #4 and #6 home heating oil. To accommodate the growing demand across the five boroughs, New York's aging gas distribution system will need to be upgraded and expanded.

Con Edison and National Grid each manage one of the oldest gas distribution networks in the country. Con Edison's 2,234 miles of gas mains serve 833,000 customers in the Bronx, Manhattan and northern Queens. Their mains are 53 years old on average and 60 percent are composed of unprotected steel or cast iron, the most leak-prone material. According to the federal Pipeline and Hazardous Materials Safety Administration, Con Edison experienced 83 leaks for every 100 miles of main in 2012. Corrosion was responsible for a total of 427 of these leaks.

Average Age of NYC's Utilities Infrastructure		
	Miles	Age
Gas Mains	6,362	56
Sewage Mains	6,437	84
Water Mains	6,785	69
Overhead Electric Cable	18,245	-
Underground Electric Cable	86,977	-
Steam Pipes	105	60

Source: NYC Municipal Water Finance Authority, "Water & Sewer System Revenue Bonds, Fiscal 2001 Series A" for water and sewage data. All other data provided during interviews.

National Grid serves approximately 1.2 million customers in Staten Island, Brooklyn and southern Queens via 4,128 miles of gas main. The average main is 57 years old, and 48 percent is made of unprotected steel or cast iron. National Grid experienced 45 leaks per 100 main miles in 2012 and 68 total leaks caused by corrosion.⁵⁸

Gas “services”, the pipes that carry gas from the mains to individual buildings, are also a significant source of leaks. Prior to being bought out by National Grid, Brooklyn Union Gas Co. undertook an aggressive replacement program, eliminating leak-prone components and improving the integrity of the distribution system. Today, only 7 percent of National Grid’s service lines were installed prior to 1960 and only 5 percent are made of unprotected steel and cast iron. The respective figures for Con Edison are 22 percent and 24 percent. Con Edison had 58 leaks per 10,000 services with 849 total leaks caused by corrosion, while National Grid had 12 leaks per 10,000 services with 238 total leaks caused by corrosion.⁵⁹

Replacing a mile of main in New York City costs approximately \$2.2 to \$8 million. Con Edison is targeting the replacement of an average of 30 miles of cast iron pipe each year, but a more aggressive replacement schedule may be warranted.

Failure to address leak-prone pipes could have environmental consequences. According to Bill McKibben, a prominent environmentalist, methane released from unburned natural gas is 20 to 100 times as potent a greenhouse gas as carbon dioxide. If more than 2 to 3 percent of gas escapes into the atmosphere from the point of extraction to its final destination, natural gas can do significant damage to the climate.⁶⁰ In New York City, 1.5 percent of National Grid’s gas is unaccounted for and 2.2 percent⁶¹ of gas entering Con Edison’s mains and service pipes—only the final stage in the extraction-transmission-distribution process—did not reach a final customer in 2012.⁶² Theft and inaccurate meter readings play a part but so do leaks from old mains and services. National Grid and Con Edison’s line losses compare favorably to peer companies in Philadelphia (2.7

percent) and Boston (4.4 percent), but it is still cause for concern.

Despite these environmental issues, the low price of natural gas as well as the Bloomberg administration’s 2011 decision to ban of heating oil #4 and #6 will almost certainly increase demand for natural gas in the coming years. At the moment, though, New York does not have sufficient distribution capacity to meet this demand. This is particularly true in the Bronx. “In some cases we couldn’t connect buildings with the main gas line because the expenditure would be in the millions of dollars,” says Wilhelm Ronda, planning director at the Bronx borough president’s office. “This was a shock to me. The #6 and #4 fuels have a sunset in the coming years, but we can’t comply with these laws if we don’t have the infrastructure.”

Electricity Distribution

The importance of New York City’s electric supply cannot be overstated. Beyond powering the City’s homes, offices and appliances, the most basic and critical city services rely on electric. Pumps transporting sewage from low lying neighborhoods, street and traffic lights guiding automobile and pedestrian traffic, the third rail of the subway, cell phone towers—each depends on the uninterrupted delivery of electricity.

NYC Electrical System: Service by Overhead Wires vs Underground Cables		
	Overhead Wire	Underground Cable
Bronx	2,679	10,901
Brooklyn	3,552	27,317
Manhattan	-	21,216
Queens	6,995	24,795
Staten Island	5,019	2,748
Total	18,245	86,977

Source: Con Edison, “Electric System”

The majority of New York City’s electric distribution system is underground. This protects feeder cables and transformers from inclement weather and provides significant redundancy—electricity is routed through multiple paths underground, allowing two feeders to trip out without any disruption in service. The city has 64 autonomous underground networks, ensuring that a disruption in distribution in Long Island City, for instance, never cascades to Rego Park.

Given the redundancy and resiliency of its distribution networks, Con Edison enjoys the lowest percentage of customer service disruptions in the United States. According to Francisco De Leon, associate professor of Engineering at NYU Poly, “Con Ed has a reliability that you cannot find anywhere in the country.”

Not all New Yorkers, however, are serviced by an underground network. Overall, 18 percent of customers and 14 percent of the load are connected through an aboveground radial system.⁶³ Not surprisingly, New Yorkers relying on overhead wire are far more likely to experience outages than those serviced by an underground network. Last year in the Bronx, 364 of every 1,000 radial customers experienced an outage, but only 10 underground network customers. Residents in Brooklyn (355 vs. 16) and Queens (231 vs. 9) experienced a similar variation.⁶⁴ In Staten Island, serviced exclusively by overhead wires, 343 of every 1,000 residents experienced outages.

While the overhead wire networks across the five boroughs perform worse than the city’s underground networks, this is typical of all electricity systems everywhere. In fact, Con Edison’s radial system performs significantly better than its peers around the nation, where 1,120 of every 1,000 customers experienced an outage,⁶⁵ and the state, where outages occur for 970 of every 1,000 customers.⁶⁶

To monitor the performance of Con Edison’s radial system, the New York State Public Service Commission (PSC) sets an electricity reliability standard for each borough. In 2012, Con Edison easily surpassed this standard throughout the city. There were, however, individual overhead feeders that did not meet the PSC standard in all four

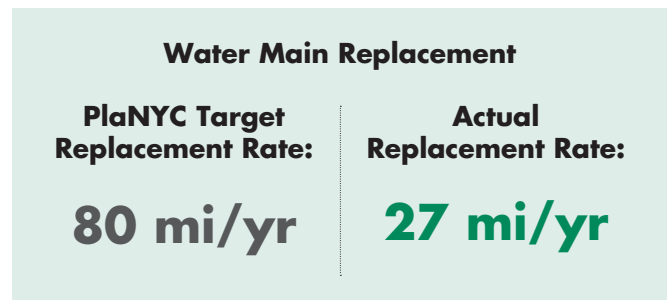
boroughs. Con Edison uses this ranking as part of their analysis and prioritization of feeder repair, maintenance, and relief work. Staten Island has the highest percentage of feeders that exceed the PSC annual interruption standard, 18.2 percent. It is followed by Queens (14.7 percent), Bronx (14.5 percent) and Brooklyn (10.3 percent).⁶⁷

According to Irving Poy, director of planning and development for the Queens borough president’s office, aboveground electric service creates vulnerabilities. “We’ve had outages in every major storm,” he says. “The vulnerability is not good for anybody. It affects businesses and schools. You don’t see this in Manhattan.”

Moving cables and transformers below ground is very expensive. Con Ed cannot simply dig a hole and drop what’s on the poles into it. Different types of cable and transformers must be installed. Given the considerable expense, only some parts of the system can be moved.

Water Mains

DEP manages a massive water system, originating in three upstate aqueducts and passing through vast reservoirs, tunnels and storage tanks before arriving in the city. While the agency is often commended for its expertise, problems are inevitable in such a monumental infrastructure network. Water main breaks, for instance, are a regular occurrence in the city. In fiscal year 2013, there were more than 400 of them across the five boroughs, and in January 2014, a major break flooded the street and nearby subways on 13th Street in lower Manhattan, disrupting New Yorkers’ commutes for hours.⁶⁸ To DEP’s credit, preventative maintenance and the monitoring of water pressure has reduced the number of water main breaks over the last decade. However, the

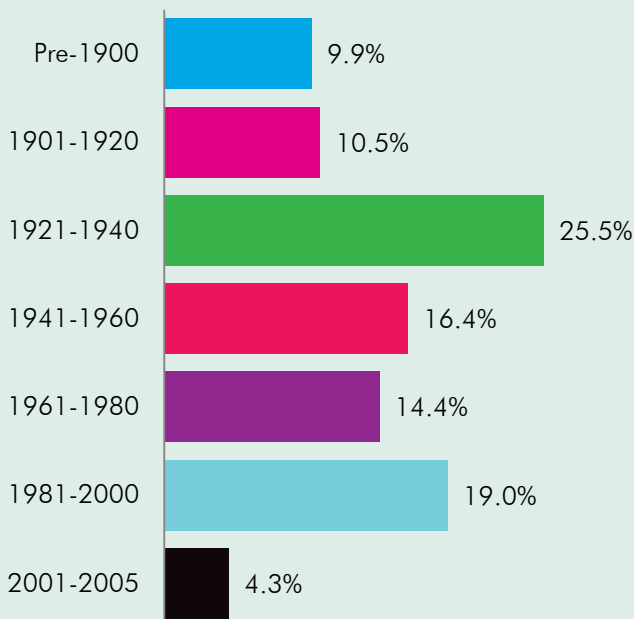


Leaky Pipes: Percent of Water Unaccounted for by Borough, 2011

	Distribution (Million Gallons per Day)	Consumption (Million Gallons per Day)	% Unaccounted For
Manhattan	334	258	23%
Bronx	203	138	32%
Brooklyn	298	205	31%
Queens	197	171	13%
Staten Island	46	42	9%
NYC	1,078	814	24%

Source: NYC Dept. of Environmental Protection, "Water Conservation Report Annual Update," June 2012

Water Pipe Inventory by Year of Installation



Source: NYC Dept. of Environmental Protection, "Water Conservation Program," December 2006

number of breaks spiked by 10 percent in 2013 and there have been at least 400 breaks in all but one year since 1998.

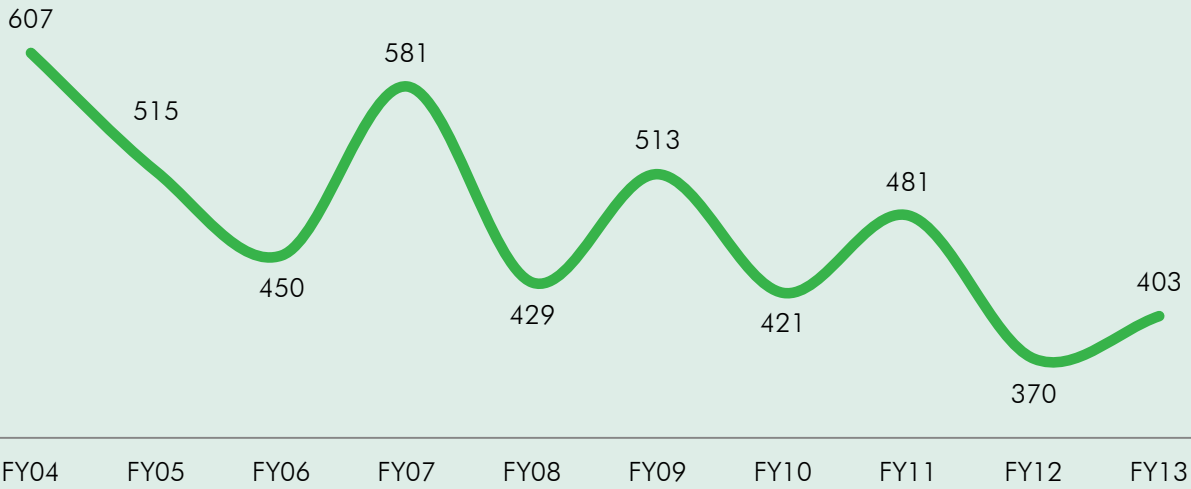
According to the last publicly available inventory, 46 percent of New York City's 6,785 miles of water main were built prior to 1941.⁶⁹ Approximately 1,000 miles are over 100 years old.⁷⁰ The 2,200 miles of pipe laid before 1930 are unlined cast iron. Another 2,400 miles are cement lined cast iron installed between 1930 and 1969.⁷¹ Both materials are inferior to the flexible ductile iron used today and are susceptible to internal corrosion and prone to leak.

The diameter of the mains is also an issue. The Army Corp of Engineers has concluded that six-inch mains are four times more likely to break than those 12 inches or wider.⁷² Five percent of New York's water pipe inventory is less than or equal to six inches in diameter with another 46 percent only eight inches wide.⁷³

The agency's ability to stave off water main leaks and breaks has been negatively impacted by federal mandates requiring it to spend billions on projects such as a new ultraviolet disinfection plant for its Catskill/Delaware supply and a filtration plant for Croton water. The combined cost of these projects exceeded \$5 billion, leaving fewer resources to plow into other critical components of its water network. "Unfunded [federal] mandates sucked up billions of dollars of the capital program and left very little for the water distribution system," says former DEP Deputy Commissioner Robert Adamski. "Now that some of those mandated projects are nearing completion, the city doesn't seem to be redirecting [funds] to the distribution and collection systems."

DEP aspires to a 100-year replacement cycle for its water mains, replacing 1 percent per year, according to Timothy Burns of the New York State Environmental Facilities Corp.⁷⁴ Accounting for the size of the city's water delivery system, this is equivalent to 68 miles of water mains being replaced each year. (In PlaNYC, the city set an even more ambitious goal of replacing 80 miles of water mains annually.) DEP has not reached this target on a single occasion since Fiscal Year 2002.

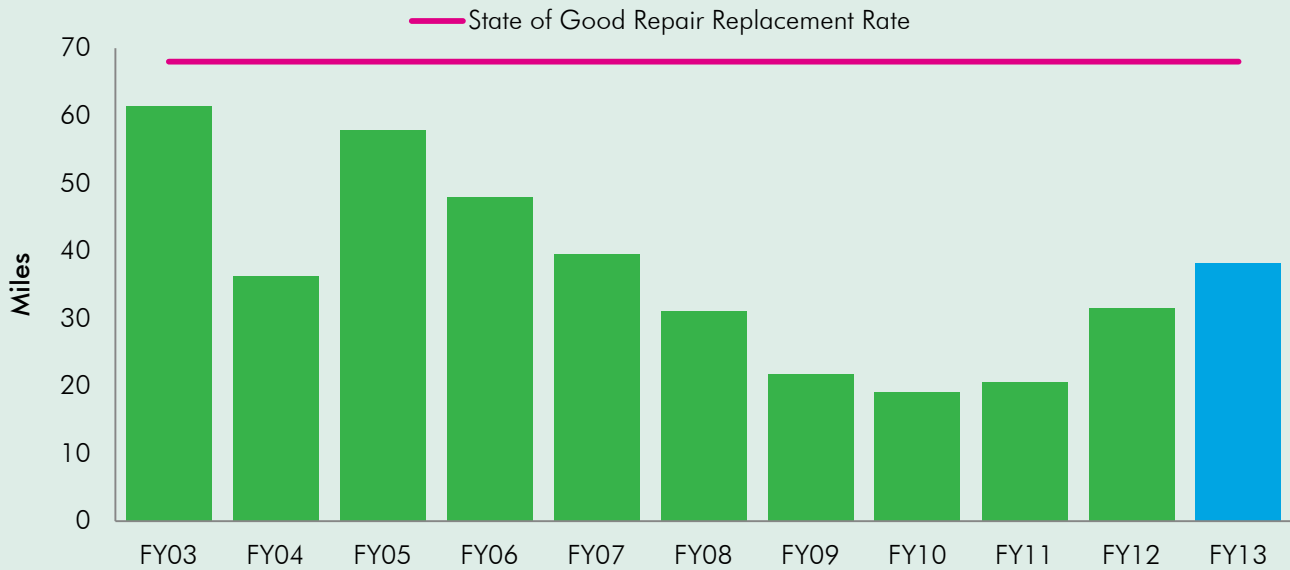
Number of NYC Water Main Breaks Per Year, 2004-2013



Source: Mayor's Management Report 2005-2014

New and Replaced Water Mains Per Year, 2003-2013

DEP aspires to replace an average of 1 percent of the city's water mains each year, which would mean 68 miles of water mains replaced per year, but the agency has not met this target once over the past decade.



Source: Mayor's Management Report, 2004 to 2014

To make up for the accumulated deficit over the last eleven years, the city would need to install 411 miles of new water main in the upcoming fiscal year, equivalent to what the DEP has installed in the last ten years combined. In a 2006 report submitted to the state Department of Environmental Conservation, the DEP restated their commitment to replace 1,120 miles from 1996-2015.⁷⁵ Thus far it has installed only 840 miles of mains. To fulfill its commitment, the DEP must construct 280 miles in the next two years, 3.5 times more than its annual average over the last decade.

Given the age of New York’s water mains, it is little surprise that water leaks are rampant. City-wide, the unaccounted-for-water rate—the difference between the amount of water that enters distribution mains and the amount that reaches customers—is a staggering 24 percent, double the 10-to-15 percent industry standard. Conditions are especially bad in the Bronx (32 percent), Brooklyn (31 percent) and Manhattan (23 percent).⁷⁶

Sewage Pipes

In the middle of the 19th century, downtown New York resembled a cesspool. Streets were clogged with household garbage, animal corpses and human waste. Bacteria from fecal matter leached into the water supply, precipitating a deadly cholera epidemic. To combat the outbreak of disease, the first sewer system was constructed in 1849. Between 1850 and 1855, more than 70 miles of pipes were installed beneath the city streets. Today, 6,400 miles⁷⁷ of sewer lines crisscross the city.

Most of New York’s original sewage pipes remain in service today. A significant percent of the pipes are over 100 years old⁷⁸ and two thirds were installed prior to 1940.⁷⁹

Approximately 4,000 miles of sewer pipe are made of vitreous clay.⁸⁰ These older, earthenware pipes are more susceptible to cracking and blockage and require vigilant monitoring and repair. Investment in the sewer system has become increasingly urgent due to rising sea levels. As the water table climbs above the sewer lines, cracked pipes are susceptible to infiltration. Entering water can wear away the pipes, creating bigger and bigger holes. Treating clean groundwater is a waste of energy and, on rainy days, its influx can overtax the water treatment plants.

Though the sewer system is in need of immediate investment, it has not received it. “Water and wastewater does not get enough recognition,” says Timothy Burns, director of engineering at the Environmental Facilities Corp. which provides funding and equipment for projects in New York state. “The infrastructure is below ground and out of the public’s eye. We see roads, airports and rail and are thus more willing to pay for it than they are water and wastewater.”

