



Regional Plan Association

HOWARD
& ABBY Milstein
FOUNDATION

Milstein Forums on New York's Future

Rescue and Renew: Addressing
the Metropolitan Region's
Infrastructure Crisis

February 2018

A Personal Introduction from Howard P. Milstein



Dear Colleagues,

Over the last year, Regional Plan Association (RPA), Governor Ed Rendell, former Senator Joe Lieberman, and I convened a distinguished group of business leaders to produce fresh thinking about the Region's and the Nation's infrastructure crisis. The report that follows delivers exhaustive analysis and bold recommendations that can serve as a blueprint for the urgent responses that are needed *now*.

"Crisis" is an apt word. As business leaders know too well, New York's and the nation's infrastructure are largely obsolete, dating from the 1950s or before. At that time, cutting edge infrastructure made the U.S. a world leader in transportation space – and New York, a world capital. But that infrastructure is crumbling and our disinvestment in infrastructure is damaging virtually every aspect of our regional economy.

While the 20th Century is often called the American Century, it should also be considered the "New York Century" – an era when the New York metropolitan area solidified its place as a capital of international business, finance, media and the arts. Now, as our infrastructure is on the precipice of decline, private sector leadership is needed to ensure that New York remains the global hub it is today.

We firmly believe that it is the engagement of the private sector that will drive the overall success of our efforts to renew the nation's infrastructure. This is why the Howard and Abby Milstein Foundation partnered with Regional Plan Association and why I am so honored to have chaired the group whose input has been so critical to the creation of this report. Participants in the forums included top business, government and civic leaders from New York City and the metropolitan area. Policy briefs, written by RPA staff, were provided to forum participants outlining the challenges and possible solutions and then discussed in each forum.

The forums topics included 1) infrastructure governance and institutions, 2) MTA capital construction costs, 3) airports, 4) the Hudson River transit connections, and 5) what the Trump Administration means for infrastructure. We compared the New York region to London, Hong Kong, Los Angeles, and Denver. Case studies of recent infrastructure projects in our region - the Tappan Zee Bridge, Laguardia Airport, and # 7 extension - were also included.

Repairing and expanding our decaying infrastructure is not a matter of choice, but of competitive necessity. I look forward to continuing to partner with the public sector in confronting these crucial issues.

Respectfully,

A handwritten signature in black ink, appearing to be 'HP Milstein', written in a cursive style.

Howard P. Milstein

Key Findings

Our infrastructure crisis is real.

The Milstein Forums on Infrastructure were established by the Regional Plan Association (RPA) and the Howard and Abby Milstein Foundation to explore the challenges facing our regional transportation network, with the imperative of maintaining New York as a global city, important not only to its inhabitants and neighbors, and connected to the world as a whole. Infrastructure investment is vital to this success.

We must act now. Our entire metropolitan economy is at risk if we fail to do a better job of maintaining, modernizing, and expanding our key regional infrastructure networks, including roads, bridges, railroads, subways, and airports.

A number of themes and key issues emerged from these forums. These include the following findings:

It's not just about roads and bridges.

Subways, buses, and airports are as important as road and bridge projects in encouraging economic growth, land development and enhancing mobility.

There are no silver bullets.

Public-private partnerships (PPPs) have helped advanced infrastructure projects in the New York metropolitan region, but have not been a replacement for government financing from the federal, state and local levels. The Federal Transit Administration's New Starts program, in particular, has been critical in financing transit projects, though the slow planning timeline for New Starts has been a consistent frustration for local agencies.

Public-private partnerships are uniquely distinct – no two are alike.

PPPs analyzed by Regional Plan Association over the course of this project were complex agreements and unique to particular locations, government leaders, and moments in time.

The market matters.

Innovative financing through land value capture is more feasible in dense areas with strong real estate markets.

No project is an island.

The most successful infrastructure projects in our region were developed as part of a broader strategy to meet long-term growth and sustainability goals, and those projects benefited from strong connections to local land use policy.

Short cuts are dead ends.

Public engagement programs that go far beyond the legal environmental review requirements have helped projects overcome obstacles and local opposition.

Leadership and institutions matter.

Strong state and city leadership and a dedicated project team are critical to advancing projects.



*Our work is dedicated to the memory of **John Zuccotti**, a Vice Chair of the Milstein Forums on New York Infrastructure until his untimely death on November 19, 2015, and a leader in New York civic, business and political arenas for more than 40 years. Through his long and distinguished career, John epitomized the ideal of the citizen-statesman, nurturing institutions, neighborhoods and his community with knowledge, wisdom and integrity.*

His dedication to our city, to our urban environment, and to civic engagement helped inspire the Milstein Forums, and his contributions to this body will be sorely missed. We will miss his expertise, his counsel and, most of all, his kindness.

Acknowledgments

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Executive Summary



New York City Streets
Source: Nancy Borowick

New York often moves to the beat of its own drummer, but when it comes to infrastructure, it shares common cause with metropolitan regions throughout the United States. Crumbling bridges, crowded airports, contaminated drinking water and dilapidated schools have become metaphors for both economic and political dysfunction. We spend far less on infrastructure than our peers: just 1.6 percent of our GDP compared to 5 to 9 percent in most other European and Asian developed countries. And transportation legislation that formerly highlighted bi-partisan compromise is now mired in political stalemate.

The results of this disinvestment, along with our failure to innovate, are palpable. Delays have grown, construction costs have skyrocketed, and our institutions have failed to modernize or learn from other world cities. It is more expensive to build new transit in New York City than anywhere else in the world, so we're not adding nearly enough new capacity. We've added 400,000 new residents and over 500,000 new jobs in 7 years, and subway ridership is up by 22% over that time period, but our system has barely changed.

Through intensive research, this report analyzes how other cities have handled infrastructure investment, where we are falling further behind, and recommends solutions that will bring New York back to its position of leadership.

Critical Recommendations

Build the new Gateway Tunnel and advance national transit priorities immediately

The New York region, and the country, will not succeed without a new passenger tunnel under the Hudson River. And it must be completed before the existing tunnels fail, which is likely to happen within the next two decades. Federal, state and local leaders need to keep their focus on this priority, and the business community must continue advocating and explaining what will happen if we lose the Northeast Corridor for an extended period of time.

Penn Station must be redesigned

Penn Station has reached its maximum practical capacity. The location, design, and connectivity of the new station must address the current and future needs of commuters into the New York Region.

Dramatically increase federal, state and local government spending on infrastructure

Our economy, national security, and future success as a region depend on our infrastructure network, a network that is currently falling apart from years of disinvestment. Even as we look to private investment in infrastructure, we still need the public sector to lead by investing in maintenance, modernization and capacity expansion. The federal government needs to lead here, and reward cities and states for providing local funds.

The business community must take a leadership role

We can't rely on politicians or the public sector to fix all our problems. London's Crossrail project was advanced in large part because of business support and willingness to contribute financially. The New York business community must step up to the plate, demonstrate leadership, and help solve this crisis.

Political leaders must unite to solve the crisis

Infrastructure projects across the country have benefited from strong leaders and political coalitions. Our elected leaders need to put aside their differences and find common ground to move forward on an ambitious program of rebuilding and modernizing. This applies equally to federal, state and local officials and legislators. Infrastructure is too important to become a political bargaining chip. The economy of New York is literally being held hostage. Every day that we fail to build the Gateway project, expand our airports or modernize our subways is another lost opportunity.

Win public support by asking voters to support a clearly defined set of projects

Too often, the public is asked to support new funding without any clear program of what it will provide. Institutions need to commit to investments – and then deliver them – to build public support for further investment and break the cycle of cynicism.

Partner more with the private sector

One Vanderbilt is an excellent example of how private companies can help advance projects and ensure they get completed on time. In other parts of the world, transit systems are operated and maintained by private corporations under strong concession agreements. This approach could provide better service and a reasonable price, if done right.

Modernize work rules

Overly restrictive work rules are not keeping pace with technology and needs of the system, and are limiting access to the workforce. New trainings programs and types of jobs are needed, to expand the roles of employees in customer service and construction.

Reform our key institutions

Outdated governance models at the MTA and Port Authority have put the agencies deeper into debt and unable to plan, finance and deliver the full range of projects necessary to keep us competitive. The Port Authority has not been able to deliver meaningful reform over three years after the Bridgegate scandal came to light. New leadership at the MTA offers hope, but institutional reform needs to give these public servants the powers and resources they need to deliver.

Initiate ambitious reform at transportation agencies

Outdated work rules, overly bureaucratic procurement processes and burdensome regulatory requirements cripple our public agencies. The lessons learned from successful projects, especially the Tappan Zee Bridge construction, need to be institutionalized to allow future projects to benefit from parallel permitting and planning, expedited procurement, and Public-Private Partnerships.

Integrate land use planning and transportation

Transportation projects should be part of an integrated planning system that encourages growth and density near stations, including new employment opportunities, housing and public ameni-

ties. Communities that are unwilling to grow should not expect to get limited public funds for capacity expansion.

Consider targeted subway and station shutdowns so work is completed faster and cheaper

Other transit systems benefit from having longer periods of time when maintenance can occur. The only way New York's subway system can be restored to a state of good repair in a reasonable amount of time is if portions of the system are shut down to allow aggressive repair and maintenance schedules, as has been done at Penn Station and will be done to the L line.

Drive innovation through value recapture, but understand its limitations

Beneficiaries of infrastructure investments can help pay for the costs of the projects, but there are limitations to this model. Land value capture successfully helped advance the #7 subway extension to the Hudson Yards, but few transit extensions have the opportunity to generate that much new development.

Plan for sea level rise now

Especially vulnerable areas with substantial infrastructure include those in the Secaucus and the Meadowlands, especially Teterboro and LaGuardia Airport. This includes phasing out Teterboro Airport by 2050 by building a new business jetport or one or several smaller close-in general aviation airports, and accommodating the growth in travel at JFK and Newark, perhaps with the addition of new runways. We need bigger airports to grow and accommodate future travel, but we need to plan in a way that takes our future coastline into account.

Utilize the certificate of occupancy to ensure that developers deliver the agreed upon improvements

The occupancy of the "bonused" space has been directly tied to the delivery of the transit improvements. This ensures that the developer will be highly motivated to complete the improvements in a timely manner. The One Vanderbilt public-private partnership is anticipated to deliver cost savings through greater efficiencies. It is a model that should be evaluated for future new developments throughout the region, no matter the scale.

Complete projects in longer but fewer phases to eliminate the drivers of construction cost

Breaking tasks into multiple phases typically increased costs for construction and soft costs. Completing projects in fewer phases increases efficiency and reduces capital costs.

The Trump Administration Infrastructure Proposal

Port Newark

Source: Maureen (flickr)



The Trump administration is proposing a \$1 trillion investment over ten-years to rebuild the nation's infrastructure. The plan will encompass all areas of infrastructure, but appears to include a substantial transportation component. Though details have yet to be released, the President has stated publicly that transportation investments would be multi-modal, including airports, ports, highways, bridges and rail.

Without increased investment, any federal infrastructure plan is stuck

One of President Trump's top priorities is to rebuild America's aging infrastructure. With thousands of miles of roads and bridges, the largest subway network in the world, three commuter railroads, three major airports, and a sprawling drinking water system, the New York metropolitan region knows about infrastructure. Ours is old, vast, and supports a \$1.8 trillion economy and serves 23 million people. Yet, it is starting to fail at an alarming rate.