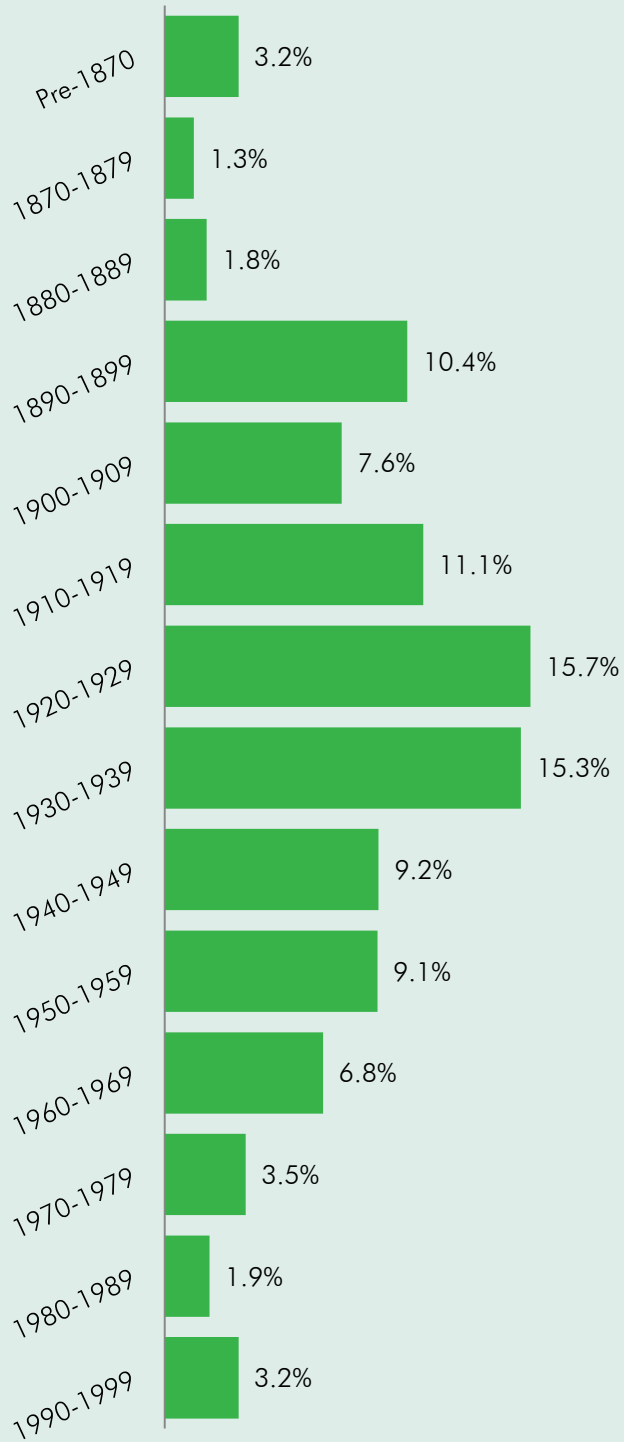
Since the turn of the century, the number of sewer lines constructed or reconstructed has fallen. From Fiscal Year 2000 to 2006, the DEP installed an average of 42 miles of sewers per year. From Fiscal Year 2007 to 2013, the average fell to 17 miles.⁸¹

In sections of the city, sewage pipes are absent entirely. Homes rely on septic systems to treat wastewater on-site. In other neighborhoods, there

Location of Active Sewage Overflows into New York Harbor, By Severity (Type 1 = Most Severe)						
Type of Outfall	Staten Island	Brooklyn	Queens	Manhattan	Bronx	Total
Tier 1	0	3	6	0	4	13
Tier 2	0	6	6	0	3	15
Tier 3	2	7	9	15	10	43

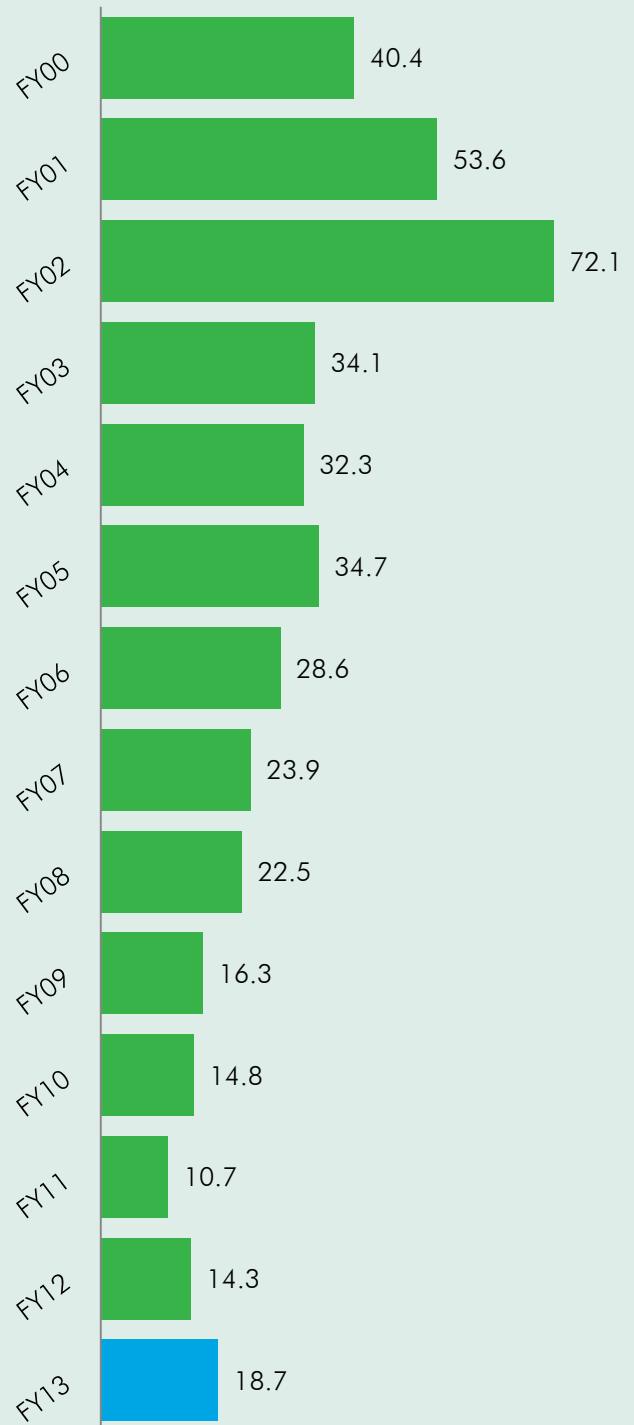
Source: NYC Environmental Protection, “What is a Combined Sewer Overflow?”

Sewage Pipe Inventory by Year of Installation



Source: NYC Municipal Water Finance Authority, Water and Sewer System Revenue Bonds, Fiscal 2001 Series A

Miles of Constructed and Reconstructed Sewers



Source: Mayor's Management Report 2001-2014

are sanitary, but not storm sewers. Rainwater is collected in drywells and other temporary measures. “In parts of southeast Queens, you can have a little drizzle and there will be flooding,” says Irving Poy at the Queens borough president’s office. “Streets and basements are inundated, there are major problems with mold.” Although the city has developed a drainage plan for southeastern Queens, inadequate funding has slowed progress.

Stormwater Management

Like many older cities, New York has a combined sewer system. Sanitary sewage and stormwater runoff are collected in the same pipes and directed to the local waste-water treatment plant. On a clear day, this poses no problem; every one of the city’s 14 treatment plants has sufficient capacity to handle intake during dry weather. During rainfall, however, excess flow is diverted to a combined sewer overflow (CSO) location and discharged, untreated, into the city’s waterways. Overflow occurs about half the time it rains, leading to an estimated 27 billion gallons of raw sewage and polluted stormwater pouring into New York’s waterways every year.⁸²

Certain areas of the city suffer more than others. While overflow can be discharged into the harbor from over 400 outfall locations scattered throughout New York, the majority are inactive. The discharge at just 13 locations accounts for 50 percent of total CSO volume. Six of these so-called Tier-1 outfalls are in Queens, four are in the Bronx and three are in Brooklyn. An additional 15 Tier-2 outfalls make up 20 percent of total CSOs. Six each are in Queens and Brooklyn and three are in the Bronx. The remaining Tier-3 locations are more evenly distributed among the five boroughs, but contribute only 10 percent of total outfall.⁸³

Stormwater management in Brooklyn, the Bronx and especially Queens is clearly an issue. Bronx River, Alley Creek, Hutchinson River, Coney Island Creek and Flushing Bay all do not comply with the water quality standards mandated by the federal Clean Water Act.

High CSO outfalls in the boroughs outside of Manhattan are at least partly attributable to

population growth. Many of the oldest wastewater treatment plants are in southern Brooklyn and eastern Queens, including Coney Island (1935), Owls Head in Bay Ridge (1952), Jamaica (1943) and Bowery Bay near Flushing (1939). As the local population grew, the storage capacity of each facility became increasingly inadequate. Treatment plants must have a substantial surplus capacity on dry days in order to handle sewage during rainstorms. While New York’s 14 treatment plants have a spare capacity of 28 percent on an average day, the four facilities in Southern Brooklyn and Queens have a surplus of only 20 percent.

To address the problem, DEP recently launched an aggressive green infrastructure campaign to make the city more permeable and better able to soak up rainwater. Bioswales, green roofs, and porous pavement have become increasingly prevalent, particularly in demonstration areas in Brooklyn, the Bronx and the Queens. The city plans to commit \$2.4 billion in public and private investment over the next 18 years to increase these efforts.⁸⁴

The emphasis on green infrastructure represents a shift in the city’s stormwater strategy. Under a 2005 Order of Consent with the state, New York City is required to reduce combined sewer overflows. Prior to 2012, it achieved this primarily through traditional practices for stormwater management known as gray infrastructure. This included construction of three underground retention facilities that temporarily hold excess sewage. The largest, near Paerdegat Basin, will reduce overflow discharges in the Jamaica Bay tributary by 70 percent—from 1.833 billion gallons to 555 million gallons per year.⁸⁵ In comparison, the city’s 2,536 Greenstreet sites capture 105 million gallons of stormwater⁸⁶ annually and its 100 bioswales retain 1,870 gallons apiece.⁸⁷ Although impressive, it pales in comparison to the magnitude of the problem: 27 billion annual CSOs.

Green infrastructure is a tremendous asset to the city. It simultaneously beautifies New York’s neighborhoods while alleviating severe gaps in the stormwater management system. But city officials will likely have to invest in more traditional mitigation efforts as well if they are ever going to

dramatically reduce CSO discharges. In fact, the federal EPA has recently deemed the city’s green infrastructure proposals near the Gowanus Canal in Brooklyn insufficient and called on the city to build two storage tanks instead of or in addition to those projects.⁸⁸

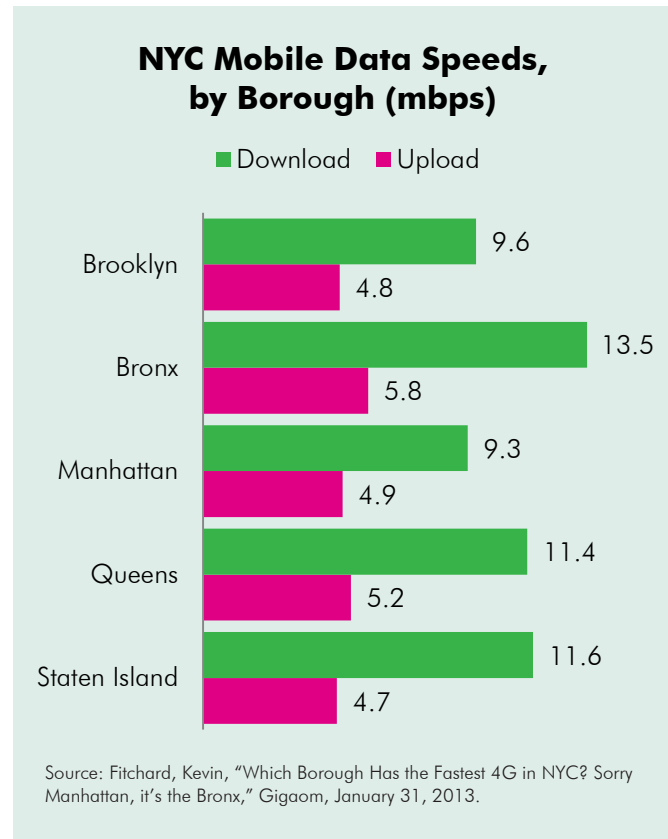
Broadband Infrastructure

Over the past decade, the city’s telecommunications infrastructure has arguably become as important to New York’s economic competitiveness as electricity or clean water. At a time when New York hopes to overtake Silicon Valley as the nation’s leading technology hub and when much of the city’s overall economic growth comes from companies built around the Internet and mobile technology, the ability to access a reliable, high-speed Internet connection is a foundation for economic success. Unfortunately, the city’s broadband infrastructure is lacking in many ways.

The good news is that the vast majority of New York City businesses and residents have no problem accessing a broadband connection. According to recent report, 97 percent of city residents have residential access to high-speed broadband.⁸⁹

For an unacceptable number of the city’s businesses, however, broadband service is spotty and unreliable. In too many commercial buildings, Internet download speeds do not meet the needs of today’s companies—particularly those in the tech sector. While the city’s largest corporations enjoy service at speeds above 100 megabits per second (Mbps), a level that is typical in many countries, many smaller firms located in older Class B and C buildings do not. When we interviewed dozens of the city’s tech company founders and executives for our 2012 *New Tech City* report, the inadequate state of broadband connectivity was the second most frequently cited threat to New York’s future growth in the tech sector.

Beyond the slow speeds, several tech companies say that their Internet connection goes down from time to time, causing considerable business disruptions. Some companies located in older office buildings—particularly in the former industrial areas that are now thriving hubs for tech and creative businesses—say that another problem is



a lack of redundancy. They may be perfectly happy with broadband service from Verizon FiOS, but worry that, if it goes down, they will not have any backup because their buildings are not equipped for business cable broadband service from Time Warner.

"Most commercial buildings do not have business cable broadband service (provided by Time Warner Cable)," says Dana Spiegel, executive director of NYC Wireless. "When it is available, this service can have technical issues (with latency and uptime) and is also highly asymmetrical (50Mbps down and at most 5Mbps upload speed), which is bad for business use. Even fewer commercial-only buildings have Verizon FiOS."⁹⁰

In some commercial buildings outside of Manhattan, it remains difficult to get any broadband connection. The gaps are mainly limited to a handful of former industrial neighborhoods—including several along the Brooklyn and Queens waterfront—but are a concern given that the buildings in these districts now attract tech companies, creative businesses, artisanal manufac-

turers and other companies that require a fast Internet connection. In many of these buildings, the telecommunications infrastructure is roughly 100 years old. When they were mainly filled with manufacturers, telecom carriers like Verizon never saw enough demand to justify the huge upfront cost of building out fiber optic lines to these buildings. And since these districts had few residential customers, cable television companies like Time Warner and Cablevision never developed the infrastructure to serve them. The city's major telecommunications providers are making progress in wiring buildings in these areas, but gaps remain.

The city's Economic Development Corp. has tried to fill the gap with its ConnectNYC program, financing fiber construction for select businesses. While this is an encouraging development, the corporation has received only \$14 million to finance the program, limiting its impact.⁹¹

Broadband access is less of a problem in the city's residential buildings. Overall, only 101,000 New York City households have no access to broadband.⁹² This comes out to 245,000 residents across the five boroughs, including 75,000 in Brooklyn, 67,500 in Queens, 47,500 in Manhattan, 41,500 in the Bronx and 14,000 in Staten Island.⁹³ The overall access rate across the five boroughs is higher than similar rates for the state and nation.

There are other broadband infrastructure challenges. Connectivity is inadequate in many of the city's schools, a major problem given the increasing importance of technology and science, technology, engineering and math education. As of July 2013, in 75 percent of New York City schools, maximum Internet speeds were 10 Mbps or less. Depending on the time of day and the number of students accessing the network, most schools will not be able to offer speeds exceeding 4 Mbps—the minimum threshold for watching video lectures and other online learning tools.⁹⁴

New Yorkers in every borough also are hampered by patchy cell phone service and slow mobile broadband speeds. This is largely due to the density of the population and the multitude of buildings, reflective glass and water bodies interfering with signals.⁹⁵ These conditions are most

prevalent in Manhattan, producing the slowest average mobile data speeds in the five boroughs. The average download speed is 9.3 Mbps in Manhattan compared to 13.5 in the Bronx, 11.6 in Staten Island, 11.4 in Queens and 9.6 in Brooklyn.⁹⁶

Mobile phone carriers often have difficulty placing cell sites and back-up generators on private buildings in the city. Negotiations with individual landlords are time consuming and the acquisition of city permits is cumbersome. Several agencies are involved in the approval process, including the Fire Department, Department of Buildings and, occasionally, the Landmarks Commission. Streamlining this process would increase the density and reliability of cell sites, improving access to mobile broadband. "There is a growing need for coverage and capacity," says David Bronston, special counsel at the law firm Phillips Lytle. "There are more devices than people in this country. Infrastructure needs to get closer and closer to the end user. We can't have towers in New York. It needs to be on rooftops, light poles and pay-phones."

While cell sites may provide mobile access, they themselves are hardly wireless. Each is supported by "backhaul" connecting them to the larger telecommunications network. The copper, coaxial and fiber cables that underlay wireless technologies also provide broadband directly to homes and businesses. Of the three cable materials, fiber is by far the fastest and most resilient. Fortunately, almost all of New York City is covered by this material. Under a 2008 agreement with the city, Verizon must lay fiber on every residential block by June 30, 2014. Thus far, it has fulfilled 91 percent of its commitment.⁹⁷ This does not, however, mean that 91 percent of residential buildings have access to fiber, only that fiber "passes" 91 percent of homes. To connect every building to the fiber running down the middle of its street will demand affirmative action from Verizon, landlords, tenants and the city government.

Government IT systems

In today's era of "smart cities," quality governance increasingly depends on modern infor-

mation technology infrastructure. Over the last decade, the city's Department of Information Technology and Telecommunications (DoITT) has introduced a number of innovations to help usher New York into the 21st century. Its open data platform offers more than 1,100 public data sets. The recently introduced DataShare enables agencies to transmit and receive data in real-time while the Data Bridge platform allows city employees to use this data for advanced statistical analysis. Still, despite this progress, much of New York City's IT infrastructure remains dated and fractured.

Numerous city agencies continue to store data and host applications on mainframe computers supported by antiquated software tools. For instance, mainframes operated by the city's Department of Information Technology and Telecommunications (DoITT) currently run approximately 170 applications on DB2 and ADABAS, database management systems released in 1983 and 1970, respectively. All DB2 applications are written in Cobol, a programming language introduced in 1959.

To maintain and update these applications, the city depends on a dwindling pool of technicians who have expertise in these decades-old programming systems. Many of them are on the verge of retirement. "Antiquated digital infrastructure affects personnel and hiring for technology jobs in the city," says Jeff Maki, product development manager at Control Group, a New York based innovation strategy firm. "Ultimately, it is off-putting to young technologists. It mires the city in its older skill set that pushes them even further back from progress."

The city's fractured IT infrastructure often prevents different city agencies from communicating or collaborating effectively. For instance, despite serving an overlapping population, health and human service agencies like the Department of Health and Mental Hygiene, Department of Homeless Services and Human Resources Administration use customer relationship management applications that are custom built and hosted individually. The health department, for instance, cannot easily see if one of its clients entered a

homeless shelter a week prior. This technological barrier makes it difficult for the Department of Health and Human Services to offer integrated service plans.⁹⁸

Faced with the need for more mobile and more modern technology, many city agencies have opted to independently contract with third-party cloud operators like Amazon or Rackspace. While this may address the agency's immediate needs, it means that data is stored outside of the city system without a coordinated vision for integrating information across agencies or even among bureaus within an agency. If the city established a single contract with third party vendors via DoITT, externally hosted applications could be better integrated and, given the consolidated buying power, less expensive.

Decentralized technological policies also hobble efforts to make data open, accessible and user friendly. Agency datasets are rarely standardized--lacking consistent labeling, agreed-upon definitions or a common set of properties--and thus difficult to integrate. Three-quarters of the city's open datasets are manually updated,⁹⁹ a process that is expensive, slow and prone to human error. A source at DoITT confirms, "Not a huge amount of money has been dedicated to the open data effort yet. It is constrained by a lack of resources." Funding is still needed to support "the analysis and automation of the information we get from agencies." Annual allocations to the open data project are set to decline by 14 percent in the coming years, from \$224,449 in 2013 to \$192,688 in 2017.

In October 2010, Mayor Michael Bloomberg issued Executive Order 140, a plan to consolidate the city's outmoded and fractured IT systems. DoITT would assume control of data storage, application hosting, procurement and technology policy. Thus far, however, progress has been slow. Less than half of the city's data centers have been consolidated,¹⁰⁰ and agencies continue to unilaterally purchase and customize software, foregoing economies of scale, complicating maintenance and upgrades, and preventing interoperability across applications.

PUBLIC STRUCTURES AND SPACES

New York's public spaces show their age as budgets fail to meet a crying need for repairs and modernization

When most people consider infrastructure, they think of bridges, train tracks, and electric substations. But, like transportation and utilities, parks, schools and homeless shelters facilitate social and economic interactions. They too are “public goods,” operated by government or publically funded and regulated authorities, and they represent parts of our infrastructure.

New York's public spaces share another, unfortunate, characteristic with transportation and utility infrastructure: They are very old. An astounding 209 of the city's 1,179 school buildings were built prior to 1920. Sixty-one percent of city-owned courthouses were erected before 1940. The average city hospital building is 57 years old.¹⁰¹ And over 75 percent of the New York City Housing Authority's (NYCHA) 2,596 residential buildings have stood for more than four decades.

The city's expansive and highly trafficked parks also are aging. Seven of the 25 oldest and six of the most visited parks in the nation are in New York City.¹⁰²

Like the parks department, the City University of New York (CUNY) and NYCHA handle a large portfolio spread across the city. CUNY operates a senior college in every borough and a community college in all but Staten Island. Its 25 campuses span 800 acres and its 295 buildings cover 28 million square feet.¹⁰³ NYCHA's footprint is even larger. With 334 developments covering 2,555 acres, it is among the largest landholders in the city. Managing these old and geographically dispersed facilities has proven difficult. CUNY campuses have accumulated \$2.5 billion in deferred capital maintenance. NYCHA's capital shortfall is projected to reach \$14 billion over the next five years.¹⁰⁴

Aging Public Buildings and Spaces

	Number of Buildings	Average Year Built
HHC Hospital Buildings	103	1957
CUNY Buildings	295	1961
DOE School Buildings	1,179	1948
NYPD Precinct Houses	49	1952
City-Owned Court Buildings	23	1943
DHS Homeless Shelters	55	1943
NYCHA Developments	2,596	1963

Source: OMB Asset Investment Management Report, Agency Reconciliation, Fiscal Year 2013

NYC School Buildings

During the Bloomberg administration, the School Construction Authority (SCA) carried out an unprecedented campaign to build new schools. Buoyed by generous building aid from the state, the SCA directed \$25 billion to building and modernizing city schools. In total, 126,000 new school seats have been added since 2002.¹⁰⁵

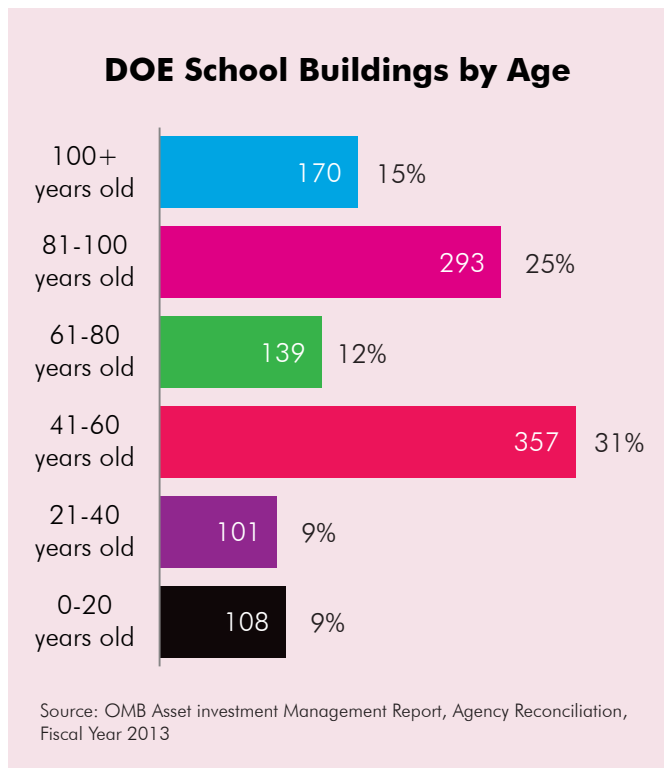
While the SCA's historic funding levels have helped address overcapacity issues and begun to modernize existing facilities, New York's schools are old and continue to demand constant maintenance and rehab. The average school building in the five boroughs was constructed in 1948.¹⁰⁶ Of the 1,179 school buildings in the DOE portfolio, 170 are more than a century old and 370 predate the Great Depression.

Brooklyn's schools are the oldest in the city. The average is over 70 years old and 77 have been standing for more than a century. Not surpris-

ingly, Brooklyn’s schools have the greatest state-of-good-repair needs: \$466.3 million according to the Office of Management and Budget (OMB) asset management report. Unfortunately, only \$71.4 million has been pledged in the four-year capital commitment plan, or 15 percent of its capital needs. By comparison, 22 percent of Manhattan’s state of good repair needs will be covered, 18 percent of Staten Island’s, 17 percent of Queens’, and 16 percent in the Bronx. These figures include only line-item state of good repair needs, not funding for upgrades, modernizations, compliance and conversions that will also be directed to borough schools.

Many, if not most, of the city’s public schools face infrastructure challenges. In a comprehensive building assessment survey commissioned by the SCA in 2012, school principals complained about insufficient lighting, broken heating, ventilation and cooling systems, leaky roofs, broken public announcement systems and even power outages. In the same survey, visiting engineers ranked building components on a scale of from 1 to 5, with a score of one representing “good condition,” a three signifying “fair condition” and a five indicating “poor condition.” A score over three recommends “preventive maintenance to prevent further deterioration and to restore it to a good condition.”¹⁰⁷ Throughout the five boroughs, architectural systems in 36 facilities, electrical sys-

31%
of NYC’s public school buildings predate the Great Depression



Repairing Aging Schools: Capital Needs vs Funding Committed, by Borough

Borough	Average Year Built	Capital Needs FY2014-17	Dollars Committed	% Committed
Bronx	1953	\$253,638,400	\$39,648,464	16%
Brooklyn	1942	\$466,260,300	\$71,403,022	15%
Manhattan	1947	\$234,655,800	\$52,106,135	22%
Queens	1951	\$258,427,400	\$43,563,789	17%
Staten Island	1949	\$75,681,400	\$13,497,652	18%
Grand Total	1948	\$1,290,484,600	\$220,219,062	17%

Source: OMB Asset investment Management Report, Agency Reconciliation, Fiscal Year 2013

44%

of the 348 DOE “temporary” trailers are located in Queens schools, far more than in the Bronx (24 percent), Brooklyn (23 percent), Manhattan (6 percent) or Staten Island (4 percent)

tems in four facilities and mechanical systems in 69 facilities were ranked above a three. These include a number of annexes and trailers that are well past their useful life (but excludes athletic fields that were also surveyed). Deteriorating assets were most common in Brooklyn, where 41 building systems scored higher than three compared to 31 in the Bronx, 15 in Queens, and 11 in Manhattan and Staten Island.

The DOE also must deal with 348 “temporary” trailers built to relieve overcrowding. Located at 119 schools across the city, nearly 80 percent of the trailers predate 2000. “The trailers are in very poor condition and are rotting away,” says Leonie Haimson, founder of Class Size Matters, an education advocacy group. “Over the last eight years, they said that the capital plan would get rid of the trailers. Yet we have as many as we did eight years ago. There is a lot of leaking and a lot of mold. This is a crisis in schools across the city.”

Nearly half of the DOE’s “transportable classroom units” (TCU), or trailers, are located in Queens, where school overcrowding remains a major problem. Though the city as a whole has 8 percent more school seats than students, Queens schools are 4 percent overcapacity with five of its seven school districts overcrowded. To address this deficiency, the DOE has sited 153 trailers in the borough, far more than in the Bronx (85), Brooklyn (80), Manhattan (21) or Staten Island (13).

The trailers take up valuable outdoor recreation space and compromise students’ health and safety. Dilsia Martinez, the principal at PS 163 in the Bronx, reports, “One of [my] top concerns is the aging TCUs. The floors are rotting. There are

holes in the structure. Heating and cooling systems are failing. Plumbing lines are blocked up. Most of all, the fire alarms in the main building and those installed in the TCUs do not interface.”

NYCHA

The New York City Housing Authority (NYCHA) is made up of over 330 developments with 2,600 buildings and 179,000 apartments scattered throughout the five boroughs. Keeping these buildings, which house well over 400,000 tenants, in a state of good repair is a herculean task that grows more difficult with every passing year.

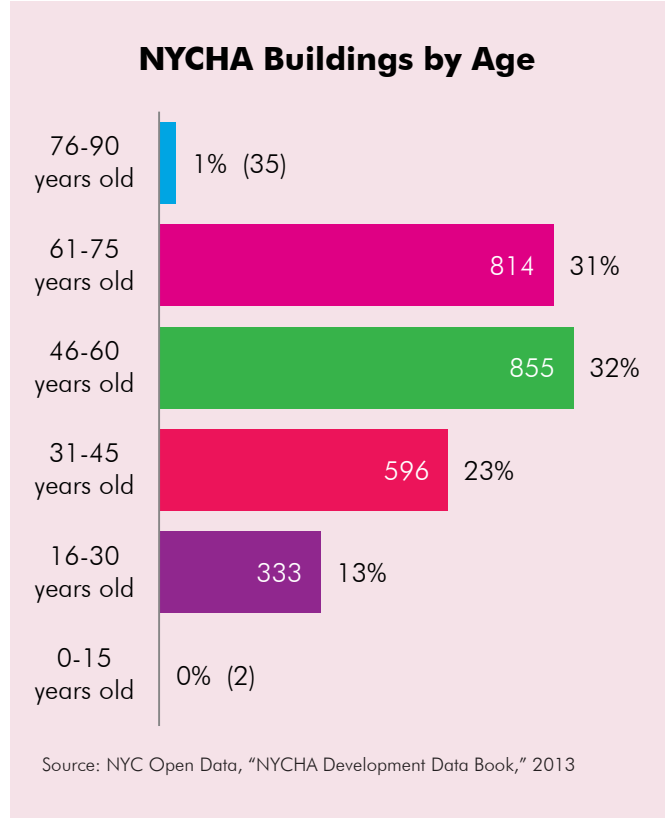
The majority of NYCHA developments were constructed between 1940 and 1960. Over 75 percent of its residential buildings are more than 40 years old and 531 have been standing since at least 1950.¹⁰⁸ To maintain its aging housing stock, NYCHA relies on capital dollars from the federal government. This funding has fallen precipitously since the end of the Clinton administration, from \$420 million in 2001 to \$256 million today.¹⁰⁹ As funding dwindles and buildings age, the backlog of deferred capital spending has exploded. Over the next five years, NYCHA’s capital shortfall will reach a staggering \$14 billion.¹¹⁰

“NYCHA developments are in serious neglect,” says City Council Member Rosie Mendez, former chair of the council’s public housing committee. “Roofs are leaking and mold does not get repaired and it takes three years to get a simple hole repaired. [There’s a] chronic budget deficit and when the federal government shortchanges you, you need to triage. Much needed repair goes on the back burner and then new problems arise.”

Over the last decade, NYCHA has become more successful at “triaging” in the face of dwindling funding. Capital and operations management are working together more closely, strategically replacing overdue boilers, plumbing, and electric equipment when maintenance costs become exorbitant. The Authority has also taken an aggressive approach toward modernizing its elevators, replacing over two-thirds in the last decade. Still, intelligent capital planning cannot compensate for severe funding shortfalls at the

NYCHA Capital Needs, By System (2011-2016)	
Category	Building System
Apartment	\$7,589,395,862
Architectural	\$6,702,844,647
Electrical	\$217,035,495
Mechanical	\$1,171,173,158
Building Grounds	\$892,498,929
Total	\$16,572,948,091

Source: NYCHA, "Physical Needs Assessment," 2011



10 NYCHA Developments in the Worst Condition

Development	Borough	Score
Butler	Bronx	39
Red Hook I (East)	Brooklyn	42
Morrisania	Bronx	44
Lower East Side II	Manhattan	46
Murphy	Bronx	46
Albany I & II	Brooklyn	47
Van Dyke I	Brooklyn	48
Castle Hill	Bronx	49
FHA Repossessed Houses V	Queens	50
Andrew Jackson	Bronx	51

Source: U.S. Department of Housing and Urban Development, Public Housing Asset Management

NYCHA Developments with Greatest Façade Needs (2011-2016)

Development	Borough	Capital Needs
Pomonok	Queens	\$124,375,134
Ravenswood	Queens	\$108,482,664
Breukelen	Brooklyn	\$96,795,137
Williamsburg	Brooklyn	\$93,880,399
Queensbridge South	Queens	\$89,341,132
Marcy	Brooklyn	\$88,494,261
Edenwald	Bronx	\$80,770,819
Queensbridge North	Queens	\$73,497,817
Castle Hill	Bronx	\$72,118,946
Sotomayor	Bronx	\$70,885,992
Patterson	Bronx	\$70,002,441

Source: NYCHA, "Physical Needs Assessment," 2011

“NYCHA developments are in serious neglect. Roofs are leaking and mold does not get repaired and it takes three years to get a simple hole repaired. [There’s a] chronic budget deficit and when the federal government shortchanges you, you need to triage. Much needed repair goes on the back burner and then new problems arise.”

federal, state, and city level. Without sufficient spending, the city’s public housing will continue to decay.

Of NYCHA’s 2,600 buildings, a staggering 1,500 do not comply with Local Law 11 standards for exterior and façade conditions.¹¹¹ A Physical Needs Assessment commissioned by NYCHA in 2011 found \$621 million in immediate façade needs and \$6.7 billion over the next five years, far greater than the \$580 million allotted for brickwork and roofs in the current five year plan.¹¹² This is in addition to the \$7.6 billion needed to rehabilitate apartments, \$1.2 billion for mechanical systems, \$893 million for building grounds and \$217 million for electrical equipment.

Physical inspections performed by the U.S. Department of Housing and Urban Development (HUD) confirm the degraded conditions of NYCHA’s housing stock. HUD inspections survey the grounds, exteriors, mechanical systems, communal areas and individual units at every NYCHA property.¹¹³ Properties are scored from 1 to 100, with the average property receiving a 72. Butler in the Bronx was the most degraded development in the NYCHA portfolio, followed by Red Hook I (Brooklyn), Morrisania (Bronx), Lower East Side II (Manhattan) and Murphy (Bronx). Of the 10 worst performing developments, five are located in the Bronx, three in Brooklyn and one apiece in Manhattan and Queens.

Developments in Queens have the most deteriorated building facades and roofs, according to HUD inspections. The average building exterior

or “envelope” in Queens scored 69, compared to 78 in Staten Island and Brooklyn, 79 in Manhattan and 81 in the Bronx. Not surprisingly, given the collateral damage of leaking exteriors, Queens also has the lowest ranked dwelling unit scores and the worst overall score.

Eleven NYCHA developments need over \$70 million in façade repairs through 2016. These include the Pomonok, Ravenswood and Queensbridge South complexes in Queens and the Breukelen, Williamsburg and Marcy complexes in Brooklyn.

Examining the last five NYCHA capital budget plans, it is easy to see how its developments fell into disrepair. At the Andrew Jackson Houses, for instance, roof repairs have been delayed for years. “Our roofs are horrible,” says Daniel Barber, resident association president at Andrew Jackson Houses. “I visited a resident [recently]. When it rained, she had flood conditions pouring into her apartment.”

Water infiltration is a major issue across the NYCHA portfolio. When bricks, roofs and windows leak, problems quickly spread to the interior. Sheet rock crumbles leaving holes in walls and collapsed ceilings. Mold spreads quickly, compromising air quality. Nearly a quarter of children living in public housing suffer from asthma—10 percent higher than the rate among all New York City children.¹¹⁴

Extreme temperatures, collapsed ceilings and persistent mold have left some apartments uninhabitable. Nearly 800 are currently vacant and

awaiting major renovation. Of these, 319 have been empty for an average of more than seven years. With over 220,000 names on the waiting list for NYCHA apartments, these vacancies only exacerbate New York’s housing shortage.¹¹⁵

While degraded building envelopes continue to plague NYCHA properties, there are signs of progress. In September 2013, a \$476 million bond deal was finalized. The funds will be devoted to sealing masonry and creating watertight roofs at 24 housing developments.¹¹⁶ Unfortunately, this infusion of funding barely scratches the surface of what is needed.

CUNY

While the CUNY system was formally consolidated in 1961, the majority of its campuses were founded much earlier. Across CUNY’s 24 campuses, the average building is 53 years old. Sixty-nine buildings were constructed more than 75 years ago and 34 have stood for at least a century.¹¹⁷

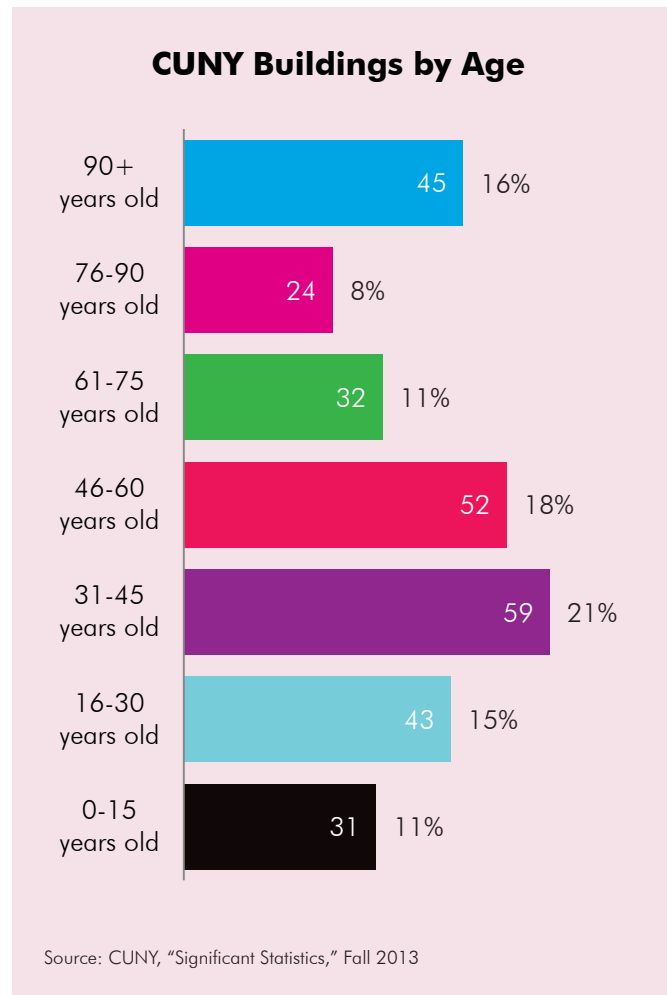
In 2007, CUNY funded a comprehensive audit of its aging infrastructure. The survey provided an overview of facility needs and calculated deferred capital investment, identifying a \$1.7 billion backlog. Senior colleges and graduate schools accounted for \$1.27 billion and community colleges the remaining \$466 million. The largest contributors to this backlog were renovations and replacement of heating, ventilation and cooling systems (HVACs) (\$700 million), exterior walls and roofs (\$277 million), and electrical equipment (\$164 million).¹¹⁸ Obsolete electrical systems are particularly disconcerting, as they hamper modernization. Several campuses cannot install new computer labs due to inadequate electrical capacity.