As President Trump starts to roll out the details of a plan, his home region can provide crucial lessons about what works and what doesn't.

Lessons

Lesson One: We know that functioning infrastructure is vital to economic growth. New York City alone has added 800,000 jobs since 2003, a 22% increase. This growth was planned. We invested in new transit connections, decked over rail yards, improved public spaces and created magnets for job growth and economic activity. It worked for us. It will work for the country.

Lesson Two: We know about the consequences of not maintaining and modernizing our systems and the authorities that run them. We are paying the price now – overcrowded subways, delayed flights, crumbling bridges, and overpriced projects. Delays on subways have tripled in the past five years. The East Side Access commuter rail connection from Long Island into Grand Central is 14 years behind schedule and 130% over budget. Riders on NJTransit and Long Island Rail Road faced eight weeks of suspended rail service to fix long-needed tracks repairs that have crippled our nation's busiest rail hub, Penn Station.

Lesson Three: We know that everyone should help pay for infrastructure projects, but the government must take the lead. Drivers pay through gas taxes and bridge tolls, riders through subway and bus fares, water users through fees. A portion of sales, business, and real estate taxes are levied to pay for the transportation network in New York City, with the belief that everyone who benefits should contribute. Federal and state governments cover the rest, because infrastructure is a public good that is good for the public. The Federal Transit Administration’s New Starts program, a program President Trump has proposed to eliminate, has been especially critical in financing many transit projects here. If we want to reinvest in infrastructure, New Starts should be expanded, not cut.

Lesson Four: We’ve learned that public-private partnerships are valuable, and can help deliver projects on time and budget, but they don’t replace public dollars and revenue streams. Take for example, the \$2 billion Hudson Bergen Light Rail. A private partner, 21st Century Rail Corporation, designed, operated, built and manages the project through a public-private partnership. The financing came largely from federal grants and state transportation dollars. The Goethals Bridge reconstruction partnered with another private entity, NYNJ Link Developer, to help design, build, finance and maintain the \$1.5 billion project. That money will be repaid, by you and me, through tolls over the life of the project. And the \$4 billion rebuilding of LaGuardia Central Terminal B by LaGuardia Gateway Partners, one of the largest public-private partnership in the nation’s history, is being funded by a combination of public and private dollars, including approximately \$1 billion collected by the Passenger Facility Charge levied on travelers.

Lesson Five: The federal government has an important role to play in rolling back outdated restrictions as a condition of federal funding. For instance, many successful projects have relied on “design-build,” a streamlined procurement process that puts the onus on bidders to deliver the project they design. Design-build has proven itself on projects from the Tappan Zee to Kosciuszko bridges, but it is allowed on only certain projects in New York State and none in New York City. If the federal government provides funding to support these projects, it can require cities and states to allow design-build and other innovative approaches.

Gateway Depends on Federal Investment

Nowhere is the importance for strong federal leadership more evident than in plans for Gateway, a new railroad running from Newark, NJ to Midtown Manhattan, including new tunnels under the Hudson River. It will double capacity and allow us to fix our failing hundred-year-old system. Costing more than \$20 billion, it is the most expensive and most important investment in the nation; the lynchpin for the entire northeast economy. Without Gateway, the existing tunnels will fail and the northeast region’s economy will be severed in the middle. The damage would be incalculable. Expediting the permitting and reviews, providing flexibility and private sector participation will help. But without the promised 50% federal share of funding, it is impossible to see how this project moves forward.

Figure 1: Prioritized Infrastructure Projects in Our Region

Project	Sector	State	Revenue Stream	Funding Request	Jobs-Direct
Second Avenue Subway - Phases 2 & 3	Mass Transit	NY	Yes (Partial)	14,200	16,000
Champlain Hudson Power Express	Electricity and Transmission	NY	Yes	2,200	1,000
The Peace Bridge	Highways and Bridges	NY	No	700	700
Gateway Program	Mass Transit/Rail	NY, NJ	No	12,000	15,000
Port Newark Container Terminal Improvements	Ports	NJ	Yes	500	500
NextGen Air Traffic Control System	National Initiative	National	No	10,000	2,300
Energy Storage and Grid Modernization	Electricity and Transmission	National	Yes	TBD	TBD

Source: Various Media, Trump Transition Team Document

Building New York's Infrastructure: Institutions and Funding



**New Tappan Zee
Bridge Rendering**
Tappan Zee Constructors

Introduction: Institutional Challenges

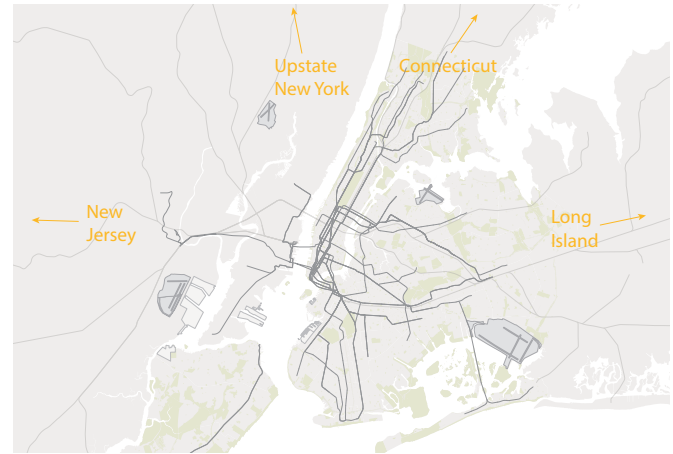
The challenges facing infrastructure in the New York region mirror those of other parts of the U.S., but with some important differences. The scale is larger, the costs are greater and its institutions are more fragmented. For transportation alone, ten agencies across three states manage a vast portfolio of rail, roadways, air and water facilities, often with overlapping service areas and jurisdictions. This has impaired efficient project prioritization and delivery, increased the vulnerability to political disputes, and exacerbated chronic underfunding by weakening public confidence. The results are a system with multiple challenges:

- ▶ Agencies are both going deeper into debt and failing to keep up with growing capital needs. The Metropolitan Transportation Authority (MTA) alone faces a \$49 billion backlog and New Jersey's transportation trust fund barely has sufficient funds to cover debt service.
- ▶ Construction costs are far higher than in many other comparable regions across the nation and around the world, and projects can take far longer to complete.
- ▶ The region's highest priority project—a new passenger rail tunnel under the Hudson River—has been studied for decades but stymied by both a lack of clear institutional responsibility and competing political priorities.
- ▶ The tenure for chief executives at the MTA and the Port Authority of New York and New Jersey (PA) is far shorter than in previous eras—the PA had five different executive directors between 2000 and 2010—leading to a lack of continuity and follow-through for agency priorities.

In spite of New York's unique challenges, there is much that it can learn, both from other regions and from recent innovations that have been implemented within the region. Four case studies in this brief show how other cities around the globe are making critical investments in their long-term economic viability through project innovation and institutional reform. All of these places provide lessons that could be adopted in the New York region.

- ▶ **London** has brought its Underground system to a state of good repair, implemented congestion pricing and is now embarked on major capacity expansions through its Crossrail and Overground projects. This transformation was only possible through institutional and financial reforms that included vertical integration of all modes under Transport for London and a new special purpose authority with the sole responsibility of delivering Crossrail.

New York Transportation System



- ▶ **Hong Kong** has integrated transportation, development and financing through a privatized corporation, Mass Transit Railway (MTR). The system's rapid expansion has been financed by large scale joint development projects around planned stations.
- ▶ **Los Angeles** has leveraged low interest federal financing with a half cent sales tax to finance an ambitious modernization and expansion of its transit network. This has been enabled by multi-modal funding and resulted in 16 completed joint development projects.
- ▶ **Denver's** aggressive use of joint development projects and public-private partnerships have helped stretch public funding and expedite project delivery. Leadership from then Mayor John Hickenlooper was critical in developing the political consensus to move forward.

Within the New York region, three success stories stand out as models of innovation that have been able to cut through the numerous challenges to funding and project delivery. Each has a unique story, but they combine strong political leadership, an active role by the private sector, and the use of innovative planning, financing and product delivery.

The New Tappan Zee Bridge has opened on time and on budget after decades of debate and delay. Through a number of innovations, a project that would have been decades in the future will now be built at a far lower cost. The most important innovations included both financing and project delivery:

- ▶ Expedited permitting was able to take advantage of accelerated federal review for critical projects, but also included dedicated staff with rigorous milestones for completion and high level agency coordination.
- ▶ Combined design/build project delivery allowed for innovative engineering and construction methods, speeding delivery and reducing costs.
- ▶ Innovative design and construction methods included new dredging and pile driving techniques.
- ▶ Use of a \$1.6 billion federal TIFIA loan, the largest ever by U.S. DOT, was able to significantly reduce project costs.

The #7 Subway Extension is the first major expansion of Manhattan’s subway system in over 30 years, and the first to be entirely funded by the City of New York since the 1930s. The project was possible only through a number of new approaches:

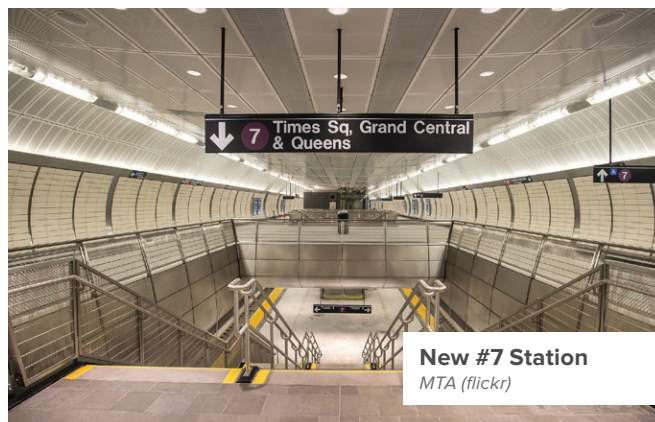
- ▶ The city’s reliance on only local funding eliminated many complexities that are found in state/federal funded projects – saving time and likely money.
- ▶ Value capture was used to fund the entire project, leveraging the enormous value of the Hudson Yards.
- ▶ The partnership between the City of New York, the MTA and private developers resulted in far better coordination between land use, economic and transportation objectives than is typical in major infrastructure projects.

The New LaGuardia Central Terminal Building is a \$3.6 billion project being delivered by a public-private partnership with the Port Authority of New York & New Jersey. Unlike the other projects, this is just beginning, but provides a number of lessons for evaluation:

- ▶ A full Design Build Finance Operate and Maintain (DBEOM) agreement provides an approach unprecedented in this region for achieving cost efficiencies and time savings.
- ▶ Flexibility in design and construction will allow greater integration with internal and external roadways and improved service.
- ▶ An infusion of private capital will fund two-thirds of the project.
- ▶ Management of half the airport by a private entity, standard practice in many places around the globe, could provide a model for expanded use.



The New Tappan Zee Bridge Under Construction
Cyclists International



New #7 Station
MTA (flickr)



LaGuardia Airport
PANYNJ

The Twin Challenges of Timely Project Delivery and Funding

The New York metropolitan region’s extensive transportation network is administrated by an extremely complex and fragmented governance system. A combination of ten different agencies with overlapping jurisdictions manages a multi-modal transportation system that consists of commuter trains, subways, light rail, airports, roadways and waterways. In addition to varying modes and jurisdictions, the agencies also rely on a diverse mix of funding sources and financing mechanisms to support their operating and capital budgets.