CUNY recently performed a follow-up survey. The preliminary findings were not encouraging. Over the last five years, the capital backlog has increased by 47 percent, from \$1.7 billion to \$2.5 billion. Deferred capital maintenance at senior colleges rose by 37 percent, to \$1.7 billion, and by 57 percent at community colleges, to \$731 million. Of the 20 colleges surveyed, only four senior colleges and one community college saw a reduction in its capital backlog. “Community colleges have suffered particularly from deferred maintenance.

These are the students who are struggling the most and their education isn’t any less important. They really need a commitment from the city,” says Robin Auchincloss, director of campus and facilities planning at Bronx Community College (BCC).

At BCC, the HVAC systems in most campus buildings are well beyond their useful life and do not provide code-compliant fresh air or air conditioning.¹¹⁹ A \$12 million investment was requested for 2012,¹²⁰ but has been pushed back to 2015.¹²¹ An \$11 million electrical upgrade also has been pushed back three years.

At Queens College, much of the campus depends on an unreliable 4160-volt electricity distribution system, leading to frequent power outages.¹²² At the College of Staten Island, power fluctuations in the Center for the Arts building cause spikes and dips that damage sensitive



CUNY Deferred Capital Maintenance by Institution (millions of dollars)

Institutions	2007 Backlog	2012 Backlog	Difference
Baruch College	58.0	36.0	(22.0)
Brooklyn College	136.1	245.9	109.8
City College of New York	337.5	438.4	100.9
CUNY School of Law	11.1	9.1	(2.0)
The Graduate Center	0.0	0.0	0.0
Hunter College	220.8	271.7	50.9
John Jay College of Criminal Justice	51.0	85.2	34.2
Lehman College	34.8	31.7	(3.1)
William E. Macaulay Honors College	2.1	4.0	1.9
Medgar Evers College	50.2	78.9	28.7
NYC College of Technology	134.5	105.9	(28.6)
Queens College	147.1	243.3	96.2
College of Staten Island	49.5	61.9	12.4
York College	38.5	135.0	96.5
Senior College Subtotal	1271.2	1747.0	475.8
Borough of Manhattan Community College	65.2	85.2	20.0
Bronx Community College	100.6	175.4	74.8
Hostos Community College	29.4	23.9	(5.5)
Kingsborough Community College	29.6	43.6	14.0
LaGuardia Community College	154.8	233.5	78.7
Queensborough Community College	85.9	169.2	83.3
Community College Subtotal	465.5	730.8	265.3
Grand Total	1736.7	2477.8	741.1

Source: Sightlines LLC, "CUNY Renewal and Backlog," December 2012

equipment. With its outdated HVAC system, high humidity levels, mold and energy waste are common throughout campus buildings.¹²³

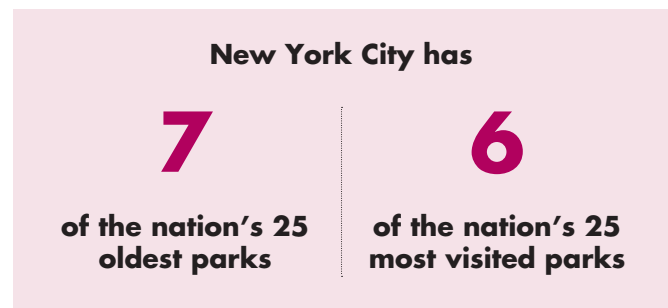
At York College, deferred capital maintenance increased 251 percent from 2007 (\$38.5 million) to 2012 (\$135 million). A rise in the Queens water table has had a particularly hazardous effect on campus facilities. Water levels have reached three feet above the basement floor of the Academic Core Building, necessitating the relocation of the electric distribution system. Waterproofing the interior of the basement and replacing damaged electrical equipment will cost \$30 million.¹²⁴

Parks Department

New York is home to the country's oldest, busiest and most expansive parks in the country. Seven of the nation's 25 oldest parks are in New York and six of the 25 most visited.¹²⁵ In all, the Parks Department maintains over 29,000 acres of property, covering 14 percent of the city and encompassing more than 1,000 playgrounds, 800 athletic fields, 550 tennis courts, 55 outdoor swimming pools, 14 miles of beaches, 13 golf courses, and four zoos.¹²⁶

Despite its vast and diverse assets, the Department of Parks is granted little autonomy over its capital budget. Instead, it relies on discretionary capital allocations from council members and borough presidents for the majority of its projects. This precludes the Parks Department from planning and prioritizing investment, creates contracting delays, exacerbates disparities among neighborhood parks, and not surprisingly, favors more visible and popular projects (like playgrounds) over more obscure assets (like bridges and retaining walls).

While the majority of park bridges are maintained by the Department of Transportation, about two dozen "need to be brought up to a certain level of good repair before the DOT will take them on" according to John Natoli, the chief engineer for capital projects at the Parks Department. These distressed bridges include the Passerelle Bridge (a wooden esplanade from the 1939 World's Fair), Porpoise Bridge (over Flushing River in Queens) and the Fort Washington Pedestrian Bridge (over



Amtrak lines in Manhattan). Not surprisingly, funding is an issue. Natoli confirms that Parks "gets an allotment of money for bridges, but it's insufficient. Some are in disrepair."

Ongoing maintenance issues at parks are often a product of their location. "Many parks were intentionally sited in locations because they weren't fit for development," says Alyson Beha, director of research, planning and policy at New Yorkers 4 Parks. "We see the most problems in parks built on cliffs and hills—Morningside Park, St. Nicholas Park, Jackie Robinson Park, St. Mary's Park, McNeil Park and Fort Greene Park. As the earth moves and erodes, stairwells are left in disrepair." Retaining walls in these parks need significant attention. While the Parks Department monitors bulges and cracks vigilantly, over \$25 million in contracts have been prepared in case of failure. According to the AIMS report, three Bronx parks (Franz Sigel, Jerome Slope and University Woods) will need \$1.6 million to fortify their retaining walls in the next four years. Manhattan parks, on the other hand, will need \$24.2 million for retaining walls, including \$6.2 at Riverside Park, \$6.1 for Central Park, \$3.3 at Fort Tryon, \$2.6 for Highbridge, \$1.8 million at Jackie Robinson and \$1.3 million for Morningside.

Seawalls

New York is a city of islands and peninsulas. Many of its most important assets, including its parks, ports and highways, are located at the shoreline. Seawalls protect this infrastructure, managing the tide and forestalling erosion. According to the OMB's official estimates, New York has approximately \$44 million in state of good repair needs for its seawalls and has set aside only \$9 million for repairs. But, according to experts,

Parks Department Seawalls			
Borough	Capital Needs FY2014-17	Total Committed	% Committed
Bronx	\$7,341,900	\$1,908,181	26%
Brooklyn	\$6,753,000	\$0	0%
Manhattan	\$15,893,700	\$6,409,931	40%
Queens	\$7,432,100	\$272,852	4%
Staten Island	\$6,295,700	\$134,964	2%
NYC	\$43,716,400	\$8,725,928	20%

Source: OMB Asset Investment Management Report, Agency Reconciliation, Fiscal Year 2013

the problem is actually much bigger than OMB is letting on. One expert we talked to said that the seawalls around the East River promenade require wholesale demolition and reconstruction, which could cost over \$100 million all by itself.

According to John Natoli, the chief engineer for capital projects at the Parks Department, most of New York’s seawalls were built 60 or 70 years ago. “They’re beyond their useful design life,” he says. “We’re patching them left and right. They really need several hundred million dollars to put a fence around it all, demolish it and rebuild it. If I were to leave the agency today, I’d say, ‘I wish we could have made a better argument for fixing the seawalls. This should have been dealt with.’”

Maintaining this essential infrastructure is complicated by their fractured management. In total, 10 city agencies oversee some portion of the city’s seawall infrastructure. This can be cumbersome, particularly when projects need approval from the state Department of Environmental Conservation (DEC). Jack Schmidt, director of transportation planning at the City Planning Department, explains, “With the seawall, if we had autonomy to do what we wanted, the process would move a little more smoothly. But to get state DEC approval is a real pain. They have ridiculous restrictions about what you can do where

and how you can do it. The approval process is lengthy and it’s never guaranteed.”

Homeless Shelters

The Department of Homeless Services (DHS) is responsible for “providing temporary, emergency shelter for individuals and families who have no other housing options.” While this is a noble mandate, the department is severely constrained by substandard facilities. The 55 buildings operated by DHS are the oldest, largest and among the most desperate of the city’s 240 shelters. Leaking roofs, poor insulation, and heating and electrical failures plague these ancient facilities, impeding the delivery of critical services to vulnerable clients.

Over the next four years, city-owned shelters will need \$50.3 million to achieve a state of good repair, according to the Asset Information Management System (AIMS) report. Only \$7.7 million is budgeted for these facilities, however, leaving a \$42.5 million gap. Manhattan’s 16 shelters are the oldest and the most neglected. From 2014 to 2017, DHS is projected to cover only \$3.7 million of Manhattan’s \$30.7 million needs. The funding gaps in Brooklyn (\$12,411,809) and the Bronx (\$2,402,407) are also substantial.

Of the \$50.3 million in capital needs at DHS, nearly half is for exterior architecture. “The primary issue with city-owned buildings is the envelope, meaning the roofs, windows and brick pointing,” confirms Yianna Pavlakos, the DHS’s commissioner for facility maintenance and development. “That is always a big challenge.” At some facilities, mold from persistent leaks has left rooms uninhabitable. In an already overcrowded system, the need to cordon off available capacity is devastating.

According to the AIMS report, six shelters will need over a million dollars each to rehabilitate their building envelopes. Only two, Fort Washington and Metropolitan, have been allocated partial funding to address these issues.¹²⁷

According to Pavlakos, DHS is clearly not getting sufficient funding to do necessary capital work. “Unfortunately,” she says, “we’re in a situation where we’re basically asking ourselves ‘what’s the biggest emergency?’”

City Shelters in Need of Repair

	Buildings	Average Year Built	Capital Needs FY2014-17	External Architecture	Sum of Dollars Committed	Percent Funded
Bronx	12	1957	\$5,889,000	\$2,319,600	\$3,486,593	59%
Brooklyn	21	1937	\$12,738,300	\$4,440,900	\$326,491	3%
Manhattan	16	1933	\$30,650,300	\$16,223,000	\$3,714,429	12%
Queens	5	1962	\$953,800	\$449,900	\$210,967	22%
Staten Island	1	1937	\$48,700	\$0	\$0	0%
NYC	55	1943	\$50,280,100	\$23,433,400	\$7,738,480	15%

Source: OMB Asset Investment Management Report, Agency Reconciliation, Fiscal Year 2013

Libraries

New York City is home to 210 public library branches. Today, these branch libraries serve more New Yorkers than ever before. They have evolved from places to check out books to community-based resource hubs where residents turn for workshops, classes and computer access. But while the bricks-and-mortar branches are increasingly important, a large percentage were built in the first half of the 20th century and suffer from a long list of maintenance challenges. Indeed, throughout the city, boilers and HVAC systems are failing and building exteriors are crumbling.

The city's three public library systems—Queens, Brooklyn and New York, which serves Manhattan, Staten Island and the Bronx—rely heavily on discretionary funds from City Council members and borough presidents to address their infrastructure needs. When funding does not arrive, capital investment must be deferred. Brooklyn, for instance, has accumulated a \$271 million capital backlog. This includes \$86.7 million for interior renovations, \$81.7 million in building envelope repairs (façade, windows and roofs) and \$57.1 million for building systems (plumbing, HVAC, boilers, electric).¹²⁸

City Health Clinics

The Department of Health and Mental Hygiene (DOHMH) operates over 20 health clinics throughout the city. These facilities provide immunizations, flu shots, testing for sexually transmitted diseases and other preventative care to all New Yorkers, regardless of income or immigration status. Located in neighborhoods plagued by poor health, DOHMH clinics also offer vital services to residents suffering from heart disease, diabetes, asthma, HIV/AIDS and other debilitating ailments.

Half of the DOHMH clinics were built prior to 1950. Maintenance and capital investment have been spotty in recent years, allowing these facilities to fall into disrepair. As with all buildings, day-to-day custodial work at clinics is closely intertwined with their structural health. This is particularly true for roofs. "Because of layoffs we don't have enough staff to check on all the roof drains to ensure they're not clogged," says Sally Yap, executive facilities director. "If you have standing water and snow and ice on the roof, that roof is not going to last a long time."

Elevators at clinics are also an issue. Most DOHMH buildings rely on geared traction elevators, an obsolete technology that requires constant maintenance and is subject to frequent breakdowns. When the elevators are not functioning, asthmatic children must be carried up

stairs and elderly patients are often forced to re-schedule appointments. Over the last three years, 9 DOHMH clinics have accumulated 24 active elevator violations. Fifteen violations were issued in 2013 alone.¹²⁹

Courthouses

New York City's courthouses are old, underfunded and overtaxed. Entryways in courthouses

are often too small to accommodate today's security procedures and machinery, leading to severe congestion and missed court dates. Broken elevators leave courtrooms inaccessible to people with disabilities, forcing them to reschedule hearings.

Throughout the city, aging courthouses are chronically underfunded. In the AIMS report, the OMB identified \$57.7 million dollars of basic capital needs, but pledged only \$24.6 million for

City Courthouses with the Largest Funding Gaps				
Court	Built	Capital Needs FY2014-17	Dollars Committed	Funding Gap
Manhattan Criminal Courts Building	1938	\$10,043,900	\$477,908	\$9,565,992
Bronx County Courthouse	1933	\$5,541,000	\$1,148,788	\$4,392,212
Bronx Hall of Justice	2003	\$3,173,800	\$0	\$3,173,800
Manhattan Supreme Court	1925	\$3,234,500	\$573,424	\$2,661,076
Queens Criminal Courts	1961	\$3,074,200	\$866,501	\$2,207,699
Queens Civil/Housing Court	1997	\$2,097,100	\$0	\$2,097,100

Source: OMB Asset Investment Management Report, Agency Reconciliation, Fiscal Year 2013

City Courthouses in Need of Repair					
Borough	Average Year Built	Courts Surveyed	Capital Needs FY2014-17	Dollars Committed	Funding Gap
Bronx	1978	4	\$19,757,400	\$11,714,108	\$8,043,292
Brooklyn	1941	3	\$7,647,800	\$5,142,016	\$2,505,784
Manhattan	1926	7	\$20,886,700	\$5,217,697	\$15,669,003
Queens	1955	5	\$8,178,600	\$2,429,025	\$5,749,575
Staten Island	1927	4	\$1,186,900	\$112,733	\$1,074,167
Grand Total	1943	23	\$57,657,400	\$24,615,579	\$33,041,821

Source: OMB Asset Investment Management Report, Agency Reconciliation, Fiscal Year 2013

courthouses in its four-year capital commitment plan. Manhattan courthouses, the oldest in the five boroughs, will experience the largest funding gap, at \$15.7 million, though courthouses in the Bronx (\$8 million) and Queens (\$5.7 million) have significant unmet needs as well.

More than \$2 million in capital funding at six city courthouses will be deferred over the next four years. The Manhattan Criminal Courts Building will experience a staggering \$9.6 million capital funding gap while unmet needs at the Bronx County Courthouse will reach \$4.4 million.

Of the 23 courthouses managed by the Department of Citywide Administrative Services, 16 have outstanding elevator violations. Five have accumulated more than four active violations over the last three years: Queens Supreme Court (18), Queens Criminal Courts (15), Brooklyn Supreme Court (6), Manhattan Criminal Courts Building (5) and Midtown Community Court (5). Queens courthouses are the worst offenders, collecting 39 of the city’s 71 open violations.¹³⁰ Elevators at the Supreme Court in Long Island City and the Queens Supreme Court rely on antiquated parts that are no longer manufactured.

Jails

New York’s jails are old and in need of repairs. The New York City Department of Correction (DOC) operates 14 jails throughout the city, including ten on Rikers Island. The average complex on Rikers Island is 44 years old, while the city’s borough detention centers are 47 years old on average.

According to AIMS, DOC will have over \$290 million in state of good repair needs over the next four years.¹³¹ Eight complexes on Rikers have capital needs exceeding \$10 million, yet only two—Otis Bantum Correction Center and Rose M. Singer Center—are slated to receive more than 30 percent of necessary funding.¹³²

The city’s 14 jail house approximately 12,000 inmates, most of whom are awaiting sentencing.

Beginning in 1975, a slew of court cases—collectively known as the Benjamin litigation—found conditions at New York City Jails were unconstitutional, and the courts appointed the Office of Compliance Consultants to oversee their remediation. While a number of issues have since been addressed, violations concerning fire safety, ventilation and modular housing units remain unresolved.¹³³

Rikers Island Jails with over \$10 million in Repair Needs

Rikers Facility	State of Good Repair Needs	Dollars Committed 2014-2018	Percent Funded
Anna M. Kross Center	\$22,951,400	\$216,891	1%
Eric M. Taylor Center	\$57,495,300	\$3,589,889	6%
George Motchan Detention Center	\$10,708,000	\$376,556	4%
James A. Thomas Center	\$34,544,000	\$0	0%
Otis Bantum Correction Center	\$14,188,900	\$11,087,382	78%
Robert N. Davoren Center	\$60,292,100	\$9,832,843	16%
Rose M. Singer Center	\$12,312,300	\$5,201,548	42%
West Facility	\$12,600,700	\$3,504,700	28%

Source: OMB Asset Investment Management Report, Agency Reconciliation, Fiscal Year 2013

In 2015, after years of budgetary delays, DOC is scheduled to complete the installation of fire alarms.¹³⁴ Though a necessary improvement, detection systems are a half measure in correctional settings—locked behind bars, inmates cannot simply run away when they hear an alarm or smell smoke. “Phase I is fire alarms, Phase II is everything else: compartmentation, sprinklers, entrances and exits,” says John Boston, director of the Legal Aid Society’s Prisoners’ Rights Project. “DOC has been focusing for some time on fire alarms despite our repeated complaints that they need to get started on the other aspects of this process. They have resisted that.”

While the Anna M. Kross Center and North Infirmary Command at Rikers Island are receiving broader safety upgrades this year, including sprinklers and improved fire smoke compartmentation, many other jails lack these systems.

When fires do occur, ventilation systems help draw smoke from buildings. They also filter and circulate air in everyday, non-emergency situations. Ventilation equipment in several Rikers Island facilities is inadequate, jeopardizing the health of inmates, 20 percent of whom suffer from asthma.¹³⁵ During one visit to the Robert N. Davoren Center, inspectors discovered ventilation ducts had been blocked off with sheet metal. No explanation was provided. The replacement and reconfiguration of the ductwork has delayed rehabilitation of the complex by at least two years.¹³⁶

Hunts Point Market

The Hunts Point Food Distribution Center is the second largest wholesale market in the world. Its meat, fish and produce markets generate more than \$3 billion in annual sales, host 125 merchants and employ 6,050 people.

While the Hunts Point Fish Market is relatively new, its meat and produce counterparts are hobbled by undersized and outdated facilities. Refrigeration capacity is inadequate, and loading docks were not designed for today’s 53-foot tractor trailers. Despite commercial success, Hunts Point’s market share is in jeopardy. If it is not modernized immediately, markets in New Jersey

and Pennsylvania will continue to poach business and jobs.

The Hunts Point Meat Market, built in 1973, contains approximately 1,000,000 square feet of refrigeration and freezer space. Most warehouses have 13-foot ceilings, tall enough to accommodate just one or two pallets of goods. According to Bruce Reingold, general manager of the Cooperative Meat Market, the ideal ceiling would be three times higher and accommodate the stacking of five pallets. To compensate for this deficit, companies must improvise, storing products in refrigerated containers on diesel trucks. Idling trucks are strewn across the grounds, exacerbating congestion and aggravating air quality in the South Bronx, where rates of asthma are the highest in the country.

Conditions are similar at the 50-year-old Hunts Point Produce Market. While modern warehouses customize temperatures to individual products, the Produce Market offers only one temperature setting and lacks a backup generator.¹³⁷ The market struggles to maintain a steady temperature throughout storage and distribution. Loading docks, for instance, are unsealed and unrefrigerated, degrading food quality and leading to spoilage and waste.¹³⁸ The docks are also undersized for modern tractor-trailers, delaying the packing and unpacking of inventory and complicating inspections.

CAPITAL CRUNCH

Bringing New York City's infrastructure into a state of good repair will cost tens of billions of dollars in public investment, but thus far only a fraction of this amount has been committed

In a city where it costs an estimated \$52 million to restore the New York State Pavilion from the 1964 World's Fair and \$150 million to renovate the New York Aquarium, it's hard to fathom, much less calculate, the full cost of addressing the infrastructure vulnerabilities laid out in this report. Drawing from our analysis of agency and authority capital budgets and asset condition assessments, however, we estimate that at least \$47.3 billion is needed to bring the city's core infrastructure to a state of good repair.

Every year, the city Office of Management and Budget (OMB) updates its Asset Investments Management System (AIMS), surveying facilities and infrastructure that are managed by many—but by no means all—of the city's agencies. Based on the most recent AIMS assessment, the city projects that it will cost \$6.3 billion¹³⁹ from fiscal year 2014 to 2017 to maintain the safety and functionality of existing assets under management at 18 city agencies. This includes \$3.2 billion for the Department of Transportation, \$1.3 billion at the Department of Education, \$471 million for the Parks Department, \$282 million at the Health and Hospitals Corp., \$109 million at the Department of Sanitation and \$85 million at the Department of Cultural Affairs.

While these numbers are large, they significantly underestimate true capital needs. Not only are water and sewage assets, East River bridges and agency vehicles excluded, but the inspections themselves are incomplete. For instance, the AIMS assessment calculated the cost of rehabilitating six City University of New York (CUNY) community colleges¹⁴⁰ at \$66 million, but a more rigorous assessment commissioned by CUNY itself put the capital backlog at \$731 million, 11 times greater.

State of Good Repair needs are even more significant in the agencies and authorities not included in AIMS. The New York City Transit divi-

sion of the MTA would need to invest \$16.3 billion from 2015 to 2019 to maintain the full functionality of its assets, according to its recently published *Twenty Year Capital Needs Assessment: 2015-2034*.¹⁴¹ New York City Housing Authority (NYCHA) developments need \$15.5 billion over the next five years to fully rehabilitate the building stock.¹⁴² Over this same five-year period, the Port Authority estimates that it would cost approximately \$6.8 billion to bring its bridges, tunnels, trains, airports and buildings in the metropolitan region into a state of good repair.¹⁴³ Finally, CUNY itemized \$2.5 billion in immediate capital needs at 20 of its senior colleges and community colleges.¹⁴⁴

It is important to note that these estimates only consider the maintenance and replacement of existing assets. They do not include creating new capacity and making programmatic changes in a facility, such as converting a classroom to a computer room or a gym to a cafeteria. When a new playground costs \$2.5 million, a new library \$15 to \$20 million, and a mile of subway line \$1.6 billion, total capital needs in New York City quickly escalate beyond the \$47.3 billion state of good repair figure.

While all this adds up to roughly \$50 billion, the city agencies and government authorities in charge of these assets have thus far only received a fraction of this amount in capital funding. Of the \$6.3 billion outlined in the AIMS report, just \$3 billion has been committed. At the Department of Education, only \$224 million (17 percent) of the estimated \$1.3 billion line-item state of good repair needs have been funded, leaving a \$1.1 billion gap. At the Department of Correction, only \$45 million (15 percent) of the estimated capital needs of \$293 million has been funded, leaving a \$247 million gap. At the Parks Department, only \$81 million (17 percent) of the estimated capital

needs of \$471 million has been funded, leaving a \$390 million gap.

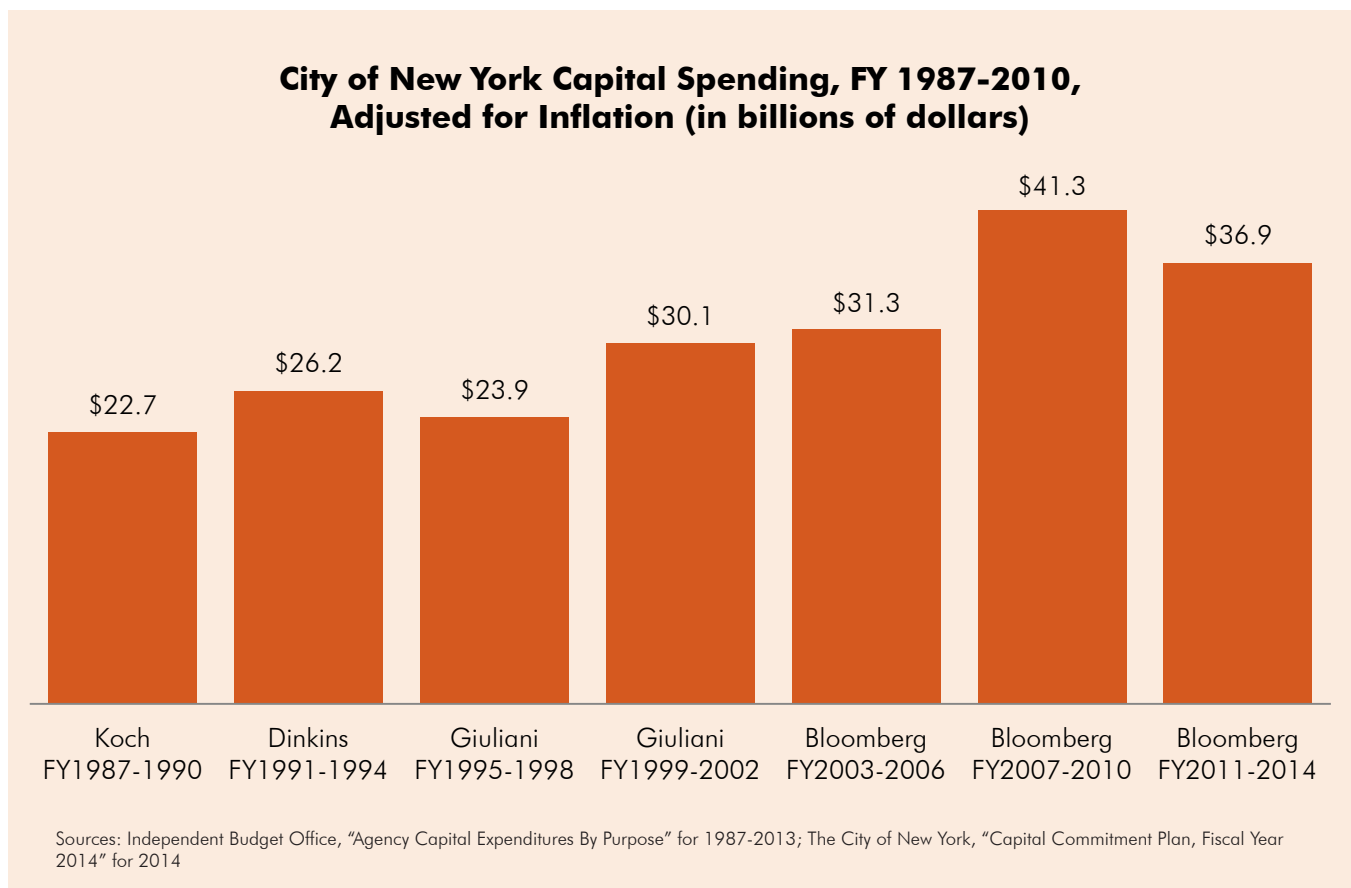
The Housing Authority, Port Authority, MTA and CUNY will face similar funding gaps as well.

The Port Authority will not meet \$6.2 billion of state of good repair needs over its 2011-2020 capital budget cycle.¹⁴⁷ New York City Transit accumulated a \$10.5 billion capital backlog over the course of its 2010-2014 budget. NYCHA's capital funding gap will reach \$14 billion by 2016.¹⁴⁸ CUNY senior and community colleges are currently contending with \$2.5 billion in deferred capital maintenance.¹⁴⁹ The Department of Environmental Protection, responsible for managing the city's water and sewage systems, has never released a publicly available unconstrained capital needs assessment, but their backlog is surely several billions of dollars.

Given the scope and age of New York City's infrastructure, these funding gaps are as inevitable as they are troubling. To his credit, Mayor Michael Bloomberg did make significant progress

in funding the city's infrastructure needs. From fiscal year 2003 to 2014, more capital dollars were invested than in the 17 years prior. Adjusting for inflation, Bloomberg devoted \$9.1 billion annually compared to Rudolph Giuliani's \$6.8 billion, David Dinkins' \$6.5 billion and, in his final term in office, Ed Koch's \$5.7 billion.

But while the Bloomberg administration devoted significant sums to new schools, parks and major projects like the third water tunnel and the 7 train extension, state of good repair needs actually increased during his tenure. According to the AIMS, capital needs increased from \$4.6 billion in 2002 to \$6.3 billion today. While state of good repair spending also grew, it was not enough to keep pace with increasing needs.¹⁵⁰



Estimated Capital Needs and Funding Gap at 18 City Agencies

Agency	Capital Needs FY2014-17	Dollars Committed	Funding Gap
Department of Education	\$1,316,169,000	\$224,484,914 ¹⁴⁵	\$1,091,684,086
Department of Transportation	\$3,192,417,000	\$2,402,590,000	\$789,827,000
Dept. of Parks and Recreation	\$471,151,000	\$81,225,000	\$389,926,000
Department of Correction	\$292,502,000	\$45,151,000	\$247,351,000
Dept. of Small Business Services ¹⁴⁶	\$229,592,000	\$13,623,000	\$215,969,000
Health and Hospitals Corporation	\$282,014,000	\$97,329,000	\$184,685,000
Department of Sanitation	\$109,867,000	\$20,296,000	\$89,571,000
Dept. of Citywide Admin. Services	\$129,929,000	\$40,550,000	\$89,379,000
Department of Cultural Affairs	\$85,267,000	\$25,212,000	\$60,055,000
Department of Homeless Services	\$50,280,000	\$7,738,000	\$42,542,000
Police Department	\$59,708,000	\$24,500,000	\$35,208,000
Fire Department	\$18,585,000	\$3,337,000	\$15,248,000
Dept. of Health & Mental Hygiene	\$17,138,000	\$2,771,000	\$14,367,000
Human Resources Administration	\$9,145,000	\$1,436,000	\$7,709,000
Department for the Aging	\$1,528,000	\$292,000	\$1,236,000
Division of Youth & Family Justice	\$1,117,000	-	\$1,117,000
Admin. for Children's Services	\$1,053,000	-	\$1,053,000
Taxi & Limousine Commission	\$1,289,000	\$1,289,000	-
Total	\$6,268,751,000	\$2,991,823,914	\$3,276,927,086

Source: OMB Asset Investment Management Report, Agency Reconciliation, Fiscal Year 2013

FIXING THE FOUNDATION

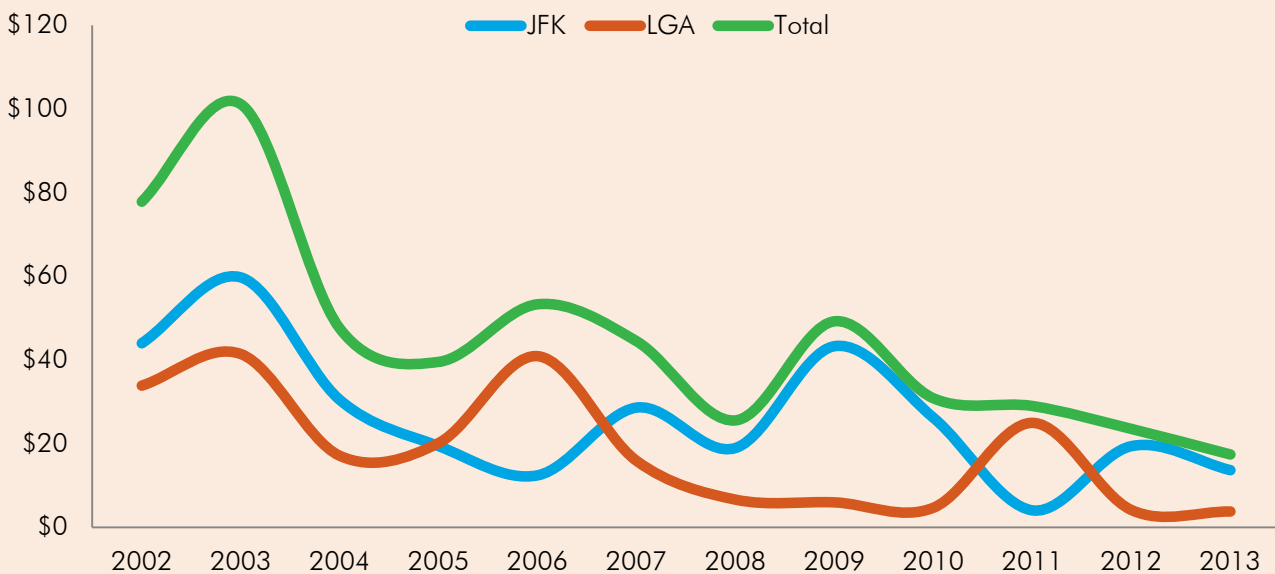
Declining levels of federal infrastructure funding, exorbitant construction costs and limited capital planning have magnified New York’s infrastructure challenges

A number of factors have made it difficult for New York City government officials to make a significant dent in repairing and modernizing its aging infrastructure. Most importantly, the federal government has failed to commit sufficient funds for New York and other older cities to address their infrastructure needs, and in recent years has even reduced the capital dollars it sends to New York. Furthermore, given its high construction costs, the money New York does have for capital spending does not go very far. In addition, the city arguably does not have enough sources of dedicated revenue for infrastructure—and in recent years, policymakers have allowed some of its dedicated revenues to be used for other purposes. Finally, the city has not done a great job of planning and prioritizing infrastructure projects.

State and Federal Retrenchment

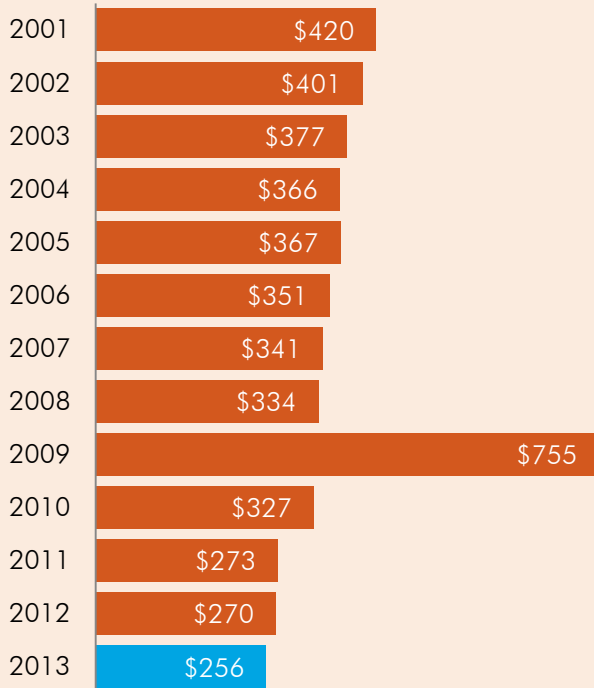
As infrastructure needs grew over the last decade, federal, state and private grants declined, now covering only one-quarter of the city’s capital budget. In recent decades, Washington has retreated from its municipal infrastructure commitments. The federal government funded 78 percent of the New York City Transit’s 1975-1978 capital budget, but only 25 percent of the MTA budget for 2010-11.¹⁵¹ It sent \$267 million (inflation adjusted) in sewage and drinking water grants to New York State in 2000, but only \$203 million in 2013. It contributed \$420 million to NYCHA’s capital budget in 2001, but only \$256 million in 2013.¹⁵² Meanwhile, the state has also reduced its funding for NYCHA and has not fulfilled its capital com-

Federal Airport Improvement Program Grants, Inflation Adjusted



Source: FAA, "Airport Improvement Program (AIP) Grant Histories," 2002-2013

Federal Capital Funding for NYCHA 2001-2013 (in Millions)



Source: NYCHA Comprehensive Annual Financial Reports, 2010-2012

mitments to City schools mandated in the Campaign for Fiscal Equity litigation.¹⁵³

The city's airports have been hit especially hard by federal divestment. The Federal Aviation Administration provided \$101 million in Airport Improvement Grants to JFK and LaGuardia in 2003, but only \$17 million in 2013.¹⁵⁴

Construction Costs

It is more expensive to build in New York City than anywhere else in the nation. According to the Rider-Levett-Bucknall Comparative Cost Index,¹⁵⁵ construction is nearly 70 percent more costly in the city than in Las Vegas, Denver or Phoenix. Even its closest rival, Honolulu, is 9 percent cheaper.