The region’s institutions face two related challenges, delivering major projects and improvements on time and on budget and identifying the funding to do so. The agency profiles (see page 21) highlighted the multitude of funding sources that our institutions rely on – many imperfect, cobbled together as part of compromises. Illustrative of this was the recent struggle to fund the MTA’s 2015-2019 Capital Plan. It took over a year to settle on a mix of funding, with both the City and State fighting over how much each would contribute. This delayed work and procurements by almost 12 months, pushing out projects and ultimately increasing their costs.

The region also suffers from a chronic disinvestment in its infrastructure. The MTA alone has \$48.8 billion state of good repair backlog and 46 percent of bridges and roads in the region are structurally deficient or functionally obsolete. The perennial funding shortfall is part of a national crisis. The American Society of Civil Engineers grades the nation’s infrastructure a “D,” estimating that the United States needs to invest \$3.6 trillion by 2020.¹ Yet, the US spends just 1.6 percent of its GDP on transportation infrastructure compared to between 5-9 percent by most other developed nations in Europe and Asia.

Table 1: Debt Service by Agency

	Debt Outstanding (\$ billions)	Debt Service Payment (\$ millions)	Debt Service (percent)
MTA	30.8	2,500	17
PANYNJ	19.5	1,400	27
NJ TTF	14.9	1,080	96
NY DHBTf	3.2	242	17
CT STF	3.8	465	35

Note: New Jersey Transportation Trust Fund (NJ TTF); New York Dedicated Highway and Bridge Trust Fund (NY DHBTf); Connecticut Special Transportation Fund (CT STF)

As a result of the funding gap, transportation agencies have an overreliance on debt. Issuing public debt can be the best course of action when making generational investments, such as

purchasing rolling stock that lasts 40-50 years or building a new transit facility that will last hundreds of years. It’s fair that future generations carry the burden of these investments as they will benefit from them as well. However, debt should not be used to cover operating expenses (salaries) or capital investments that are short-term, ten years or less.

Unfortunately, there are many instances in the region when this has occurred – the most egregious being New Jersey’s Transportation Trust Fund (TTF). TTF’s debt service is funded by the gas tax and general revenues. It has already become insolvent several times, where fund revenues are only sufficient to cover debt service let alone provide any subsidies for transit or needed road and bridge repair projects. Since 2001, the TTF’s debt outstanding has more than tripled. It has been used to cover New Jersey Transit’s expenses, both operating and capital, meaning the tax payer will be responsible for paying someone’s salary, several times over, for decades to come. New Jersey is not the only state with this problem. The region’s agencies as a whole have issued a staggering amount of debt over the past two decades, as shown in the table below. A balance between debt financing and pay-as-you-go is desperately needed.

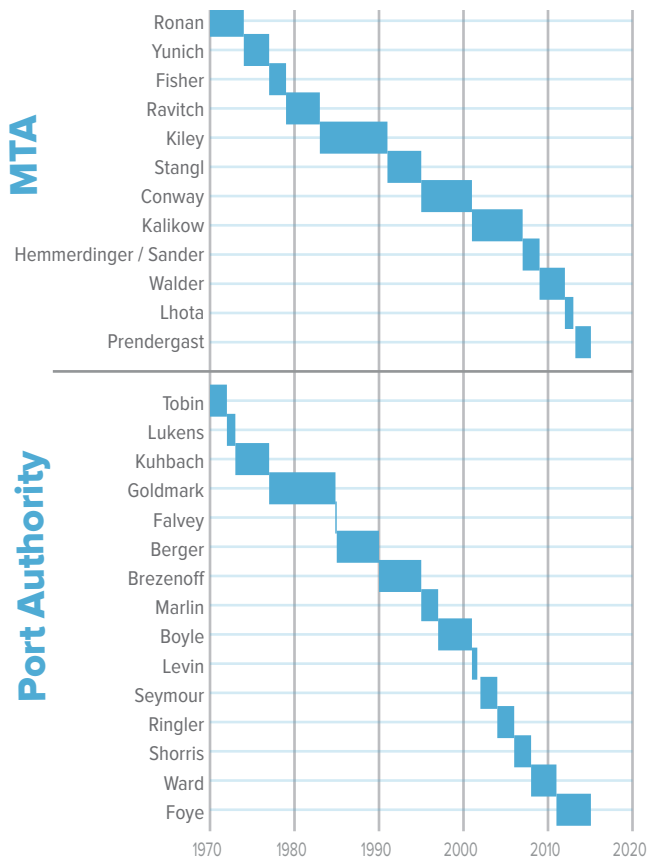
The region suffers from a disinvestment in its infrastructure.

Institutional and political barriers also impede timely, efficient project delivery and add to overall costs. Inflexible organization structures and poor coordination across different agencies make it difficult to set priorities and reach decisions, and add to the complexity of planning and construction, resulting in inflation of both project budgets and timelines. Procurement timelines and both federal and state-mandated planning and environmental reviews have greatly extended the time it takes to get projects approved and implemented. Elected officials will cancel, delay or underfund good projects, or promote poor ones, based on political, rather than transportation, priorities. Not only do we have much higher costs than our peers, but we rely on conventional forms of funding—fares, tolls, federal grants—rather than more innovative forms of financing, including value capture and public-private partnerships.

Exacerbating these problems is the high executive turnover experienced by the region’s most critical transportation authorities in recent years. As the figure below illustrates, CEO tenure at the MTA and Port Authority is in decline. From 2000 to 2010 the Port Authority had five different Executive Directors – that’s an average term of just two years – a blip when compared to Austin Tobin’s thirty-year reign. More recently, the MTA cycled through three chairmen during Governor Cuomo’s first term in

¹ American Society of Civil Engineers. 2013 Report Card for America’s Infrastructure. 2013. Web. <<http://www.infrastructurereportcard.org/>>.

Figure 1: High Executive Turnover



office, a mere four-year period. Frequent turnover at the top is extremely disruptive to an organization. Every new leader brings his own set of priorities – projects that were once considered critical are shelved and new ideas are introduced. Even if priorities align, leadership changes invariably result in delays which costs the agency time and money.

It's also impossible to ignore how high the region's capital construction costs are, much higher than in many other cities in the nation and around the globe. The reasons for this are varied and include labor costs and work rules, property costs, performance of our institutions (project management) and politics. There are many examples of each, including the following:

- ▶ The need for a new passenger rail tunnel under the Hudson River has been apparent for decades, but progress has been thwarted both by a lack of clear institutional responsibility and competing political priorities. The formation of the Gateway Corporation is an attempt to join the competing interests of four transportation agencies, two states and the federal government.
- ▶ As of December 2017, the Federal Transit Administration is not acknowledging the existence of the 2015 agreement between the US Department of Transportation and the States of New York and New Jersey. This agreement, previously supported by the Obama administration, pledged 50% of the funding for the project with NY and NJ responsible for the other half.²

- ▶ The MTA's East Side Access project was initially projected, through a politically driven estimation, to cost \$4.3 billion and be completed in 2009, instead it is now anticipated to cost \$10.8 billion and be completed in 2023, 14 years after construction commenced.³
- ▶ The work rules for the Sandhogs (Local 147), workers who man the machinery that mines new tunnels, still require 20 men for tunnel excavations, even though modern Tunnel Boring Machines (TBMs) only require a crew of five to operate.

It's impossible to ignore how high the region's capital construction costs are, much higher than in many other cities.

Projecting costs in New York requires anticipating the regulations and vagaries of the urban environment - such as hourly restrictions mandating that construction start no earlier than 7am and be finished by 7pm; relocating utilities (often more than once); and remediation of older buildings, which our agencies have not done well.

New York's costs are higher than all of the other comparatives on per track-mile basis, many in places with similar complexities and stronger unions. Despite these similarities, most cities manage to build more new rail at a relatively lower cost compared to NYC. For example, the Northern extension of the M12 Line in Paris cost 256.1 million dollars which breaks down to 68.1 million dollars per mile of track. In comparison, NYC's Second Avenue Subway extension cost 4.4 billion dollars, which equates to 1.2 billion dollars per mile of track.

Our closest peer is London, which is building Crossrail - its most expensive transit project ever. The cost per track mile for Crossrail is closer to the three New York City projects. However, it includes nine large new underground stations constructed in a very dense urban environment that are tightly integrated with existing tube and commuter stations; a much more complex and expansive project than anything New York is currently undertaking.

While the challenges of project delivery and funding that New York faces are considerable, many cities have surmounted them through rethinking their intuitions and developing new forms of funding.

² Williams, K. Jane. Letter from the Federal Transit Association to the New York State Division of the Budget. 29 Dec 2017. Web. <http://www.craigslist.com/assets/pdf/CN1137151229.PDF>

³ Donohue, Pete. "MTA walks back targets on East Side Access yet again, completion now not expected until 2023." Daily News. 27 Jan. 2014. Web. <<http://www.nydailynews.com/new-york/east-side-access-work-won-conclude-2023-article-1.1593233>>.

Lessons from Four Cities

New York tends to march to the beat of its own drum. New York is an exceptional region, but this can often lead to a false perception that we are too different to learn from others. Frequent excuses include that we are too big, our systems are too busy, and our residents don't follow rules. In truth, there is much to learn from others – many solutions do scale and there are even transportation systems that are larger and busier than New York's.

Four case studies – London, Hong Kong, Los Angeles and Denver – were chosen that illustrate the diversity of thinking and creativity occurring in cities around the globe and in the nation. The progress and innovations made in each of these cities wouldn't have been possible without strong institutions and local political support. All of these cities see these investments as critical to their long-term economic viability.

The London and Hong Kong case studies showcase two relatively young entrepreneurial transportation organizations with large infrastructure portfolios. Both have achieved success and are considered leaders in the industry. Los Angeles and Denver have more conventional public transit agencies that have done some unconventional thinking, demonstrating that creativity and ambition are alive and well in the United States.

New York is an exceptional region, but this can often lead to a false perception that we are too different to learn from others.



London Crossrail
Canary Wharf Station
Matt Brown (flickr)

London

In 1997 London's transport system was approaching collapse, after decades of mismanagement, labor strife and dis-investment. That year Tony Blair campaigned to become Prime Minister on a platform that included a proposal to create a new elected Mayor for Greater London, and to give the Mayor two principal responsibilities: transport and strategic planning.

Transforming an Institution

Ken Livingston became Greater London's Mayor in 2000, and immediately recruited Bob Kiley, then President of the New York City Partnership and former Chairman of the MTA as Chief Executive of Transport for London (TfL), the city's newly established transport agency. Kiley set out to rebuild the decaying London Underground (the Tube) and improve the performance and amenity of its privatized bus fleet by introducing quality incentive contracts.⁴ Unfortunately, he also inherited a poorly conceived privatization scheme for the Tube imposed on the city by the national government. The scheme ultimately fell apart, with the operators going bankrupt and then being absorbed into TfL (a similar story took place in New York City in the 1950s). With support from the Mayor, Kiley also instituted one of the world's first congestion pricing systems for London's gridlocked roads, and utilized most of the proceeds to finance renewal of the region's bus fleet and to subsidize a reduction in fares, making buses far cheaper than the Tube on a per trip basis. Buses operating in the congestion zone also benefited from a 15-20 percent increase in speed and today carry twice as many riders as the Tube – in 2014 annual bus ridership was 2.4 billion. The Mayor also instituted large increases in Underground fares so that they now cover all of the Tube's operating expenses. In fact TfL as a whole, including its bus fleet, has an operating recovery ratio of 80 percent and requires a subsidy of just one billion pounds annually.