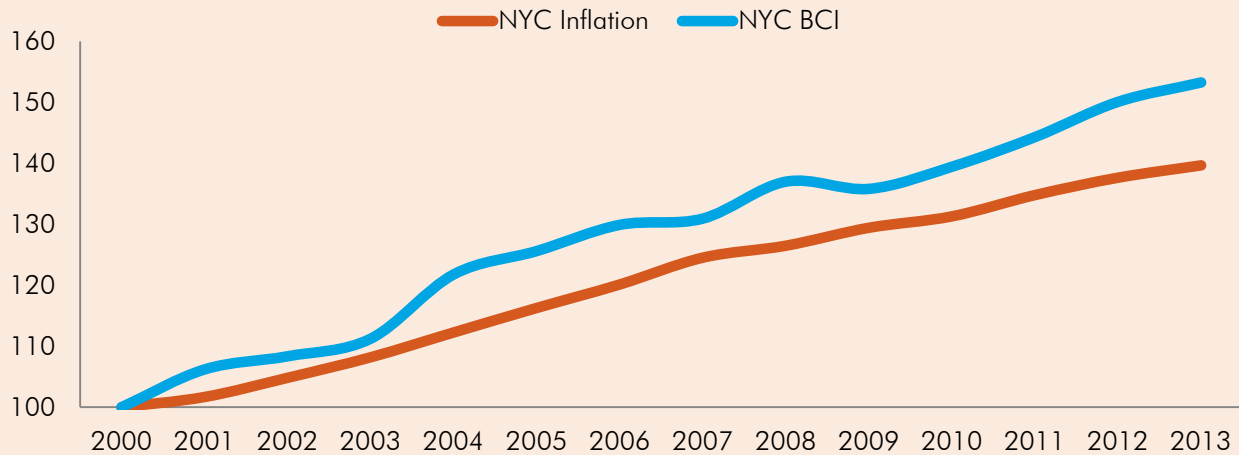
Not only is New York expensive, it has grown increasingly more so. From 1990 to 2000, the cost of construction held steady, closely tracking inflation. Since the turn of the century, however, these figures have diverged. According to the *Engineering News-Record's* Building Cost Index, construc-

tion expenses have outpaced inflation by 13 percent since 2000, 53 percent versus 40 percent. As the real cost of construction rises, the city's capital dollars buy less and less.

While these high and escalating construction costs are, in part, inherent to New York City's age, density and dynamism, a number of regulatory impediments contribute. The city's procurement and construction laws remain subordinate to the state, severely constraining innovation and contributing to cost overruns. Public works projects can only be contracted via a design-bid-build methodology, where the lowest bidder must be awarded the contract, with little emphasis on their qualifications. According to several people interviewed for this report, design-bid-build enforces an arbitrary and injurious separation between the design, construction and maintenance of an infrastructure project, effectively precluding life-cycle considerations. Because drawings are finalized prior to consulting the builder, their "constructability" is not assessed as it would be in a joint Design-Build contract. Once building begins, the design will often need modification, necessitating time consuming and expensive "change orders." The rigid separation of designing and building discourages and complicates the use of on-time and on-budget incentives and penalties in city contracts because it is difficult to apportion liability between the contractor, the designer or the city agency that scoped the project. Joint Design-Build contracts are more conducive to these important clauses. Additionally, the costs of operating new infrastructure cannot be considered in design-bid-build contracts, even if a more expensive bid uses high-quality materials that last longer and are cheaper to maintain. Were New York City authorized to issue Design-Build-Operate-Maintain contracts, appropriate emphasis could be placed on life-cycle outcomes. This would open the door for long-term public-private partnerships.

In recent years, Albany has made a cautious effort to reform their antiquated procurement laws. A 2011 bill authorized a handful of state agencies to pursue Design-Build contracts, but it excluded municipalities. It is set to expire at the

NYC Inflation vs NYC Building Cost Index



Sources: BLS, "Consumer Price Index New York-Northern New Jersey-Long Island, 2004-2014"; Engineering News-Record, City Cost Index - New York, 2000-2013

end of 2014.¹⁵⁶ Were the state to renew the legislation, expand its scope beyond horizontal infrastructure, authorize both Design-Build and Design-Build-Operate-Maintain contracts, and allow municipalities to participate, New York City's procurement process and the long-term quality of its infrastructure would be significantly improved.

In 2008, Albany granted local governments the right to issue Project Labor Agreements (PLAs) in lieu of Wicks Law, a cumbersome regulation requiring agencies to issue separate contracts for plumbing, electric and HVAC on any construction project exceeding \$3 million. New York City's PLAs will expire on June 30, 2014.

The 2008 Wicks reform included a provision authorizing local governments to pre-qualify public works contractors based on credentials, experience and past performance, thus ensuring that selected contractors are capable of providing quality construction.¹⁵⁷ While the Department of Design and Construction, Department of Housing, Preservation and Development and Department of Information, Technology and Telecommunications have begun to experiment with pre-qualification, thus far, the emphasis appears to be on reducing the length of the procurement process. Many of those we interviewed for this report believe that pre-qualification should be used more

aggressively for complex projects to screen out unqualified candidates incapable of honoring their "low bid" and to create a readily available pool of competent vendors.

Under New York City's current procurement rules, all contracts over \$25,000 must receive approval from the OMB, the Law Department, Mayor's Office of Contract Services and numerous other agencies. The procurement cycle lasts 162 days on average,¹⁵⁸ with more complex contracts taking as long as two years. "It kills a lot of the efficiency when every small contract jumps through the same hoops as a \$100 million contract," says former Parks Commissioner Adrian Benepe. "People say agencies can't get anything built, but it's because the system is built-in with inefficiencies."

The city environmental impact assessments also lead to costly delays as well as inflated legal fees. The City Environmental Quality Review requires that "environmental, social and economic factors be considered before governmental approval is given to proposed activities that may significantly affect our urban environment." While agencies at the state-level adhere to strict timetables for environmental assessments, the city does not set time limits for their preparation or review. A typical environmental review in the city can take six months to complete and cost be-

MTA “Megaproject” Cost and Completion Schedules

Project	Original Project		Current Projection	
	Estimated Cost (in millions)	Completion Schedule	Estimated Cost (in millions)	Completion Schedule
South Ferry Terminal	\$420	April 2009	\$541	February 2011
Fulton Street Transit Center	\$750	July 2009	\$1,400	June 2014
Flushing Line Extension	\$1,900	June 2013	\$2,153	June 2014
Second Avenue Subway	\$3,800	June 2014	\$4,500	December 2016
East Side Access ¹⁶²	\$6,300	August 2014	\$10,000	2021

Source: Citizens Budget Commission, “A Better Way to Pay for the MTA,” October 2012

tween \$100,000 for smaller projects and \$2.5 million for larger ones.¹⁵⁹

Given the extensive environmental review and procurement process, one might expect that city construction projects are accurately scoped, planned and budgeted prior to their authorization. But while a recent pilot program that increased funding for preliminary project scoping has paid dividends, problems remain. Thirty-one percent of school capital improvement projects, 30 percent of structural work on bridges and 12 to 17 percent of construction projects performed by DDC run behind schedule. At DEP, large projects have experienced tremendous cost overruns. The Catskill-Delaware Water Ultraviolet Disinfection Facility, completed in October 2013 at a cost of \$1.6 billion, was four years late and \$1 billion over budget. The Croton Water Filtration Plant, slated for completion in 2012, is currently two years overdue and \$2 billion over budget.¹⁶⁰

These overruns are hardly exclusive to city agencies. As of 2012, the MTA Capital Construction Company was \$5.5 billion over-budget on five of its recent “megaprojects”: South Ferry Terminal, Fulton Street Transit Center, Flushing Line Extension, Second Avenue Subway and East Side Access. Both East Side Access and the Fulton

Street Transit Center are at least five years behind schedule.¹⁶¹

Dedicated Revenues

As Washington and Albany withdraw from their infrastructure commitments, it becomes increasingly important to establish generous, secure and stable funding sources for maintaining New York’s critical assets. Unfortunately, the city and state have developed few dedicated revenue sources in recent years and have diverted money from those already in place. Moving forward, New York can learn from other cities (and past missteps) to create dual purpose tolls and fees that simultaneously discourage the overuse of existing infrastructure and provide dedicated funding to maintain and expand these facilities.

In Seattle and Philadelphia, Stormwater Management Fees not only provide funding to the water and sewer system, they also encourages resident to reduce the amount of rainwater entering the sewer system from their property. Customers are billed based on the percentage of their lot that is permeable, thus absorbing rainwater. The more green elements—such as grass, gardens, green roofs and permeable concrete—the lower the fee.¹⁶³

BORROWING TO BUILD

To finance capital projects, New York, like other cities around the country, relies primarily on borrowing. From FY2002 to FY 2013, total outstanding debt rose from \$42.1 billion to \$67.6 billion¹⁷⁴ and annual debt service levels increased from \$3.9 billion to \$5.8 billion.¹⁷⁵

While the city's debt has increased, there is ample evidence that its financial position has improved since the turn of the century. As a percentage of total city revenue, outstanding debt actually fell during the Bloomberg administration, from 158 percent in FY2002 to 135 percent in FY2013.¹⁷⁶

These figures exclude Water Authority debt, which finances the capital needs of the city's water and sewer system. Over the last decade, massive Department of Environmental Protection projects—including the 3rd Water Tunnel (\$4.7 billion), an upgrade to the Newton Creek Wastewater Treatment Plant (\$5 billion), the Delaware/Catskill Ultraviolet Disinfection Facility (\$1.6 billion) and the Croton Filtration Plant (\$3.2 billion)¹⁷⁷—were financed by a rapid increase in borrowing, from \$11.2 billion in FY2002 to \$29.3 billion in FY2013.¹⁷⁸ To cover their growing debt, sewage and water fees have risen 124 percent over the last decade.

The MTA also has grown increasingly reliant on borrowing to finance its state of good repair needs as well as its ambitious expansion projects. From 2000 to 2011, the MTA's outstanding debt increased from \$14 billion to \$32 billion, and its annual debt service increased from \$1 billion to nearly \$2.2 billion.¹⁷⁹

The congestion fee, which was approved by the City Council but defeated in Albany, offers another example of a fee that both generates new revenue and incentivizes more optimal use of city assets. Bridges without tolls attract a disproportionate share of truck and cars, causing congestion on bridges and local roads that lack the structural capacity to handle the weight. Tolling the East River bridges, for instance, could extend their useful life, improve traffic flow and create a dedicated revenue stream for public transportation.

The leasing of city property could also generate revenue while addressing infrastructure deficits. In densely populated cities, telecom companies favor “small cell technology,” opting to put cell sites close to street level rather than building macro towers on top of buildings. Companies like Verizon are considering all available locations, including city-owned payphones, streetlights and traffic lights. Leasing such spaces to these providers would give the city a new revenue stream while improving cell service and mobile broadband. The fee could potentially be used to fund the Economic Development Corp's ConnectNYC

program, which provides fiber internet connectivity in commercial districts.

As the city considers new dedicated funding streams, it must also work to protect existing ones. At the MTA, \$20 million from the Metropolitan Mass Transportation Operating Assistance account was transferred to the state's General Debt Service Fund in 2013. Another \$40 million transfer has been proposed for 2014.¹⁶⁴ Funds from the Dedicated Highway and Bridge Trust Fund have also been used to cover state budget costs.¹⁶⁵ A recent toll cut at the Verrazano-Narrows Bridge, announced in February, will cut \$7 million in toll revenue from the state budget and \$7 million from the MTA budget.¹⁶⁶ In New York City, revenue dedicated to the water and sewage system is redirected to the city's expense budget through “rental payments.” While these payments were established to pay off water-related bonds that preceded the 1985 creation of the Municipal Water Financial Authority, that provision was tweaked in 2005 so that they are no longer connected to prior debt service.¹⁶⁷ Since 2005, rental payments have increased significantly, from \$109 million to \$208 million.¹⁶⁸

The city's airports also have been affected by local politics, as well as the financial difficulties of many airlines. While the airports generate significant revenues from landing fees, gate fees and other levies, \$214 million at JFK was diverted to non-airport related activities between 2004 and 2010.¹⁶⁹ Federal regulations require airport operators to reinvest all airport revenue into their facilities, but the Port Authority received an exception. Area politicians in several cases have pushed the Port Authority to use money generated by the airports to prevent toll and fare increases at other Port Authority-managed projects, such as the PATH train.

Capital Planning

Given the breadth and variety of New York capital assets and its vast inventory of needs, it is critical that the city's scarce capital dollars are appropriated intelligently. Yet many of those we interviewed say that the city does not have an adequate process for documenting infrastructure needs and prioritizing investment.

The AIMS report published by the city's Office of Management and Budget provides some of this analysis, but it does not cover a large portion of critical infrastructure, including everything under the purview of the DEP, and inspections are often cursory.

Sam Schwartz, an early advocate for the AIMS report, says it has never been as effective as intended. "Back in the 1980s, bridges were rotting, water mains were breaking, sewers were collapsing. At that point, we needed to honestly report on our infrastructure. There was a charter revision in 1988 to require this reporting," he says. "At the time, I screamed 'Don't let it be OMB that reports on it! They will just make up something that makes everything sound okay.' Low and behold, it became a useless document with too many pages," he says

As the Mayor's Office of Data Analytics has demonstrated, high quality and accessible data is critical to improving city operations and planning. During its short tenure, MODA has made several contributions to infrastructure maintenance, such as helping DEP prevent sewer backups and pin-

pointing old buildings vulnerable to catastrophic fires. This kind of statistical analysis could be applied to infrastructure planning, to optimize replacement cycles, maintenance staffing and user fees.

Currently, some existing planning tools have been underutilized. One is the Environmental Impact Assessment. When a planned development is found to have a significant impact on infrastructure—such as increased demand on roads, subways, schools, sewage plants or the electric grid—the developer is required to propose "mitigations" that must be approved by the responsible city agency.¹⁷⁰ While this analysis was meant to aid infrastructure planning, there is no method to ensure that mitigations are implemented.

The Department of City Planning has played only a limited role in capital planning in recent years. The quadrennial Zoning and Planning Report—establishing planning policy in conjunction with the "ten-year capital strategy [and] the four-year capital program"¹⁷¹—was released only once since 1989 and eliminated in 2012.¹⁷² The Annual Report on Social Indicators, which details demographic, environmental and infrastructure conditions and trends and proposes plans to respond to them, has not been prepared since 2005. This lack of reporting is particularly notable because it took place at a time when, as a recent City Council Infrastructure task force documented: "The city has gone through a decade or more of aggressive development that has exacerbated its infrastructure maintenance problems and created an intense demand for additional infrastructure."¹⁷³

RECOMMENDATIONS

Though New York's essential infrastructure has improved over the past 25 years, a look under the hood reveals a number of critical vulnerabilities. From structurally deficient bridges and deteriorating roads to leaking water pipes, antiquated airport terminals, decaying school buildings and fraying copper telecom wires, too much of New York's infrastructure is unworthy of a growing and global city facing increased competition for talented workers and business investment.

To be sure, we do not expect New York policymakers to address every one of the city's infrastructure vulnerabilities at this time. Policymakers will need to prioritize. But if a significant chunk of the city's critical infrastructure is not brought to a state of good repair in the years ahead, it could seriously undermine the city's economic competitiveness and quality of life—and lead to substantial long-term costs.

In the pages that follow, we lay out more than a dozen recommendations for city and state policymakers to address these challenges. Our ideas fall into four key areas: 1) Increasing Infrastructure Investments; 2) Bringing Down Infrastructure Costs; 3) Improving Infrastructure Planning; and 4) Developing New Infrastructure Innovations.

Increasing Infrastructure Investments

Make investing in NYC's aging infrastructure a key part of the de Blasio administration's plans to create middle-income jobs

With 35 percent of working adults in New York City in "low-wage jobs" and nearly one in ten working New Yorkers earning too little to officially climb above the federal poverty line, it's refreshing that Mayor Bill de Blasio is looking to develop new strategies for creating middle-income jobs. The de Blasio administration should consider a sizable public works program. It's hard

to think of any other city action that could generate more blue-collar jobs than an increased and sustained investment in repairing the city's aging infrastructure. Such a program could include new apprenticeship programs and job training to ensure that a diverse mix of New Yorkers can access these jobs and build long-term skills in the construction trades.

Refocus capital spending on state of good repair needs

During the 12 years of the Bloomberg administration, city infrastructure investment reached new highs but the overwhelming focus was on expanding capacity—developing new parks, schools, water infrastructure, subway extensions, etc.—rather than on repairing aging assets. It's now time to focus on preserving existing infrastructure. The de Blasio administration should devote a larger share of the capital budget to state of good repair work and favor new infrastructure projects that explicitly relieve overburdened assets, thus extending their useful life.¹⁸⁰

Identify new dedicated revenue sources to pay for infrastructure projects—and stop diverting money from existing "dedicated" funding streams

To finance the city's growing state of good repair needs, the city must develop new dedicated revenue sources. For example, the New York Building Congress has suggested the city implement a residential parking permit program, with the revenues going to transportation infrastructure projects. Another possibility is environmentally sound Waste to Energy facilities which, according to the Building Congress and the Citizens Budget Commission, would reduce waste disposal costs and create a potential revenue stream to support the city's sanitation operations. But poli-

cymakers should look to identify other opportunities. In the years ahead, if the state ultimately decides to legalize fracking, it should consider dedicating a share of the potentially lucrative new tax revenues for infrastructure projects.

In addition, city and state officials should refrain from diverting or dipping into the already-insufficient dedicated revenue streams, a practice that has been all-too-common in recent years.

Implement East River tolls or congestion fees

City and state policymakers should get behind plans to establish a fairer bridge toll system to reduce vehicle congestion in the city's central business districts and create a needed mechanism for funding transit infrastructure projects. Though prior efforts to impose tolls on the East River bridges—including Bloomberg's congestion pricing initiative—were dead on arrival in the state legislature, there are indications that newly designed bridge tolling proposals could gain broader support. For instance, while Sam Schwartz's "Fair Plan" would add new tolls on the East River bridges that bring vehicles into the central business district, it would sharply reduce tolls on bridges that don't enter the Manhattan's business district. Most importantly, Schwartz's plan would result in \$1.2 billion annually for transit projects and regional highway improvements. At a time when transit ridership is at record levels but the MTA's precarious finances have left the authority without funds to maintain and improve the system, Mayor de Blasio, Governor Cuomo and other city and state policymakers must throw their full support behind this—or some alternative—bridge tolling plan.

Introduce a Surface Water Management Fee to incentivize capture of rainwater before it enters sewers

To address the roughly 27 billion gallons of raw sewage and polluted stormwater that enter local waterways each year, the city has increased the number of green elements in New York City streets and parks, absorbing rainwater before it enters the sewer system. To incentivize similar rainwater capture on private property, the DEP

should consider introducing a Surface Water Management Fee. Customers would be billed based on the percentage of their lot featuring impervious surfaces. The more green elements added—such as grass, gardens, green roofs and permeable concrete—the lower the fee.

Over 500 utilities currently apply stormwater charges, including Philadelphia, Washington DC, and Seattle. Sophisticated Geographical Information Systems (GIS) programs enable these utilities to track impervious surface area in order to maintain accurate assessments. This new revenue source could be coupled with a credit program to help customers finance the installation of green elements on their property; repaid each month via the utility bill.

Create new mechanisms to capture value from infrastructure projects

Over the past 15 years, much of the public investment in new parks, transit, schools and other infrastructure across the five boroughs has led to significant increases in nearby property values. But as Chris Ward, former executive director of the Port Authority, laments, "We've lacked the capacity to capture that wealth" to help underwrite the cost of those public investments. One example is the development of the Hudson River Park, where hundreds of millions of dollars of investment by city and state agencies has sparked a wave of new housing and commercial development in the surrounding blocks, creating financial windfalls for the property owners. City officials should consider ways that those benefitting most from the improvements could contribute to their financing.

In London, for instance, the Community Infrastructure Levy helped finance major infrastructure improvements, including the city's ambitious Crossrail, a new commuter rail line connecting the suburbs to central London. Surrounding neighborhoods were assigned to one of three zones, depending on their proximity to the new line. In areas that are closest to the new rail line, new development is taxed at £50 per square meter. In the next two zones, the levy falls to £35 per square meter and £20 per square meter.

New York City could introduce a similar mechanism for residential construction around new parks, bus rapid transit, subway lines and any other infrastructure that bolsters real estate values. The city has experimented with forms of value capture at Hudson Yards and Brooklyn Bridge Park. London's Community Infrastructure Levy offers a more systematic and ambitious model.

More federal support

While America's global competitors invest in new airports, transit systems, schools, telecommunications networks, smart energy grids and highways, the United States government is providing less and less infrastructure funding to America's most important global city. This needs to change. New York and other cities simply do not have the resources to tackle their aging infrastructure alone. In his 2014 State of the Union address, President Barack Obama urged Congress to provide ample revenues for "rebuilding our roads, upgrading our ports, unclogging our commutes." Then, in February 2014, President Obama proposed a \$302 billion dollar transportation spending package to address the nation's deteriorating infrastructure. Congress should embrace the challenge and develop a bipartisan framework to significantly increase resources for fixing and modernizing the nation's infrastructure. Such a plan should help cities and states repair the oldest bridges, highways, airports and schools; upgrade public housing that was built by the federal government but is now rapidly deteriorating; and modernize transit infrastructure in cities where ridership levels are growing rapidly. It should consider competitive grants that empower cities to come up with innovative infrastructure solutions. Mayor de Blasio should team up with other mayors, business leaders and labor officials to put urban infrastructure needs on the national agenda and lobby Congress to fund a meaningful investment.

A lift from Albany

Governor Cuomo made infrastructure investment a key part of his 2014 State of the State speech, noting, "We have to rebuild our infrastruc-

ture because we need a 21st century infrastructure to build on." The governor proposed major state investment to modernize JFK and LaGuardia airports and build new Metro North stations in parts of the Bronx that are underserved by the subway system. He called for a referendum that, if passed by voters, would provide \$2 billion to upgrade the technology infrastructure in schools across the state. This is a very important start, but the state must do far more to support New York City's infrastructure needs.

Given that New York City is the state's economic engine, the governor and legislature have a responsibility to help modernize its aging infrastructure. Albany leaders can start by upping its investments in New York City highways that are managed by the state Department of Transportation and which have seen declining levels of maintenance in recent years. It should also provide more stable support for the Metropolitan Transportation Authority's (MTA's) capital plan and honor its capital commitments to City schools mandated in the Campaign for Fiscal Equity litigation. Beyond this, Governor Cuomo and the legislature should introduce a much larger package to modernize bridges, roads, transit systems, schools and energy infrastructure from Brooklyn to Buffalo.

Officials in Albany could follow the lead of several other states that recently developed innovative approaches to funding infrastructure. For instance, Pennsylvania legislators recently approved a package of tax and fee changes that will raise \$2.3 billion a year for transportation infrastructure. Maryland raised the gas tax for the first time in 20 years, passed a measure to index the tax to keep pace with inflation and levied a new sales tax on gasoline—all of which will enable the state to pump \$4.4 billion into transportation infrastructure projects over the next six years. In Massachusetts, the legislature approved a transportation infrastructure financing bill that includes a three-cent per gallon hike in the gasoline tax and a \$1 per pack cigarette tax increase. All together it will provide up to \$800 million in new annual revenue for transportation by 2018. And in January 2014, the state's governor proposed an

additional \$12.4 billion package to modernize the state's infrastructure by pumping billions of dollars into transportation.

Stop diverting airport revenue

JFK and LaGuardia airports both require significant infrastructure investments, yet hundreds of millions of dollars in revenues generated by these airports have been diverted to other Port Authority assets, such as the PATH train system. Federal regulations require airport operators to reinvest all revenue into their facilities to prevent cities from irresponsibly using their airports as a "cash cow." The Port Authority is the only major airport operator in the nation that has been granted an exception to this mandate. With the city's airports in need of significant new investment, de Blasio and other city and state policymakers should push the Port Authority to end this practice—or commit to a ceiling on how much can be diverted from each airport—and reinvest funds into the modernization of JFK and LaGuardia.

Create an infrastructure bank to help select and finance projects with high strategic and economic potential

When structured appropriately, and provided sufficient resources, government infrastructure banks can be an effective way to stretch funding while continually targeting new needs. Effective banks like California's Infrastructure and Economic Development Bank (I-Bank) are able to make their initial capitalizations go much further in terms of loans by securitizing bonds with loan repayments; the I-Bank, for instance, started out with approximately \$180 million in 1999 and has since made over \$400 million in loans to a wide variety of agencies, authorities and nonprofits.¹⁸¹ But rather than using the bank to finance projects chosen by other entities—whether an agency or elected official—California's I-Bank uses a competitive application process to select only those projects with an economic return. As Chicago's relatively new Infrastructure Trust demonstrates, this model could also help the city or state tap into private funding sources. Chicago's Infrastructure Trust has so far raised \$1.7 billion in funding

from Citibank, JP Morgan and other banks, and as with the I-Bank, loans are to be repaid through revenue generating and cost savings opportunities. As we demonstrate in this report, New York has no shortage of such projects: Building retrofits at NYCHA and the city's libraries could generate significant energy savings, for example, while an expansion of fiber in the city's former manufacturing areas, where tech start-ups are often stymied by poor broadband service, would create a clear source of new revenue.

Bringing Down Infrastructure Costs

Authorize Design-Build and public-private partnerships

In 2011, at Governor Cuomo's initiative, the legislature authorized a handful of state agencies to pursue Design-Build contracts, but excluded municipalities. The law is set to expire at the end of 2014. Given the results to date, including the positive impact this approach had on the projected cost of replacing the Tappan Zee Bridge and in expediting the reconstruction of major upstate roads severely damaged by Hurricane Irene, the state should renew the legislation, but also expand its scope beyond horizontal infrastructure (such as roads and bridges), authorize both Design-Build and Design-Build-Operate-Maintain contracts and allow municipalities to participate. Streamlined procurement could reduce costs and shorten delivery time frames. New York City's procurement process and the long-term quality of its infrastructure would be significantly improved.

Avoid "Low Bids" from unqualified contractors

Construction delays and cost overruns are often traced to inexperienced contractors who fail to live up to their "low bid." In 2009, Albany authorized cities to pre-qualify public works contractors based on credentials, experience and past performance, thus ensuring that selected contractors are capable of providing quality construction. While the DDC, HPD, DOT and DoITT have begun to implement pre-qualification lists for select contracts, thus far the emphasis has been on reducing the length of the procurement process.

Moving forward, pre-qualification lists should be used for more complex projects with a focus on screening out unqualified candidates incapable of honoring their “low bid.”

“Low bids” also become inflated when they underestimate the cost of relocating underground utilities for a project. To avoid these oversights, the State Legislature authorized “joint-bidding” in Lower Manhattan. This practice requires bidders to provide separate prices for municipal and private utility work, with the contract awarded to the lowest responsible bidder for the combined work. Utility companies, by separate agreement, reimburse the City for additional costs if the low bidder on the municipal work is not the same as the low bidder on the combined work. To avoid cost overruns and delays, these provisions should be extended to the rest of the city.

Reduce the time to design and approve construction contracts

As they develop new sources of funding, city and state officials should also take immediate steps to address the high cost of building. The cost of construction is extremely high across the board in New York City, but public projects are in a league of their own. They take much longer to complete and cost consistently more than similar work in the private sector. The city could start by reducing the time it takes to design and approve construction contracts, particularly for smaller projects and those with a history of on-time and on-budget construction. For any project over \$25,000, agencies typically need approvals from the Office of Management and Budget, the City Comptroller, the Law Department, the Department of Finance and the Mayor’s Office of Contract Services. This exhaustive process can last anywhere from 162 days to two years. Introducing procurement software that allows agencies to simultaneously, rather than sequentially, review proposals could expedite approval. The city’s Environmental Quality Review process is another source of expensive delays that could be avoided if the city adopted time limits on reviews similar to those at the state level.

Renew Project Labor Agreements

The city should renew project labor agreements (PLAs), which are due to expire on June 30, 2014. These PLAs provide labor-cost certainty and exempt the city from the state’s Wicks Law, a cumbersome and expensive regulation that requires agencies to issue separate contracts for plumbing, electric and HVAC on any construction project exceeding \$3 million.

Repeal the Scaffold Law

Albany elected officials should repeal the nation’s last remaining “Scaffold Law,” which significantly inflates insurance costs compared to other states. The Scaffold Law holds builders responsible for “elevation related” injuries regardless of fault. Determining compensation based on comparative liability, as is done in most other states across the country, could save agencies like the School Construction Authority tens of millions of dollars in insurance premiums every year.

Improving Infrastructure Planning

Create a more effective capital planning process

With at least \$34.2 billion in unfunded infrastructure needs, New York will have to make intelligent choices about which projects to fund and which can be delayed. To do that effectively, the de Blasio administration should invest in a more accurate and complete survey of the city’s state of good repair needs and commit to funding future projects based on explicit and rigorous social and economic goals rather than historical precedent. It also should go beyond OMB and involve planning and economic development agencies to a greater extent than has been the case. The administration might draw lessons from the MTA and Port Authority. The MTA has significantly reformed its asset management strategy in recent years, favoring component rather than full systems replacement and introducing sophisticated cost, risk, performance and resource analysis through the new Strategic Assets Lifecycle Value Optimization program. The Port Authority too has refined its capital planning using a “comprehensive planning process and risk-based prioritiza-

tion that considered asset condition, operational and revenue impact, threat assessment, customer service, regional benefit, and regulatory or statutory requirements.”

Establish a more accurate and thorough survey of the city’s infrastructure assets and their state of good repair

Each year, the Office of Management and Budget (OMB) releases the Asset Information Management System (AIMS) report surveying city-owned buildings, parks, bridges and piers and detailing the investment needs of individual city assets. The inspections are incomplete and the report cursory. It excludes the city’s water and sewer systems, public housing and East River bridges, among other things. It also overlooks handicap accessibility, asbestos abatement and modernization measures. Those assets that *are* surveyed are subject to only visual inspections, without any probing or specialized equipment.

High-quality capital planning depends on a high-quality assessment of conditions. This is especially important for smaller agencies, which cannot afford rigorous inspections by private consultants. Assessment data should be open to the public, allowing residents to track the city’s progress toward state of good repair, identify funding gaps and recommend more effective capital investment management strategies.

Better align infrastructure investments with economic development goals

When individual agencies and authorities develop their capital plans they don’t normally consider the city or state’s broader economic development goals. The MTA’s projected investment in a new train storage facility in Long Island City, for example, is based largely on the operational needs of the agency, not the development opportunities of the surrounding business district and neighborhood. Other cities and states have begun to invest in initiatives that better align these otherwise distinct spheres of deliberation and planning. The Oregon Business Plan initiative, for example, has led to strategic investments in bridges and transit infrastructure as a part of a broader

plan to increase exports. Unlike a citywide capital plan or attempts to align capital plans across different agencies and authorities, this approach has the benefit of linking specific infrastructure projects with human capital investments to achieve important and measurable economic goals.

Take a census of underground utilities

In 2010, the MTA inspector general investigated cost overruns on the Second Avenue Subway and found that the discovery and rerouting of public utility lines drove up costs by more than \$80 million and delayed the line’s completion by at least six months. To prevent future confusion and construction delays, New York needs to take a citywide census of public utility lines. The technology to perform this survey is already available. Con Edison experimented with Ground Penetrating Radar (GPR) around the World Trade Center site and along 149th Street and Southern Boulevard in the Bronx, discovering old trolley tracks running along high-voltage transmission lines. Because the radar is expensive, there should be a central repository of images, allowing public and private entities to pool their findings to assemble a comprehensive map.

Developing Infrastructure Innovations

Expand the MTA’s Small Business Mentoring Program

Beyond funding and track access, the greatest impediment to updating MTA’s signal system is the dearth of qualified contractors. Only three to four contractors are qualified to install and modernize signals. This limits competition, increases expenses and caps the amount of signal replacement that can be performed at any one time. To address this, the MTA recently began a small business mentoring program for training contractors. It should expand this program.

Invest in real-time bridge sensor technologies

Every year, New York City bridges are thoroughly inspected and assessed. Their condition ratings alert the city Department of Transportation to the most distressed bridges, helping them

prioritize capital and maintenance needs for the coming years. While these inspections are known for their rigor, they are also time-consuming, expensive and inherently limited, relying on visual inspections that often identify problems only after internal cracking has occurred and rebar corrosion has begun. Oregon is piloting a real-time bridge sensor program. The sensors monitor temperature and moisture, collect chloride concentrations at multiple depths within the concrete and assess corrosion. New York's city and state departments of transportation should invest in these technologies as well.

Lease space on city street lights, traffic signals and pay phones for telecom company cell sites

New Yorkers in every borough are hampered by patchy cell service and slow mobile broadband. In the city's dense neighborhoods, signals often are blocked by buildings, water and reflective glass. To circumvent these physical barriers, telecom companies are shifting to "small cell technology," opting for cell sites close to street level rather than macro towers on top of buildings. Companies like Verizon are considering all available locations, including payphones, streetlights and traffic lights. The city should rent these

spaces to telecom providers, tapping into a new source of income while improving cell service. The new revenue source could be dedicated to the Economic Development Corp.'s ConnectNYC program, which provides fiber internet connectivity in commercial districts.

Reassign agency tech engineers to DoITT

In October 2010, Mayor Bloomberg issued Executive Order 140, a plan to consolidate the city's outmoded and fractured IT systems. The Department of Information Technology and Telecommunications (DoITT) would assume control of data storage, application hosting, procurement and technology policy. Thus far, progress has been slow. City agencies have been reluctant to relinquish control over their tech operations, foregoing efficiency gains from centralized procurement and storage. To expedite this process, technical employees responsible for infrastructure in individual agencies should be reassigned to DoITT. There they would work on modernizing and integrating the city's old and fragile information technology systems. Such an ambitious effort to overhaul tech infrastructure could attract young engineers to replace those currently maintaining legacy systems who are nearing retirement.

ENDNOTES

1. This includes Port Authority assets not located in NYC.
2. It also excludes the Department of Environmental Protection, responsible for maintaining the city's water and wastewater infrastructure. Were they to be included, the funding gap would be several billion dollars higher.
3. This includes its New York City territory and sections Westchester.
4. "Greenwich Village water main break floods streets, disrupts trains," ABC News, January 15, 2014.
5. "Subway lines still affected by water main break," ABC News, February 2, 2013.
6. "Water main breaks near Penn Station," ABC News, August 23, 2012.
7. "Fred Smith, NYCT Sr. VP Capital Program Management, updates the NYCTRC," pcac.org, April 2011.
8. The \$6.3 billion figure excludes CUNY schools, which performed a separate assessment, and libraries.
9. State of good repair needs for the Port Authority are sourced from a September 2012 consulting report prepared by Navigant. Includes all PA assets.
10. CUNY and the MTA's funding gap refers to immediate needs, while those at NYCHA and the Port Authority reflect their estimated needs over the next five years. Port Authority's funding gap was calculated by halving the \$13.6 billion in state of good repair capital needs from 2011-2020 (according to a September 2012 Navigant study commissioned by the PA) and subtracting that figure by the budgeted state of good repair funding in their most recent 10 year capital plan.
11. Rider Levett Bucknall, "Riders Digest 2013," p. 41.
12. Comparisons are in constant 2011 dollars. For Japan's most recent subway project see: "Fukutoshin subway line debuts," *The Japan Times*, June 12, 2008. For these and other comparisons, see Alon Levy, "US Rail Construction Costs," *Pedestrian Observations*, May 15, 2011.
13. Mayor's Management Report, 2002-2014.
14. Interview with Eric Beaton, New York City Department of Transportation director of Transit Development.
15. Transportation Alternatives, "Bicycle Blueprint," Chapter 4, 1998.

16. NYC DOT, "INFRASTRUCTURE: Street and Roadway Construction," <http://www.nyc.gov/html/dot/html/infrastructure/construction.shtml>, accessed February 25, 2014.
17. Mayor's Management Report.
18. *ibid.*
19. *ibid.*
20. Port Authority Committee on Operations, "George Washington Bridge: Replacement of Suspender Ropes and Main Cables Rehabilitation & Rehabilitation of Cable Strands in Anchorages," December 8, 2011.
21. Port Authority, "Capital Plan Summary 2014-2023," <http://www.panynj.gov/corporate-information/pdf/2014-public-capital-plan.pdf>, accessed February 25, 2014.
22. Johnson, Kirk. "MTA Finds Weak Fire Safety in Subway," *New York Times*, December 11, 1988.
23. MTA. "Annual Disclosure: Appendix A," April 20, 2013.
24. MTA, "Countdown Clocks Station List," http://web.mta.info/cclocks_stations.htm, accessed February 25, 2014.
25. "Fred Smith, NYCT Sr. VP Capital Program Management, updates the NYCTRC," *pcac.org*, April 2011.
26. *ibid.*
27. Kabak, Benjamin, "Rockaways subway service inching closer," *2nd Ave. Sagas*, May 6, 2013.
28. Lyon, Cody, "Keeping It Running: Mass Transit's Future," *Gotham Gazette*, October 14, 2013.
29. L.K. Comstock, "No. 7/Flushing Line CBTC Modernization," <http://lkcomstock.com/project/no-7flushing-line-cbtc-signal-modernization>, accessed February 25, 2014.
30. MTA, "MTA Twenty-Year Capital Needs Assessment 2015-2034," October 2013, <http://web.mta.info/mta/news/books/docs/TYNA-Consolidated.pdf>, accessed February 27, 2014. 2015-2034", October 2013.
31. *ibid.*
32. "Commuter Newspapers Blamed for Surge in Subway Track Fires," *NY1 News*, February 28, 2006.
33. Karni, Annie, "Free Newspapers Blamed for Subway Flooding," *New York Sun*, October 26, 2006.
34. New York City Transit Riders Council, "Unwelcome Mats: New York's Subway Stations in Disrepair," August 2008.
35. MTA, "MTA Twenty-Year Capital Needs Assessment 2015-2034," October 2013, <http://web.mta.info/mta/news/books/docs/TYNA-Consolidated.pdf>, accessed February 27, 2014.
36. From 2002 to 2012, MTA subway ridership increased from 1.42 billion to 1.65 billion.
37. WNYC, The Brian Lehrer Show, "MTA Chairman Prendergast," July 25, 2013.
38. Flegenheimer, Matt, "A Plan to Revamp Subway Entryways Has Elements of Disneyland and Feng Shui," *New York Times*, September 22, 2013.
39. MTA, "Comprehensive Annual Report for the Years December 31, 2012 and 2011" <http://www.mta.info/mta/investor/pdf/2012/2012-Comprehensive-Annual-Financial-Report.pdf>, accessed February 25, 2014.
40. wiki@ttmg.org/mediawiki/index.php?title=MTA_Subway_Yard_Roster, accessed February 27, 2014.
41. MTA, "MTA Twenty-Year Capital Needs Assessment 2015-2034," October 2013, <http://web.mta.info/mta/news/books/docs/TYNA-Consolidated.pdf>, accessed February 27, 2014.
42. *ibid.*
43. MTA. "Capital Program Dashboard," <http://web.mta.info/capitaldashboard/CPDHome.html>, accessed February 27, 2014.
44. "JFK Air Cargo Study" NYC EDC and Port Authority, January, 2013. Chapter 6. http://www.nycedc.com/sites/default/files/filemanager/Projects/Air_Cargo_Study/06-Air_Cargo_Capacity_and_Future_Demand_053112_MN.pdf.
45. US Department of Transportation, "Air Travel Consumer Report," July 2013, http://www.dot.gov/sites/dot.dev/files/docs/2013JulyATCR_0.pdf.
46. Geiger, Daniel, "Makeover at LaGuardia Advances," *Crain's New York Business*, July 31, 2013.
47. Delays at JFK and LaGuardia also stem from outdated air traffic control system and limited capacity of the airports' runways.
48. Geiger, Daniel, "Makeover at LaGuardia Advances," *Crain's New York Business*, July 31, 2013.
49. Ortiz, Priscila and Bill Hutchinson, "LaGuardia and Newark are at the bottom of the barrel, but \$6 billion dollars in upgrades are coming," *New York Daily News*, July 29, 2013.
50. *ibid.*
51. RootMetrics, "Tally of Airport RootScore Awards at the 50 Busiest U.S. Airports," August 1, 2013.
52. "JFK Air Cargo Study" NYC EDC and Port Authority, January, 2013. Chapter 6. http://www.nycedc.com/sites/default/files/filemanager/Projects/Air_Cargo_Study/06-Air_Cargo_Capacity_and_Future_Demand_053112_MN.pdf.
53. *ibid.* Executive Summary.
54. "JFK Air Cargo Study" NYC EDC and Port Authority, January, 2013. Chapter 6. http://www.nycedc.com/sites/default/files/filemanager/Projects/Air_Cargo_Study/06-Air_Cargo_Capacity_and_Future_Demand_053112_MN.pdf.
55. Testimony of Caswell F. Holloway, Commissioner, New York City Department of Environmental Protection (DEP), New York City Council Committees on Environmental Protection & Finance, Fiscal Year 2011 Executive Budget, May 13, 2010.
56. Citizens Budget Committee, "New York City Debt Outstanding," <http://www.cbcny.org/sites/default/files/NYCDebt.html>.
57. NYC Special Initiative for Rebuilding and Resiliency, "A Stronger, More Resilient New York," June 11, 2013. Chapter 6.
58. Pipeline and Hazardous Materials Safety Administration, "2012 Distribution Annuals Data."
59. *ibid.*
60. McKibben, Bill, "The Methane Beneath Our Feet," *New York Review Blog*, April 1, 2013.
61. This includes its New York City territory and sections Westchester.