Over the past ten years the Underground system has been largely brought to a state of good repair and is now in the process of being modernized. As service quality and reliability improved, the system experienced a 38 percent increase in ridership. To create new capacity in the system to accommodate the region's growth and to reduce congestion on Tube lines in central London, TfL has initiated two new transit services, Crossrail --a new east-west transit service and London Overground, a new circumferential transit service. Both have utilized innovative financing, procurement and project delivery systems to build and operate

⁴ Transport for London. "London's Bus Contracting and Tendering Process." 2015. Web. <<http://content.tfl.gov.uk/uploads/forms/lbsl-tendering-and-contracting.pdf>>.

these services under tight budget and schedule constraints, as described below.

CrossRail, Through-Running Commuter Services

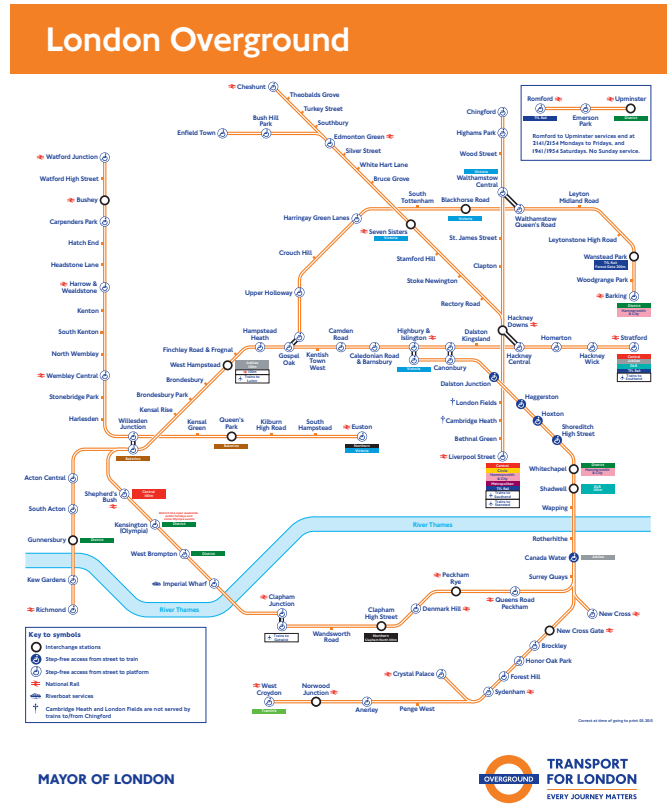
Crossrail is a new service that will run on a 78-mile, two-track transit line from Heathrow Airport to Docklands, with connections to the regional rail and national rail networks. The heart of the system is a new two-track, 12-mile tunnel running under central London. Crossrail will bridge the gap in central London – connecting the Paddington and Liverpool Street national rail stations with a new through-running service – and parallel the Central line, relieving London’s most congested Tube line. When it opens in 2018, Crossrail will add 10 percent to the total capacity of London’s transit system, and significantly cut travel times and congestion across the Greater London region. It will be operated by Hong Kong’s MTR transit company under a concession from TfL and accommodate both special purpose Crossrail trains for through running and operate in a mixed environment with traditional commuter rail trains outside of central London operated by several other private operators.

Crossrail is being built by Crossrail Ltd, a new special purpose public authority with the sole responsibility of financing, designing, procuring and delivering the project. Crossrail Ltd was initially a 50/50 joint venture company between TfL and the Department for Transport, but in 2008 it became a full owned subsidiary of TfL.⁵ Importantly, this company is exempt from the many bureaucratic procedures that occur in long established public agencies. This is a model that has been used to deliver a number of large, complex public infrastructure projects in the UK, including the HS1 and HS2 High Speed Rail projects, the 2012 Olympics and others. The Company will be dissolved following the project’s completion. Approximately a third of Crossrail’s \$22 billion budget is being provided by special tax assessments on commercial properties across the region, and “Community Infrastructure Levies” designed to capture the increase in property values in districts surrounding Crossrail stations. The other half of the budget is being provided by the UK and Greater London governments. The project is being delivered on-time and on-budget.

London Overground, Affordable Circumferential Rail

As in New York, London is seeing a growing number of “borough-to-borough” trips, which are not well served by its radial underground system. It is also experiencing regeneration of its outer boroughs, as in New York.

To serve these expanding travel markets, TfL has transformed several abandoned or underutilized Tube and surface commuter and freight lines into a new circumferential “London Overground” system. Opened in 2010, and completed in phases over the following two years, at a cost of \$2.4 billion, the Overground now carries more than half a million daily passengers, a number that is expected to exceed one million daily passengers by 2020. It is also helping transform many formerly isolated outer borough communities, leading to new housing and employment opportunities in these places.



The Overground was designed by TfL’s own staff, who delivered the project in phases without experiencing budget overruns. It is operated to very high performance standards on a concession basis by a joint venture between Hong Kong’s MTR transit company and Deutsche Bahn called LORAL.

Takeaways for New York

In less than a generation, London has made tremendous progress in modernizing and expanding its transit system. There are many lessons for the New York region that can be gleaned from London’s experience.

- ▶ **Reorganizing Institutions = Positive Outcomes.** Now only fifteen years old, Transport for London has created an entrepreneurial culture capable of designing, delivering and managing high-quality transport projects in a cost-effective way. The shakeup of the Underground’s bureaucracy as a result of privatization has also been partially credited with contributing to the success of the rejuvenation and modernization of the Tube. In addition, the vertical integration of TfL with all modes and control over the surface streets has resulted in synergies that New York City also could benefit greatly from. TfL and other UK agencies have also effectively utilized special purpose project delivery companies to deliver important projects, such as Crossrail. This model should be explored in the region for delivering future megaprojects.
- ▶ **New Typologies of Service for Conventional Network.** London’s new transit investments follow “best practices” from around the globe. Crossrail and the Overground move beyond the radial metro projects that characterized prior expansion efforts and instead introduce new typolo-

5 Crossrail Ltd. About Us. 2015. Web. <<http://www.crossrail.co.uk/about-us/>>.

gies and services to one of the world’s oldest metros. New York should do the same. Through-running at Penn Station and other terminals like Hoboken must be explored. Even more importantly, circumferential rail on the Bay Ridge line and in parts of New Jersey, in some cases using Bus Rapid Transit, is paramount if we are to serve the growing number of unconventional (non-radial) trips by transit.

► **Paying for Transit Improvement - Value Capture.**

Congestion Charging and Higher Fares: It helps, of course, for London to be the national capital, and to have a national government that is prepared to invest in its systems. But London has also played a major role in encouraging the UK Treasury to make these contributions by raising significant funding from value capture, implementing congestion charging and increasing fares. Municipalities and transit agencies in the region will need to expand local revenues as both state and national grants are in decline. Higher ridership in London also demonstrates a tolerance for riders to absorb higher fares if improvements are visible and a variety of transit options (with different fare levels, bus vs. tube) exist.

Hong Kong

Hong Kong is Asia’s global center of finance and one of its largest ports of commerce – with a population of 7.2 million and a gross domestic product of \$274 billion.⁶ Its dynamic economy depends on the Hong Kong MTR (Mass Transit Railway), an urban rail system created in 1979, to move almost 5 million daily passengers.⁷ In little more than three decades it has become one of the world’s leading transit agencies, operating 135 miles of rail with 155 stations on twelve heavy rail and ten light rail lines. Almost alone among the world’s transit operators the MTR is operated as a private company. Although it was originally established as a public authority, the agency was privatized as MTR Corporation Limited in October 2000, when it was listed on the Hong Kong Stock Exchange. (The Hong Kong government maintains the majority shareholder, however.) Importantly, MTR’s transit operations turn a profit; the company has an annual operating recovery ratio of 181 percent. By comparison, the New York’s recovery ratio is 50 percent, requiring the public to subsidize one half of every trip.⁸

Keys to Profitability

The keys to MTR’s extraordinary profitability lie in a unique feature of Hong Kong’s geography and governance system: most of the Territory’s undeveloped land is owned by the government of the Hong Kong Special Administrative Region (SAR). The territory provides for close coordination of its transit and urbanization plans. MTR’s rapid expansion has been financed largely by large-scale joint development projects around planned

stations. The SAR works with MTR to plan new and extended transit lines, and then transfers ownership of station areas to MTR along with planning permission for intensive development of these areas. MTR then executes long-term leases with private developers who build high density residential, commercial and retail development, with a portion of net rents going to MTR to cross-subsidize the capital and operating costs of the rail line serving each station.

The company and region are also conservative when planning and extending their transit system, in particular they stretch the spacing between stations to maximize the density of operations at each. By limiting the number of stations per-kilometer, MTR reduces its operating expenses - Table 2 highlights this fact, showing the average distance between stations and the station density (population/# of stations).⁹

Table 2: Hong Kong and NYC Station Metrics

	Hong Kong (heavy rail)	Hong Kong (heavy & light rail)	New York City (heavy rail)
Average distance between stations (miles)	1.3	0.86	0.53
Station density (population per # of stations)	85,949	47,498	16,733

While the greater distance between stations means that riders are forced to walk a longer distance, it increases system performance (faster travel times) and reduces the number of facilities that need to be maintained – lowering expenses. Fewer stations mean more riders per station and a greater density of use, again ensuring that all stations are fully utilized and not idle. This approach, while not as sensitive to all public policy consider-

⁹ This is a crude measure since it does not consider the population’s actual density around stations and walk-shed, a more accurate measure would require a geospatial analysis.



⁶ The World Bank. Data: GDP per capita. 2015. Web. <<http://data.worldbank.org/indicator/NY.GDP.PCAP.CD>>.

⁷ "The world’s top 10 busiest metros." 13 Nov. 2014. Web. <<http://www.railway-technology.com/features/featurethe-worlds-top-10-busiest-metros-4433827/>>.

⁸ Regional Plan Association. "Transit Leadership Summit: 2012-2014." 2015. Web. <<http://transitleadership.org/docs/Transit-Leadership-Summit-2012-2014.pdf>>.

ations, is more cost effective and partially explains why the MTR is able to make a profit.

A World Class Airport Connected by High-Speed Transit

Hong Kong's International airport leads the world in size and amenities. It was constructed for \$20 billion on a 3,083 acre artificial island called Chek Lap Kok. A central component of the project was a multi-modal bridge to link the airport to the mainland, providing air travelers with a quick transit service, operated by MTR, to the city center in 24 minutes. The premium nature of this service allows MTR to charge more – the average fare revenue per passenger is three-times higher than a standard transit user.¹⁰

Innovative and Modern Fare Payment

The entire MTR system uses the contactless "Octopus" rechargeable card, which is now the most common source of electronic commerce in Hong Kong. It can be used in retail and other commercial establishments throughout the city, generating significant revenues for MTR. Another innovative use of the technology has been the "Octopus Access Control System" which allows the fare card to be used in many unconventional ways, such as to access buildings and elevators, for employee time keeping and parking management, among others.

Expanding to Other Markets

MTR offers consulting services and has successfully bid for operating concessions in other countries, operating the Stockholm transit system, the London Overground system and other major transit properties in Europe and Asia.

Takeaways for New York

Several features of MTR's operations and finances could provide replicable lessons for New York, including the following:

- ▶ **Coordination of Land Use and Transportation.** New York should more closely coordinate major urban development projects with improvements in transit services. The MTA and other transit providers can more effectively plan additional transit services to meet greater need in growth areas of the region. The City of New York and other municipalities could work with the MTA and other agencies to create "value capture" systems around station areas, which could cover a significant share of capital and operating costs for current and expanded transit services.
- ▶ **Higher Density of Transit Service.** New York has a large number of stations, far more than Hong Kong. This makes its operations far more inefficient and expensive than Hong Kong's. To reduce costs and increase efficiencies, New York should explore opportunities to further consolidate some of its stations and increase the density of its operations.



Hong Kong Octopus Card
(contactless fare card)
Alexander Synaptic (flickr)

- ▶ **Joint Development.** The New York region's transit system is mature, limiting opportunities for joint development of station areas. And the agency owns very limited land areas around its stations. Nonetheless, the agencies should be more entrepreneurial about air rights and other development around its commuter rail and subway stations. Recent development projects at Hudson and Atlantic Yards and Vanderbilt Avenue suggest that it may be possible to increase private contributions to future capital projects.
- ▶ **Higher Farebox Recovery Ratio.** As noted above, the New York region has more limited opportunities for value capture and joint development projects than does Hong Kong. But it should evaluate instituting more sophisticated fare structure and policies, which might include raising its farebox recovery ratio to cover a larger share of its operating expenses.
- ▶ **Contactless Smart Fare Card and Mobile Payments.** The New York region is lagging behind Hong Kong and most of its peers in other world cities in adopting contactless fare media and other new fare media. MTR has demonstrated that these systems can expand the convenience and utility of transit, foster fare integration, reduce the cost of fare collection, and potentially add a major new source of revenue if a rechargeable card or mobile app can become widely adopted for retail and other transactions in the region. MTA recently announced they would be adopting this new technology, though it will be phased in over five years.
- ▶ **Privatization and International Opportunities.** Could our transit agencies be privatized? Nearly all of the New York region's component agencies began as private companies. Returning the entire system to a profit-making company is improbable and would sacrifice control over infrastructure that is critical to public well-being. However, it may be desirable to spin off operations that can be run more efficiently with private owners while developing strong contractual arrangements that protect public interests. As such, the private company could also compete globally to

¹⁰ Mass Transit Railway. Annual Report 2014: Key Figures. 2014. Web. <<http://www.mtr.com.hk/en/corporate/images/investor/2014frpt/E109.pdf>>.

operate transit systems and provide expertise through consultancy services.

Los Angeles

Los Angeles has typically been thought of as a sprawling, car-centric metropolis. However, over the past two decades the city has placed a strong emphasis on comprehensive transportation planning, investing in transit and embracing greater densities. LA Metro, originally just a bus-operating agency, now plans, constructs and operates a complex network of metro, light rail, commuter rail, Bus Rapid Transit, express buses, high occupancy lanes and local buses. This new structure is indicative of Los Angeles' integrated, multi-pronged approach to transportation planning, funding and operation.

Building Support for Local Revenues and Federal Financing

In July 2009, Los Angeles County instituted a half-cent sales tax – Measure R – dedicated to transportation. The funds generated by Measure R have successfully financed a variety of new transportation projects and programs and accelerated those already in the project pipeline. The tax is expected to generate \$40 billion in new local sales tax revenues over 30 years, at a cost of only \$25 annually for each LA County resident. These revenues will be put towards a combination of transit capital investments including BRT, metro and commuter rail (40 percent), highway capital investments (20 percent), rail operations (5 percent), bus operations (20 percent) and local projects such as street resurfacing and pedestrian and bikeway improvements (15 percent).¹¹

Measure R is a key example of how Los Angeles County has undertaken a number of innovative approaches to funding and financing. Specifically, LA Metro has leveraged the local funds generated by this tax with low-interest TIFIA federal financing.¹² Measure R combined with other state and local sources, such as other dedicated tax revenues, fares and land leases around train stations, have successfully provided 75 percent of the funding of LA Metro's recent expansion projects. The remainder of the budget is funded by federal and state grants.

Ambitious Expansion Plans

The majority of LA Metro's focus has been on expanding its 110-km light rail network. In 2011, the agency adopted an ambitious plan called America Fast Forward to build 30 years' worth of transit expansion projects over the next ten years, including extensions to the Purple, Expo, Orange and Gold lines and construction of the Crenshaw line and Regional Connector – a tunnel running through Downtown LA with three new stations that will allow the agency to through-run many of the existing light rail lines that terminate at Union Station or in Downtown LA. To reap the economic benefits of those investments on an accelerated timeline, LA Metro's annual budget, \$4.5 billion in

¹¹ LA Metro. Proposed One-Half Cent Sales Tax for Transportation: Outline of Expenditure Categories. 2010. Web. <http://media.metro.net/measure_R/documents/expenditure_plan.pdf>.

¹² U.S. Department of Transportation Federal Highway Administration. Fact Sheets on Highway Provisions. 2015. Web. <<https://www.fhwa.dot.gov/safeteal/factsheets/tifia.htm>>.



Del Mar Station Transit Village is a successful example of joint development. The mixed-use development oriented around a station on the Metro Rail Gold Line in Pasadena, California consists of 347 apartments, of which 15 percent are affordable, and about 20,000 square feet of retail space. The project cost \$77 million.

FY2012, increased 27 percent just in one year - exceptional today in the U.S.

Land Use and Transportation, World Class Urban Design

LA Metro has also partnered with developers to encourage greater density and higher quality urban design around stations and transit corridors. The program also aims to reduce auto use, introduce mixed-use, improve design, create a strong connection to the nearby neighborhood, increase affordable housing options and enhance the pedestrian and transit user experience. The revenues and sales proceeds from these projects are reinvested in eligible transportation projects throughout LA County. Since 2007, sixteen joint development sites have been completed, two are under construction and seven are under negotiations.¹³

Takeaways for New York

Los Angeles is in the process of transforming itself from a transit poor, sprawling city to an interconnected series of walkable communities with greater density and high quality urban design. New York can learn much from the City of Angels. Major takeaways include:

- ▶ **Integrated, Multi-Modal Funding Approach.** Measure R demonstrates that a comprehensive, multi-modal funding package is possible. Transportation agencies in the New York region should consider remodeling their funding/financing packages to address multi-modal needs.
- ▶ **Leverage Local Funds with Federal Financing.** The New York region's transportation agencies should look to more aggressive funding and financing options similar to Measure R. The MTA currently underwrites some capital investment with a small, dedicated sales tax surcharge of

¹³ LA Metro. Joint Development Program. 2015. Web. <http://media.metro.net/projects_studies/joint_development/images/joint_dev_project_fact_sheet_rev.pdf>.

just 0.375 percent within the MTA region. This surcharge generated \$823.2 million in revenue for the MTA in 2012. As demonstrated by Los Angeles, even a small increase in this surcharge and/or other sales tax measures could yield a significant amount of funds to support the region's transportation infrastructure.

- ▶ **Joint Development.** The New York region could benefit greatly from practicing LA's joint development strategies. The program could help to effectively increase density, transit use and the mix of uses, as well as enhance the pedestrian experience in lower density communities across the region.

Denver

The Denver metropolitan region faced substantial economic and population growth beginning in the late 1990s. To alleviate future congestion on an already overburdened transportation system, the Denver Regional Transit District (RTD) created a proactive plan for building a high quality regional transit network. FasTracks is RTD's accelerated construction program for its regional transit and Bus Rapid Transit (BRT) network. Upon its completion, this system will include six new commuter and light rail lines totaling 122 miles in length.¹⁴ Initiated in 2004 with the adoption of a 0.4 percent regional sales tax, the project has moved quickly to develop an extensive transit network for nearly 3 million residents, many of whom had no rapid transit access on nine of the region's major corridors prior to FasTracks.¹⁵ The project has underpinned a region-wide transit oriented development strategy focusing on the system's 57 new

transit stations.¹⁶ Notable among these is the system's hub, the renovated Denver Union Station, which was reopened in 2014 with 15 acres of public spaces and plazas, and has attracted more than 3,000 residential units and 1.5 million square feet of new commercial space around the station.¹⁷

Regional Political Leadership

The project was initiated under the leadership of Denver Mayor (and now Colorado Governor) John Hickenlooper following the earlier rejection by voters of a transit bond issue.¹⁸ To build public and political support for FasTracks, Hickenlooper reached out to 34 suburban mayors to gain their endorsement for the project.¹⁹ All of these mayors --most of them Republicans-- supported the 2004 ballot question that approved the project's proposed scope and financing, with the bipartisan Metro Mayors Caucus continuing to support FasTracks.²⁰

Innovative Financing Strategies and Public Private Partnerships (PPPs)

RTD has made extensive use of new financing and public-private partnerships to stretch locally generated tax funding for the whole program. Notably this has included joint development at Denver Union Station and public-private partnerships.²¹ The "Eagle" P3, for example, is designing, building and operat-

¹⁴ Denver Regional Transit District. "FasTracks Fact Sheet." 2015. Web. <http://www.rtd-fastracks.com/media/uploads/main/FT_Gen_Fact_Sheet_rev_Jun_15.pdf>.

¹⁵ Denver Regional Transit District. "Fastracks Plan." 2015. Web. <http://www.rtd-fastracks.com/media/uploads/main/FasTracks_Plan.pdf>.

¹⁶ Denver Regional Transit District. "FasTracks Fact Sheet." 2015. Web. <http://www.rtd-fastracks.com/media/uploads/main/FT_Gen_Fact_Sheet_rev_Jun_15.pdf>.

¹⁷ Union Station Neighborhood Company. "Denver's Newest Urban Center: Union Station Neighborhood." 2015. Web. <<http://unionstationdenver.com/>>.

¹⁸ Werbel, R. and Haas, P. Local Transportation Funding Initiatives with a Substantial Transit Component: Case Studies of Ballot Measures in Eleven Communities. San Jose State University: Minetta Transportation Institute. 2001. Web. <<http://transweb.sjsu.edu/MTIportal/research/publications/documents/01-17.pdf>>.

¹⁹ TransitCenter. "A People's History of Recent Urban Transportation Innovation: Denver." 2015. Web. <<http://transitcenter.org/peoples-history/denver/>>.

²⁰ Colorado Metro Mayors Caucus. Issues: Transportation. 2015. Web. <<http://www.metro-mayors.org/index.aspx?nid=96>>.

²¹ Jaffe, M. "Denver's Renovated Union Station has been a 30-year Barn-raising." Denver Post. 13 Jul. 2014. Web. <http://www.denverpost.com/business/ci_26139214/denvers-renovated-union-station-has-been-30-year>.