62. Pipeline and Hazardous Materials Safety Administration, "2012 Distribution Annuals Data."
63. "Electric System," Con Edison. http://www.coned.com/newsroom/energysystems_electric.asp, accessed February 27, 2014.
64. Con Edison. "2012 Annual Report on Electric Service and Power Quality," March 31, 2013, <http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7BC1DB47A6-21A2-411B-906A-48798F5CD931%7D>, accessed February 27, 2014.
65. Figures supplied by Con Edison.
66. *ibid*
67. Con Edison. "2012 Annual Report on Electric Service and Power Quality," March 31, 2013.
68. "Greenwich Village water main break floods streets, disrupts trains", ABC News, January 15, 2014.
69. DEP. "Water Conservation Program," December 2006. p 26. http://www.nyc.gov/html/dep/pdf/reviews/land_acquisition_program/draft_water_supply_permits_exhibits11082010.pdf
70. NYC DDC. "INFRASTRUCTURE CHALLENGES And NYC CLIMATE RISKS," http://www.same-nyc.org/130306_SAME-NYC-Infrastructure-Challenges.pdf, accessed February 27, 2014 .
71. New York City Department of Environmental Protection Information Statement About Water Main Breaks, April 14, 2005.
72. Sam Schwartz, "The Age of New York City Infrastructure." Cooper Union: 1991.
73. The Urban Utility Center, Polytechnic University, Construction Interference Cost Reduction Demonstration, February 2005, <http://uuc1.poly.edu/ProfessionalTrainingProgram/Part1-Intro.pdf>, accessed February 26, 2014.
74. Interview with Timothy Burns, Director of Engineering & Program Management at the New York State Environmental Facilities Corporation
75. DEP. "Water Conservation Program," December 2006. p 26.
76. New York City Department of Environmental Protection, Water Conservation Report Annual Update, June 2012, http://www.nyc.gov/html/dep/pdf/conservation/water_conservation_report2012.pdf, accessed February 27, 2014.
77. New York City Municipal Water Finance Authority, Water and Sewer System Revenue Bonds, Fiscal 2001 Series A, http://nycbonds.org/NYW/pdf/2001/NYW_2001_A.pdf, accessed February 26, 2014.
78. New York State Department of Environmental Conservation, City's Water Conservation Program, December 2006 with Annual Updates through June 2010, http://www.dec.ny.gov/docs/permits_ej_operations_pdf/exhibit12.pdf, accessed February 27, 2014. Page 14
79. New York City Municipal Water Finance Authority, Water and Sewer System Revenue Bonds, Fiscal 2001 Series A, http://nycbonds.org/NYW/pdf/2001/NYW_2001_A.pdf, accessed February 26, 2014.
80. New York State Department of Environmental Conservation, City's Water Conservation Program, December 2006 with Annual Updates through June 2010, Page 14.
81. Mayor's Management Report
82. Riverkeeper, Combined Sewage Overflows Fact Sheet, <http://www.riverkeeper.org/campaigns/stop-polluters/sewage-contamination/cso/>, accessed February 26, 2014.
83. NYC DEP, "What is a Combined Sewer Overflow?" http://www.nyc.gov/html/dep/pdf/cso_long_term_control_plan/ltpc_disp_nyc_cso_program.pdf, accessed February 26, 2014.
84. Navarro, Mireya, "A Greener Strategy for New York's Runaway Sewage," *New York Times*, March 13, 2012.
85. New York City Department of Environmental Protection, DEP Completes Paerdegat Basin CSO Facility, May 12, 2011. http://www.nyc.gov/html/dep/html/press_releases/11-36pr.shtml
86. Compton, Nette, "Why Green Infrastructure Matters," City of New York Parks and Recreation. <http://www.trb-adc60.org/downloads/6-2%20Nette%20Compton%20Why%20Stormwater%20Infrastructure%20Matters.pdf>
87. Sledge, Matt. "Gowanus Canal To Feature 'Sponge Park' Green Infrastructure," *Huffington Post*. February 7, 2012.
88. Musumeci, Natalie. "Tank battle: City defies feds, says it won't build Gowanus sewage storage," *The Brooklyn Paper*. May 8, 2013.
89. New York State Broadband Program Office, Annual Report 2012-2013.
90. Q&A with Bruce Kushnick, from "Welcome to the New York City Hunger Games for Broadband," *Huffington Post*, January 13, 2014.
91. Messina, Judith, "How broadband service lags in NYC," *Crain's New York Business*. February 18, 2014.
92. New York State Broadband Program Office, Annual Report 2012-2013.
93. *ibid*
94. Office of the Manhattan Borough President, "New York City's Digital Deficit," August 2013,
95. Sheth, Niraj, "The Worst Cellphone Dead Zones," *Wall Street Journal*, May 28, 2010.
96. Fitchard, Kevin, "Which Borough Has the Fastest 4G in NYC? Sorry Manhattan, it's the Bronx," *Gigaom*, January 31, 2013.
97. NYC Digital, "Access," <http://www.nyc.gov/html/static/pages/roadmap/access.shtml#4>, accessed February 26, 2014.
98. Interview with Robert Richardson, former Director of Strategic Technology Development at DoITT and Senior Director of Strategy at Control Group,
99. Interview with John Kahane, Reinvent Albany
100. NYC DoITT, "Chief Information & Innovation Officer Progress Report," December 2013, http://www.nyc.gov/html/doitt/downloads/pdf/CIIO_Report_12_16_13_FINAL.pdf, accessed February 27, 2014.
101. City of New York Office of Management and Budget Asset Information Management System (AIMS) Report, Fiscal Year 2013, http://www.nyc.gov/html/omb/downloads/pdf/as05_13.pdf, accessed February 27, 2014.
102. The Trust for Public Land, "2012 City Park Facts," <http://cloud.tpl.org/pubs/ccpe-cityparkfacts-2012.pdf>, accessed February 27, 2014.

103. CUNY, Significant Statistics Fall 2013, <http://www.cuny.edu/about/administration/offices/fpcm/departments/cb/29Statistics2013.pdf>, accessed February 27, 2014.
104. NYCHA, "Five Year Capital Plan Calendar Years 2013-2017," May 22, 2013, p. 5.
105. City of New York press release, "Mayor Bloomberg Discusses the Values That Have Shaped New York City and Will Guide Its Future," December 5, 2013, <http://www1.nyc.gov/office-of-the-mayor/news/388-13/mayor-bloomberg-the-values-have-shaped-new-york-city-will-guide-its-future/#/0>, accessed February 27, 2014.
106. City of New York Office of Management and Budget, "Asset Information Management System (AIMS) Report, Fiscal Year 2013."
107. Nair, Prakash, R.A. and Nadine Chin-Santos, "A Proven Methodology for Assessing School Buildings," School Planning & Management, December 2000.
108. NYCHA Development Data Book, <https://data.cityofnewyork.us/Housing-Development/NYCHA-Development-Data-Book/evjd-dqpz>
109. NYCHA, Comprehensive Annual Financial Report for the Year Ended December 31, 2012, <http://www.nyc.gov/html/nycha/downloads/pdf/CAFR%202012.pdf>, accessed February 27, 2014.
110. NYCHA, "Five Year Capital Plan Calendar Years 2013-2017," May 22, 2013, p. 5.
111. HR&A Advisors, Inc. "Cost of Rehabilitation versus the Cost of Replacement Across NYCHA's Portfolio," August 16, 2013, p. 16.
112. NYCHA, "Five Year Capital Plan Calendar Years 2013-2017," May 22, 2013, p. 14.
113. Under HUD's Public Housing Asset Management Program, NYCHA's 300+ developments were consolidated into 185 AMPs (Asset Management Projects). In many cases, inspection scores are assigned by AMP rather than by development.
114. Samaha, Albert, "NYCHA Mold Removal Settlement Has Wide Scope Thanks to High Asthma Rate," *The Village Voice Housing Blog*, December 18, 2013.
115. Navarro, Mireya, "In Public Housing, Units Languish in Limbo," *New York Times*, December 15, 2013.
116. Barbanel, Josh, "Bond Deal Allows Housing Repairs," *Wall Street Journal*, September 19, 2013.
117. CUNY, Significant Statistics Fall 2013.
118. Pacific Partners Consulting Group, "Analyzing CUNY Facility Renewal and Backlog Needs," November 2, 2007.
119. Bronx Community College, "Five-Year Capital Plan Request FY 2010-11 through FY 2014-15," <http://www.cuny.edu/about/administration/offices/fpcm/departments/cb/cap-request-2/BronxCC.pdf>, accessed February 27, 2014.
120. CUNY, "Five-Year Capital Plan Request FY 2010-2011 through FY 2014-15 Summary," <http://www.cuny.edu/about/administration/offices/fpcm/departments/cb/10-11Summary.pdf>, accessed February 27, 2014.
121. CUNY, "Five-Year Capital Plan Request FY 2014-2015 through FY 2018-19 Summary," <http://www.cuny.edu/about/administration/offices/fpcm/departments/cb/FY14-15CapReqSummALL.pdf>, accessed February 27, 2014.
122. Queens College, "Five-Year Capital Plan Request FY 2010-11 through FY 2014-15," <http://www.cuny.edu/about/administration/offices/fpcm/departments/cb/cap-request-2/Queens.pdf>, accessed February 27, 2014.
123. College of Staten Island, "Five-Year Capital Plan Request FY 2010-11 through FY 2014-15," <http://www.cuny.edu/about/administration/offices/fpcm/departments/cb/cap-request-2/StatenIsland.pdf>, accessed February 27, 2014.
124. York College, "Five-Year Capital Plan Request FY 2013-14 through FY 2017-18," <http://www.cuny.edu/about/administration/offices/fpcm/departments/cb/cap-request-5/18York-College-ALL.pdf>, accessed February 27, 2014.
125. The Trust for Public Land, "2012 City Park Facts," <http://cloud.tpl.org/pubs/ccpe-cityparkfacts-2012.pdf>, accessed February 27, 2014.
126. Mayors Management Report
127. According to Yianna Pavlakos, the roof at the Sumner Armory Shelter is also slated for repair. This funding was absent from the AIMS report.
128. Data provided by Brooklyn Public Library
129. Department of Buildings, Buildings Information System.
130. *ibid*
131. City of New York Office of Management and Budget Asset Information Management System (AIMS) Report, Fiscal Year 2013, http://www.nyc.gov/html/omb/downloads/pdf/as05_13.pdf, accessed February 27, 2014
132. *ibid*
133. Baer, Harold with Arminda Bepko, "A Necessary and Proper Role for Federal Courts in Prison Reform: The Benjamin v. Malcolm Consent Decrees," *New York Law School Law Review*, vol. 52, 2007/08.
134. NYC Department of Correction, Statement to the New York City Council Committee on Fire and Criminal Justice Services, March 7, 2013.
135. NYC Department of Correction, NYC DOC at a Glance, 2nd Quarter Fiscal Year 2012, October-December, http://www.nyc.gov/html/doc/html/about/032812DOC_at_a_Glance_single_page.pdf, accessed February 27, 2014.
136. Letter from Chlarens Orsland, Assistant Corporation Counsel at the City of New York Law Department, to the Office of Compliance Consultants. December 19, 2012
137. Weiss, Lois, "Hunts Market talks off," *New York Post*, September 9, 2013.
138. NYC Economic Development Corporation, Hunts Point Terminal Market, NYS Council on Food Policy, June 12, 2009, http://www.nyscfp.org/docs/Hunts_Point_Terminal_Produce_Market-Madelyn_Wils.pdf, accessed February 27, 2014.
139. The \$6.3 billion figure excludes CUNY schools, which performed a separate assessment, and libraries.
140. The report excluded the recently founded Guttman Community College
141. MTA, "MTA Twenty-Year Capital Needs Assessment 2015-2034," October 2013, <http://web.mta.info/mta/news/books/docs/TYNA-Consolidated.pdf>, accessed February 27, 2014.
142. NYCHA Five Year Capital Plan Calendar Years 2013-2017, May 22, 2013, p5.

143. Navigant. "Phase II Report," September 2012. <http://12.1.49.39/corporate-information/foi/13556-WTC-5.pdf>. The report provides a 10-year unconstrained capital needs assessment. To arrive at our estimate, we divided this figure in half.
144. Sightlines. "Comparison of CUNY Renewal and Backlog," December 2012.
145. Includes only line-item state of good repair needs listed in the AIMS report, not upgrades and modernizations
146. Most DSBS buildings are leased facilities and tenants could be responsible for capital improvement.
147. Navigant. "Phase II Report," September 2012.
148. NYCHA Five Year Capital Plan Calendar Years 2013-2017, May 22, 2013.
149. *Sightlines*. "Comparison of CUNY Renewal and Backlog," December 2012.
150. Citizens Budget Commission, "The Most Important Economic and Fiscal Decisions Facing the Next Mayor, December 6, 2013, <http://www.cbcny.org/sites/default/files/CBC%20Post-Election%20Conference%20Book.pdf>, accessed February 27, 2014.
151. Permanent Citizen's Advisory Committee to the MTA, "The Road Back: A Historic Review of the MTA Capital Program," May 2012, <http://www.pcac.org/wp-content/uploads/2013/01/The-Road-Back-Final.pdf>, accessed February 27, 2014.
152. NYCHA, Comprehensive Annual Financial Report for the Year Ended December 31, 2012, <http://www.nyc.gov/html/nycha/downloads/pdf/CAFR%202012.pdf>, accessed February 27, 2014.
153. Baker, Al. "Suit Will Seek State Money Promised to Schools in 2007," *New York Times*. February 10, 2014.
154. Federal Aviation Administration, Airport Improvement Program (AIP) Grant Histories, http://www.faa.gov/airports/aip/grant_histories/, accessed February 27, 2014. Both figures are in 2013 dollars.
155. Rider Levett Bucknall, "Riders Digest USA 2013," <http://rlb.com/wp-content/uploads/2013/04/rlb-usa-riders-digest-2013.pdf>, accessed February 27, 2014.
156. Anuta, Joe. "Design-build law set to expire, worrying backers," *Crain's New York Business*. February 24, 2014.
157. The Construction Law Committee of the Association of the Bar of the City of New York "21st Century Construction 20th Century Construction Law," February, 2008.
158. Mayor's Office of Contract Services. "Agency Procurement Indicators: Fiscal Year 2013." Page 21.
159. Cohen, Hope, "Rethinking Environmental Review: A Handbook on What Can Be Done," Manhattan Institute for Policy Research, May 2007.
160. Doulis, Maria. "Planning After PLANYC: A Framework for Developing New York City's Next Ten-Year Capital Strategy," CBC. December 2013.
161. Brecher, Charles. "A Better Way to Fund the MTA," CBC. October, 2012.
162. Mann, Ted. "Higher Cost, More Delays for LIRR Station" *Wall Street Journal*. January 24, 2014.
163. Booz, Allen, Hamilton. "Evaluation of Expenditures, Revenue Sources, and Alternative Water, Wastewater, and Stormwater Rate Structures in New York City: Final Report," December 18, 2009.
164. Miller, Stephen. "Governor Cuomo Calls for Annual Transit Raids Until 2031," *Streetsblog*. January 24, 2014.
165. Office of the State Comptroller. "The Dedicated Highway and Bridge Trust Fund: A Shrinking Investment in New York's Future," February, 2014
166. Correal, Annie. "Verrazano Bridge Toll Cut Despite High-Level Protest," *New York Times*. February 26, 2014.
167. Shultz, Harold M. "Liquid Assets," Citizens Housing and Planning Council. 2008.
168. DEP. "New York City Water and Sewer System 2013."
169. Port Authority, Annual Financial Statements, 2005-2011
170. Cohen, "Rethinking Environmental Review: A Handbook on What Can Be Done"
171. City Charter, Section 192f
172. Hotz, Alexander. "Commission targets city reports for elimination," *The New York World*. May 8, 2012.
173. New York City Council, "Infrastructure Task Force Final Report," <http://www.garodnick.com/sites/default/files/Infrastructure%20Task%20Force%20Report.pdf>, page 14 accessed February 27, 2014.
174. Citizens Budget Commission, "NYC Debt Outstanding," <http://www.cbcny.org/sites/default/files/NYCDebt.html>, accessed February 27, 2014. Excludes Municipal Water Finance Authority debt. Includes GO, TSASC, TFA, and Conduit bonds.
175. Independent Budget Office, "Adjusted Service Expense of Outstanding Debt as defined the Mayor and Comptroller," <http://www.ibo.nyc.ny.us/RevenueSpending/debtser-vice.xls>, accessed February 27, 2014.
176. Total City debt includes GO, TSASC, TFA, and Conduit. CBC. "NYC Debt Outstanding."
177. Doulis. "Planning After PLANYC: A Framework for Developing New York City's Next Ten-Year Capital Strategy."
178. CBC. "NYC Debt Outstanding."
179. Brecher, Charles. "A Better Way to Fund the MTA," CBC. October, 2012.
180. The Citizens Budget Commission has suggested that the de Blasio administration should adopt a "fix-it-first" strategy and dedicate 70 percent of the next Ten-Year Capital Strategy to state of good repair work.
181. Robert Puentes, "Obama's Plan a Chance to get Strategic on Infrastructure," *The New Republic*, September 9, 2011.

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We acknowledge the helpful support we received from the members of an advisory board created for this project. Advisory board members, who provided suggestions and guidance but were not asked to endorse the final study nor are responsible for any errors or omissions contained in the final study, included:

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