Denver Union Station

Ryan Dravitz (flickr)



ing two new regional rail lines, including the 23-mile route between Denver International Airport (DIA) and Downtown Denver.²² The A Line will provide frequent and rapid transit service to DIA, which is one of the nation's busiest airports and a hub of operations for both Southwest and United Airlines. Additionally, the new commuter rail route has bolstered the urban development of the 4,700 acre vacated Stapleton airport, adding 12,000 residential units and 14 million square feet of new commercial space to the region.²³ Despite these financing innovations, however, the FasTracks program has experienced cost overruns that will result in the system's completion being extended to 2042, a number of years beyond its original scheduled completion date.²⁴

Takeaways for New York

Several features of Denver's FasTracks system could be adopted in New York. These include:

- ▶ **Political Leadership.** Denver Mayor John Hickenlooper's political leadership was critical to the project's approval. An active partnership between the Mayor of New York City and suburban mayors and county executives could help build broader public and political support for transit investments.
- ▶ **Joint Development and P3s.** Adoption in New York of Denver's aggressive use of joint development projects at station areas and of public-private partnerships could help stretch the transit agency's capital dollars and expedite project delivery for the agency's projects. The recent developer agreement for 1 Vanderbilt Avenue, in which the developer

is providing \$220 million in transit investments at Grand Central Terminal²⁵ should become the norm and not the exception for major station-area development projects. New York should also consider using P3 techniques for major new projects, such as the design/build/operate approach used on Denver's Eagle Project.

- ▶ **Station Modernization and Expansion.** Modernization and expansion of Denver's Union Station has made it once again the focal point for both the regional transit system and for urban economic development. A similar modernization and expansion at Pennsylvania Station or other transportation facilities could achieve similar results in New York.

None of these projects are perfect, but there is much to learn from each. All have taken big steps and demonstrate that it's possible to overcome many of the barriers of funding, leadership and siloed thinking that has permeated many of our past efforts.

²² RTD. Eagle P3 Project. 2015. Web. <http://www.rtd-fastracks.com/ep3_2>.

²³ Denver Urban Renewal Authority. Stapleton. 2015. Web. <<http://www.renewdenver.org/redevelopment/dura-redevelopment-projects/denver-county/stapleton.html>>.

²⁴ Leib, J. "RTD Decides Not to Seek FasTracks Tax Hike This Year." The Denver Post. 14 April 2010. Web. <http://www.denverpost.com/search/cj_14879221>.

²⁵ Schram, L. "Councilman Garodnick is Making Midtown East Rezoning Hinge on Transit Upgrades." Commercial Observer. 12 Aug. 2015. Web. <<https://commercialobserver.com/2015/08/councilman-dan-garodnick-is-making-the-midtown-east-rezoning-hinge-on-transit-upgrades/>>.



Success Stories in the Region

New Tappan Zee Bridge: The Value of Design Build

Like all places, New York also has its share of accomplishments. The new Tappan Zee Bridge, the #7 line subway extension and the replacement of LaGuardia Airport's central terminal building will renew and extend infrastructure in the region. Two of the projects – Tappan Zee Bridge and LaGuardia Central Terminal Building – are state of good repair investments that took decades to get underway, leaving the region saddled with substandard infrastructure. The third - #7 line extension - is a throwback to an earlier era (1930's) when the city funded the construction of the subway and the Mayor was the project champion.

The New York State Thruway Authority is building a new Tappan Zee Bridge on a fast track permitting, procurement and construction schedule that is expected to save more than a billion dollars in project costs and reduce the time of construction by several years. After more than a quarter century of study, planning and debate, the new project is finally moving forward to replace the outdated and unsafe bridge with a modern structure. Getting the project on this accelerated schedule required a number of innovative practices, controversial decisions, flexibility from the federal government, private sector experience and savvy, and clear, focused priorities from both New York State Governor Andrew Cuomo and the Thruway Authority's then-chairman Howard Milstein. The history of the project, and the process for bringing it to a conclusion, are instructive for large infrastructure projects with competing objectives and requiring approval from multiple layers of government.

When the first of the new bridge's two new spans opened in 2017²⁶ it replaced the original Tappan Zee Bridge (TZB), which was opened in 1955 as a critical link in the New York Thruway Authority's limited access highway system. The bridge was located at the widest point in the Hudson River (more than 3 miles across) so that it would be just outside the boundary of the Port Authority's jurisdiction.²⁷

Unfortunately, in addition to making the crossing more expensive than if it had been located at a narrower point in the river, this location also caused the bridge to be built in a section of the Hudson River with perhaps the worst geology for supporting a bridge. The TZB's footings rest on hundreds of feet of silt described by one of the new bridge's engineers as having the

consistency of "tapioca." Bedrock²⁸ is located far below this silty layer, making it impossible to situate bridge supports in firm ground. This accounts for the unusual engineering and construction of the original bridge, with its low-lying western causeway leading to a steep grade to the bridge's cantilevered towers over the navigation channel, which float on concrete caissons resting on pilings sunk into the silt.

A new bridge is required for a variety of reasons:²⁹

- ▶ Overall daily traffic volumes now exceed 135,000 -- far in excess of the original bridge's capacity.
- ▶ The volumes combined with steep grades result in severe traffic congestion, even when there aren't any incidents to cause delays.
- ▶ The bridge requires tens of millions of dollars of annual maintenance just to keep it in a safe condition. Over the past decade this bill has exceeded \$500 million.³⁰
- ▶ Heavy truck traffic is damaging the bridge's light deck sections, requiring continuing additional maintenance. Trucks must slow down on the steep grades of the bridge's eastern section, slowing traffic and increasing safety concerns.
- ▶ The bridge lacks breakdown lanes (its median was converted to moveable "fourth lane" to accommodate peak direction demand), with the result that even a minor fender bender can ruin an entire rush hour commute.
- ▶ The existing bridge cannot handle transit, pedestrian or bicycle traffic.

Action Following More Than A Quarter Century of Study

The Thruway Authority, Metropolitan Transportation Authority and NY State Department of Transportation began to study alternatives for replacement of the bridge more than a quarter-century ago. Environmental impact studies were initiated in the 1990s, but these never led to decisions on how to finance and build a new bridge. Several factors contributed to the delays, including the complexity of the engineering and environmental challenges and the requirements of federal and state environmental review procedures. But two related challenges were paramount—the high cost of replacing the structure and the desire to create a transit link across the bridge serving the heavily-traveled

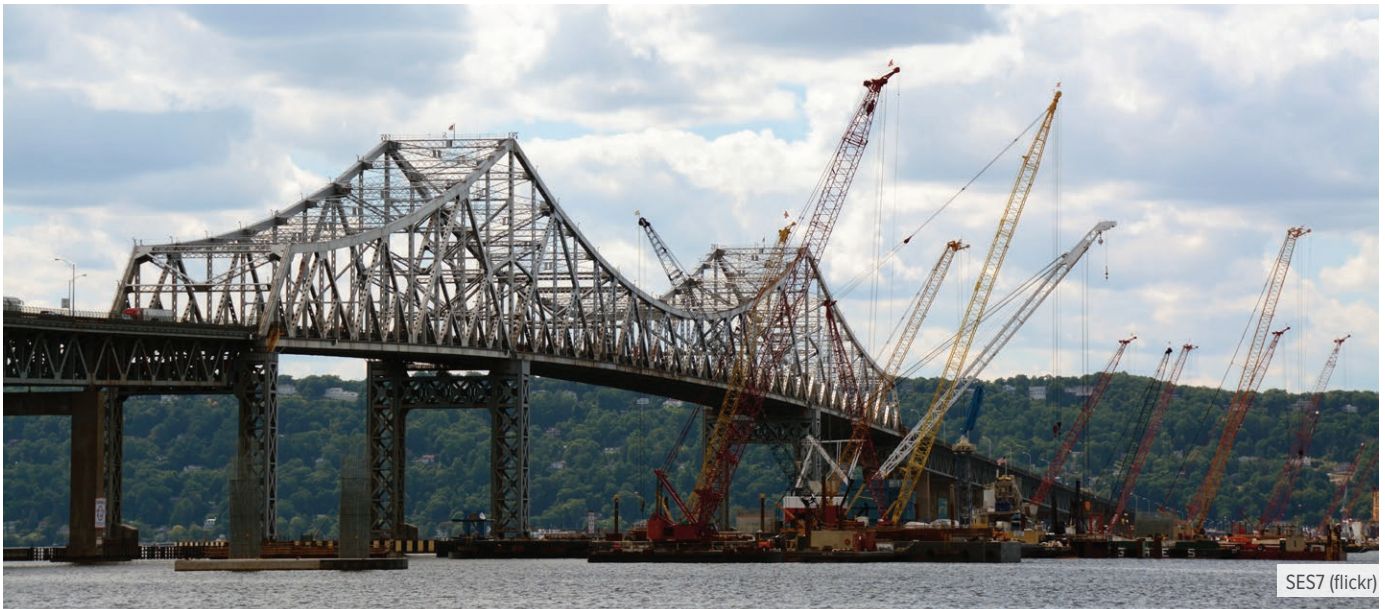
²⁸ Bedrock is located 300ft below sea level.

²⁹ The Tappan Zee Bridge Project. "About the Tappan Zee Bridge." 2015. Web. <<http://tappan-zeebridge.randcommercial.com/about-the-tappan-zee-bridge/>>.

³⁰ Fitz-Gibbon, Jorge. "Old Tappan Zee Bridge span's upkeep will cost million." The Journal News. 10 Feb. 2012. Web. <<http://archive.lohud.com/article/20120210/NEWS02/302100049/Old-Tappan-Zee-Bridge-span-s-upkeep-will-cost-millions->>.

²⁶ New York State Thruway Authority. "The New NY Bridge: About the Project." 2015. Web. <<http://www.newnybridge.com/about/index.html>>.

²⁷ This geographic area is called the "Port District" which extends 25 miles radially from the Statue of Liberty National Monument.



I-287 corridor. With very limited rail or bus service in Rockland County and other areas west of the Hudson River, and growing auto congestion in Westchester County to the east, a new bridge offered the opportunity to address one of the missing links in the region's transit network. However, transit options increased the projected costs and debate over the type of transit connection (different configurations of commuter rail or BRT led to numerous studies and a lack of political consensus. It is estimated that these studies cost taxpayers \$88 million for 430 meetings and the development of 150 concepts³¹ -- even as the bridge continued to deteriorate and maintenance costs increased.

In 2012 Governor Andrew Cuomo announced that he planned to put a new bridge on a fast track and nominated Howard P. Milstein, who was unanimously confirmed by the New York State Senate, to spearhead the project as the Thruway Authority's new Chairman. Milstein and the Governor succeeded in getting the state legislature to provide the Thruway Authority with authority to design and build the bridge as a single "design-build" project, instead of the usual time-consuming and costly process of first designing the bridge, and then building it under a separate and consecutive construction bidding process. The design-build model was introduced by Milstein based on his private sector experience, marking the first time the State ever used it in a capital construction project. They also decoupled the transit and highway projects, removing the Federal Transit Administration and the Metropolitan Transportation Authority from the project team and review process. Although the bridge was to be designed to be compatible with transit, opponents protested the delay and were skeptical that transit would be added at a later date. The involvement of the transit agencies had added to the complexity of the environmental review and decision-making, and the cost of including rail or BRT service in the project was a major impediment to constructing a bridge replacement. With the Federal Highway Administration now acting as a willing federal partner, the Thruway Authority was in a much better position to propose more aggressive strategies to advance the project.

³¹ The Tappan Zee Bridge Project. 2015.

Cost estimates for the project were reduced from a range of \$8 to \$22 billion (with transit options included and conventional permitting and procurement processes) to \$3.9 billion for the bridge only. The new bridge is designed to allow for future transit use with an extra wide inboard "emergency" shoulder on each span that could be converted to a transit right-of-way and engineering to hold the load and provide for the space for a rail crossing. To implement transit service along the corridor, the approaches would need to be rebuilt and new rail or BRT stations and infrastructure would be needed along the corridor at a cost likely to exceed the cost of the bridge itself.

Even without including transit in the initial construction, the time and cost of the bridge were also greatly reduced through the use of several innovative permitting and procurement processes. These made it possible to move from the Governor's announcement of the project to a construction start in less than one year -- a small fraction of the time required to deliver a conventional project in New York. This accelerated project also saved several hundred million dollars compared with anticipated costs when the project was initiated. These features included:

- ▶ **Expedited Permitting.** The TZB was one of the first projects to use President Obama's "Dashboard" environmental review process, which provided accelerated reviews for the project. Under this process, the entire environmental review and permitting process was placed on a critical path, with weekly and monthly milestones for completion of each element of the permitting process. This essentially prioritized the project by dedicating staff to the review process and co-locating them to streamline correspondence and promote a more collaborative team environment. A high level official at the Federal Highway Administration was placed in charge of the whole process, and staff from federal review agencies were seconded to the project. Consequently a permitting process that normally takes from two to three years (and has been known to take as many as ten years) was completed in nine months. Although this process was expedited by the fact that it was able to draw from several earlier environ-

mental studies completed over the past decade, it set a new precedent for expedited public reviews.

► **Combined Design/Build Project Delivery.** Typically the state commissions a firm to do the design/engineering for a project under its supervision and once this is completed to the state's satisfaction it then bids the designs out for builders to construct. The TZB used a more innovative approach where the design and construction were combined into one contract. While this required the agency to do a little more work upfront to "spec" the project, it gave the firms greater flexibility in design and encouraged the use of innovative construction techniques, while, at the same time ensuring greater responsibility and accountability in every step of the project. The state pre-qualified four design-build teams, including the contractors, to develop designs and construction plans for the new bridge. One of these dropped out early in the process, leaving three finalists in the competition. Also, during the ten-week period when the bids were prepared, the Thruway Authority directly engaged each team on a weekly basis, asking for their feedback on various aspects of the RFP process. A blue-ribbon panel was convened to review and select the winner among the three proposals, adding greater transparency to the process. The team selected was led by Tappan Zee Constructors, LLC, a consortium led by Fluor Corporation, an internationally recognized bridge and infrastructure company. The procurement that followed was the single largest in New York State history.

► **Innovative Design and Construction Methods.** The bridge is being built with a number of innovative design and construction features. These include a dredging process that is using a shallow draft floating crane, known as the "Left Coast Lifter," that was brought through the Panama Canal from the West Coast. The Lifter's shallow draft allowed for shallower dredging, and consequently, lowered costs and reduced impacts on the river's fisheries and benthic environment. Innovative pile driving techniques reduced noise, vibration and costs. Several additional design features were

also incorporated into the twin-spans to reduce lifecycle costs and extend the life of the bridge.

► **Creative Federal Financing.** In addition to raising tolls to cover the costs of constructing the new bridge, the State was successful in obtaining a \$1.6 billion TIFIA loan from the U.S. Department of Transportation, the largest such loan ever disbursed by the agency. TIFIA loans are low interest loans that are typically 35 years in duration with extremely generous repayment terms that defer debt payments for up to five years to allow the agency to complete construction.³² This federal financing instrument will save the project tens of millions of dollars in debt service.

Takeaways for New York

Replacing the Tappan Zee Bridge was stuck in neutral for over a decade. During this time the Turnpike Authority was making emergency repairs to an obsolete bridge that was past its prime and ill-equipped to reliably carry the traffic that it served. Governor Cuomo and Thruway Authority Chairman Howard Milstein dramatically changed the course of the project, moving it forward at a rapid pace and saving billions of public funds. While some aspects of the project remain uncertain, including the toll increases that will pay for the bridge, the \$3.9 billion TZB is expected to be fully complete in 2018, just five years after construction began.³³

Many strategies and approaches were advanced during the renewed EIS process, but there are four that stand out among the others:

1. Providing strong executive leadership from the Governor and Thruway Authority Chairman to keep all participants in the process focused on expediting the project;
2. Decoupling transit from what was essentially a highway project and participating in the "dashboard" environmental review process, putting the whole EIS process on a critical path to expedite permitting.
3. Advancing design/build which allowed for innovative engineering and construction methods, which sped up project delivery and reduced procurement costs.
4. Leveraging creative financing opportunities to lower borrowing costs.



³² U.S. Department of Transportation. TIFIA FAQs. 2015. Web. <<https://www.transportation.gov/tifia/faqs>>.

³³ The Tappan Zee Bridge Project. 2015.

Using Land Development to Build Transit: #7 Line Subway Extension

The #7 line subway extension is a \$2.1 billion, 1.5 mile extension of rail service from Times Square to a new Hudson Yards Station at 11th Avenue and 34th Street on Manhattan's Far West Side (FWS). A second station at 11th Avenue and 41st Street was originally planned as part of the project but later dropped due to rising costs.

Opened in September 2015 the project has already been an important catalyst for redevelopment of the Far West Side, which will ultimately contain more than 50 million square feet of new office, retail and residential space. This was the first addition to Manhattan's subway system in over 30 years, and the first to be entirely financed by the City of New York since the 1930s.

As with most subway extensions, this project was repeatedly proposed over the decades. It was finally brought to life by Mayor Bloomberg and Deputy Mayor Dan Doctoroff, who urged that it be built to provide access to the proposed Jets Football Stadium as part of the City's 2012 Olympic Bid. The Stadium was not ultimately approved by State officials and the 2012 Olympics went to London. The subway extension proceeded as part of the City's rezoning of the Far West Side in 2005 and, as such, supports the Hudson Yards mixed use development now being built on air rights over the Long Island Rail Road's John D. Caemerer West Side Yard, located between 10th and 12th Avenues and 30th and 33rd Streets.³⁴

³⁴ New York City Department of City Planning. Projects and Proposals, Manhattan: Hudson

The subway extension to the FWS will have several benefits:

- ▶ Open the area for redevelopment by making it transit accessible. Without such access, the 12.7 million square feet Hudson Yards development would not be feasible.
- ▶ Connect the existing Jacob Javits Center to hotels and other services it relies on in midtown Manhattan, making it a much more attractive venue for events and diverting trips from taxis/autos to transit.
- ▶ Improve access to the waterfront for New Yorkers and to the expanding Hudson River Park and High Line at 34th Street.

Action on the Extension, Finally Bringing the Subway to the Far West Side

With a project champion and funding in place, construction on the extension began in 2007. It was originally planned to be completed in 2013, but only just opened in September 2015 due to construction delays – almost two years late. However, its innovative financing and permitting processes and its coordination with economic development goals have created important precedents for future projects in New York

- ▶ **Local Innovative Finance, No Federal Funding.** The project is being financed locally through the City's capital program. The city issued \$4 billion in debt to cover the costs of the subway extension (\$2.1 billion), new open spaces and other supportive infrastructure to prepare the site for redevelopments. It is expected that the City will be reimbursed for most or all of these costs through a value capture system, designed specifically for the Hudson Yards District, from

Yards. 2015. Web. <<http://www.nyc.gov/html/dcp/html/hyards/proposal.shtml>>.



7 Line Hudson Yards Station Entrance

payments in lieu of taxes and development fees. Once the development is built out the taxes collected will eventually service the debt, but until then it is being paid for out of the city's general operating funds.

- ▶ **Streamlined Permitting and Construction.** Although the MTA Capital Construction Corporation was responsible for designing and building the project, the City decided not to pursue state and federal funding so that construction costs and environmental reviews could be reduced and the project delivered in time for the 2012 Olympics. This approach eliminated the need for approvals from the Governor and Legislature, and it would not have to compete for funding with other state priorities, potentially shaving years off the state funding and approval process. It did not require a federal environmental impact statement (EIS), cutting two or more years from the permitting process (it was subject to the city CEQR and ULURP environmental review process). The project would not be subject to additional federal reviews and restrictive construction standards (i.e. "Buy America" requirements), again shaving significant costs and avoiding delays.
- ▶ **Coordinated Economic and Infrastructure Development.** Although it is common in other world cities to closely coordinate urban planning, economic development and housing with infrastructure development, this does not often happen in New York. Construction of the #7 Extension was the first such coordinated economic development and transit construction project in New York in decades. For example, all of the auxiliary subway structures on #7 (vent shafts) are designed for overbuilds and integrated into the site plan. By comparison, the six auxiliary structures being constructed along Second Avenue, for that long awaited subway project, will be four story structures in a corridor dominated by 20-30 story residential towers.

Takeaways for New York

The cost and time savings permitted by the #7 Extension's innovative finance, permitting and approval processes cut years and perhaps several hundreds of millions of dollars from the project's construction schedule and cost. The fact that it was not delivered on time was mostly the result of poor vendor decisions made by MTACC and NYCT operational certification process, both of which must be reviewed so that lessons are learned and mistakes not repeated on future projects. The budget for the subway extension never increased, but during its development there were cost overages which resulted in the elimination of the 41st and 10th Avenue station. This budget discipline, while laudable, was somewhat myopic, given the existing demand for service in this area and the unlikelihood that an opportunity like this would come again.

The city's path-breaking use of value capture financing for the project has created an important precedent for the use of this financing technique in New York. Its avoidance of federal funding and resulting cost and time savings could become a model for future infrastructure projects in the region. As the



Hudson Yards Development Rendering

federal government moves away from direct grants, localities will be required to generate the revenues streams themselves to fund infrastructure projects.

The model of the Hudson Yards Development Corporation³⁵ as a marshalling and coordinating body for this project is one that should be studied further and possibly replicated. The partnership between the MTA, City and developers resulted in synergies that moved the project along and gave each group leverage when negotiating within their own bureaucracies. During construction all sides benefited from regular communications and the ability to exert pressure collectively to work through tough problems.

Finally, the project demonstrates the value resulting from coordinating transit investments with economic development plans and land use; the City's significant investment in the #7 project will be paid many times over by the additional employment, economic activity and tax base that will result from its construction. Four takeaways that stand out include the following:

1. The city's reliance on only local funding eliminated many complexities that are found in state/federal funded projects – saving time and likely money.
2. Value capture, and its application here, is a model that should be replicated in future transit projects.
3. The partnership between the transit agency, local municipality and the developers, fostered by the City and its Hudson Yards Development Corporation, resulted in many synergies and should be considered an approach for future projects of this type.
4. Integration of land use, economic development and transit made this project possible, and should be part of any transit project.

³⁵ Hudson Yards Development Corporation. "About HYDC". 2015. Web. <<http://www.hydc.org/html/about/about.shtml>>.

New LaGuardia Central Terminal Building

The Port Authority of New York and New Jersey is in the process of constructing LaGuardia Airport's new Central Terminal Building (Terminal B). A public-private partnership is being used to deliver the \$3.6 billion project, which is anticipated to be completed by 2021.

LaGuardia Airport (LGA) opened in 1939 and was the first modern airport in the region. It is the most land constrained airport of the three major airports, with a footprint of only 680 acres. In 2014 it served 26.9 million passengers, most of them on domestic flights; with the only international destinations served in Canada and the Caribbean. Many of these passengers passed through the Central Terminal Building (CTB), the largest of four terminals at the airport, with half of its 74 gates. Opened in 1964 (upgraded in the 1990's) it was designed for a different era and to serve only 8 million passengers – millions fewer than use it today. It has many passenger circulation constraints and limited gate capacity. Its configuration also reduces overall airport efficiency and capacity. The internal roadways and curbs were insufficient to meet the demands that were placed on them and its adjacent parking structure was inadequate.³⁶

A new terminal and associated improvements were required for a variety of reasons:³⁷

- ▶ Inability to process arriving flights; modern planes bring more passengers than the original hold room, circulation, concessions and rest rooms were built to handle;
- ▶ Lack of space to accommodate and process departing passengers through security, as hold rooms were not designed for passengers to arrive an hour or more before their flight; post-9/11 Transportation Security Administration (TSA)

³⁶ According to the 2015 Regional Air Service Demand Study, by the 2021 to 2034 period, depending on the pace of air passenger growth, the short-term parking situation at LGA will become severe

³⁷ The Port Authority of New York & New Jersey. 2015. Web.

screening requirements take up more space and cause longer queues;

- ▶ Aircraft ramp and narrow alleyways constrain aircraft movement and the ability to serve larger more modern fuel efficient aircraft, which result in delays, higher costs and other inefficiencies;
- ▶ Parking garage (P2) was approaching the end of useful life;
- ▶ Terminal frontage roads did not meet industry design standards and were frequently congested, as the number of lanes was inadequate, and the existing curb was neither long or wide enough.

The lack of amenities and subpar customer experience at CTB have been well documented, with the Vice President of the United States, Joe Biden famously saying on a 2014 visit to LGA that, "I must be in some third-world country!"³⁸ But politicians aren't the only ones complaining. Customers are as well. For years LGA has earned the unenviable distinction of providing the worst airport experience in North America.³⁹ This is a serious problem for the Port Authority and the region, as the airport contributes about \$16.3 billion annually in regional economic activity, generating about 121,000 total jobs and \$5.9 billion in annual wages.⁴⁰ These improvements will enable LGA to accommodate an additional 4 million air passengers. A poor performing LGA has broad economic consequences that cannot be ignored.

³⁸ Welch, Chris. "Joe Biden on LaGuardia Airport: 'I must be in some third-world country.'" The Verge. 6 Feb. 2014. Web. <<http://www.theverge.com/2014/2/6/5387148/joe-biden-laguardia-airport-third-world-country>>.

³⁹ Harshbarger, Rebecca. "LaGuardia is the worst airport in North America, passenger survey says." AM New York. 23 Oct. 2015. Web. <<http://www.amny.com/transit/laguardia-named-worst-airport-in-north-america-in-passenger-survey-1.11002859>>.

⁴⁰ The Port Authority of New York & New Jersey. Airport Traffic Report. 2014. Web. <http://www.panynj.gov/airports/pdf-traffic/ATR_2014.pdf>.



Central Terminal Building Rendering

Port Authority of New York & New Jersey

The Port Authority's Response – A Public Private Partnership

The Port Authority, well aware of the problems with the CTB, began a process of planning and designing a replacement over a decade ago. The FAA released its record of decision for the Environmental Impact Study in 2014 with a finding of “no significant impact,” requiring just a handful of minor mitigation measures by the Port Authority.⁴¹ In 2011, during the course of its efforts the agency made a decision to move to a procurement model that would involve a partnership with the private sector, typically referred to as a public-private partnership or P3 for short. These partnerships can range from involvement of the private sector in designing and delivering a funded project to also providing full-on financial contributions and operating the facility once it's completed. The agency opted for the most aggressive P3 called a Design Build Finance Operate and Maintain or DBFOM. The Port Authority's private sector partner would design and build the terminal based on the Port Authority's specifications, provide private capital to fund part of its construction, and operate and maintain CTB over a defined contracted period. A DBFOM structure was used for the replacement of the LGA CTB, the reasons were likely due to:

- ▶ The agency's success with prior P3 initiatives at its airports, specifically Terminal 4 redevelopment at JFK.⁴² There, it also worked in partnership with the private air carriers on terminal improvements at all three airports.
- ▶ The reconstruction of the World Trade Center left the Port Authority with a funding gap in its capital program and the Federal government's inability to raise the passenger facility charge (PFC) further limited the agency's resources for the project. The agency just didn't have the resources to fund a project that was estimated to cost almost \$4 billion. Access to private capital was one way to could close the gap - an approach that has been successful here and in many airports around the globe.

The Port Authority has stated that they pursued this type of PPP because it is considered the most efficient way to transfer construction risk, especially in cases where maintaining operations is critical.

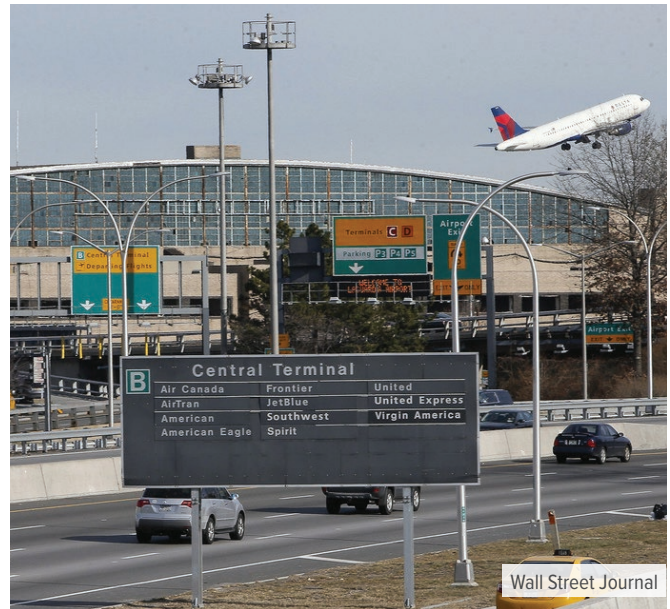
Action to Finally Turn LaGuardia into a World Class Airport

In 2012 the Port Authority published a request for qualifications (RFQ), which began the process of pre-qualifying teams or consortia (partnerships of various engineering, design, finance, construction and airport operating firms) in preparation for the release of the request for proposals (RFP) which was to commence one year later. Four teams were initially selected to respond to the RFP, with one eventually dropping out. The agency developed a detailed briefing book for the teams with information on the program and its detailed project specifications to help guide their submissions.⁴³ After a two year process

⁴¹ The Port Authority of New York & New Jersey. 2015.

⁴² JFK International Air Terminal. “About Terminal 4.” 2015. Web. <<http://www.jfkia.com/about.html>>.

⁴³ The Port Authority of New York & New Jersey. LaGuardia Airport Central Terminal Building Replacement Project: Project Briefing Book for RFQ #31224. 26 Oct. 2012. Web. <[https://www.](https://www.panynj.gov/business-opportunities/pdf/project-briefing-book.pdf)



the Port Authority board selected LaGuardia Gateway Partners in May of 2015. The consortium, led by Vantage Airport Group and Skanska, was comprised of various ventures - each tasked with specific components of the terminal redevelopment including: Vantage Airport Group, Skanska and Meridiam for terminal development and equity investment; HOK and Parsons Brinckerhoff as the design and engineering team; Skanska and Walsh Construction to construct the new terminal; and Vantage Airport Group will operate the new terminal and has already taken over operations of the existing CTB. The cost of the new terminal and associated infrastructure is \$3.6 billion, of which the Port Authority is contributing \$1 billion with the LaGuardia Gateway Partners funding the balance. The P3 should improve the long-term fiscal stability of LGA airport and not be a short-term funding gap solution, and support the “user pay” principle that underlies transportation finance.⁴⁴

Construction on the new CTB commenced in 2016 and is expected to be completed by 2021. However, several developments that occurred over past year delayed the award of the P3 by over nine months and have the potential to further complicate the project.

In response to negative press surrounding LGA (including Vice-President Biden's comments), Governor Cuomo announced a design competition for LGA and JFK in October 2014, with a focus on LGA. Submissions were tendered over the holidays and evaluated by a panel of experts selected by the Governor. The panel's recommendations for LGA were released early in 2015 and included the addition of a “Great Hall” to bridge the CTB and Delta's Terminals C & D, a new AirTrain with a terminus at Willets Point, Queens, a 100-200 room hotel and other landside improvements. Several months later (July of 2015) a rendering and additional details of the new terminal configuration were released that showed a new configuration for the CTB – remote concourses/gates connected by air bridges with an inboard taxiway running parallel to a head house – and extension of the

[panynj.gov/business-opportunities/pdf/project-briefing-book.pdf](https://www.panynj.gov/business-opportunities/pdf/project-briefing-book.pdf).

⁴⁴ Regional Plan Association. “Proceed with Caution: Ground Rules for a Public Private Partnership in New Jersey.” 8 Jan. 2007. Web. <<http://www.rpa.org/pdf/rpapp01082007.pdf>>.

building and its configuration to the east to the site of the existing Delta terminals.⁴⁵ Another recent development was a study requested by the Governor to evaluate the impacts of removing LGA's longstanding perimeter rule, which limits flights to 1,500 nautical miles with just a few exceptions.⁴⁶ As of this writing the outcome of the perimeter rule study along with the scope and details of the full airport project are still unknown. However, with the approval of the contract for the CTB, work is finally underway which, in itself, will reshape the customer experience at LGA and dramatically improve how the airport operates.

Takeaways for New York

There are likely to be many construction lessons to garner from the CTB project once its completed in 2021. It is also impossible to completely judge how successful the new terminal operator will be compared to the Port Authority. However, the application of the all-encompassing DBFOM model to a public sector project of this scale is a major innovation unto itself. There were several benefits of this the new model:

1. **Flexibility to Design and Construct a World Class Facility**, including the integration with ground access at the curb and internal roadways. Similar to the TZB project, this

⁴⁵ New York State. "Governor Cuomo Unveils Vision for Transformative Redesign of LaGuardia Airport." 27 July 2015. Web. <<https://www.governor.ny.gov/news/governor-cuomo-unveils-vision-transformative-redesign-laguardia-airport>>.

⁴⁶ Mutzabaugh, Ben. "LaGuardia 'perimeter rule' to go away? Maybe, report says." USA Today. 26 Feb. 2015. Web. <<http://www.usatoday.com/story/todayinthesky/2015/02/25/laguardia-perimeter-rule-to-go-away-maybe-report-says/24012295/>>.

strategy should streamline the design/build of the project and encourage innovative methods of construction.

2. **Infusion of Private Capital**, Funding Two-Thirds of the Project Budget, enabling the authority to move forward with the project now instead having to wait until it has financial capacity to self-fund the project. While the consortium will require a return on its investment, indirect costs to the economy due to the delay can justify this loss of income to the authority.
3. **Management of Half of LGA by a Private Airport Operator** is a first for the Port Authority at this scale (half of the airport) but is standard practice in many places around the globe. This should result in operational savings for the agency and, based on global comparatives, a better standard of service and more upscale amenities.

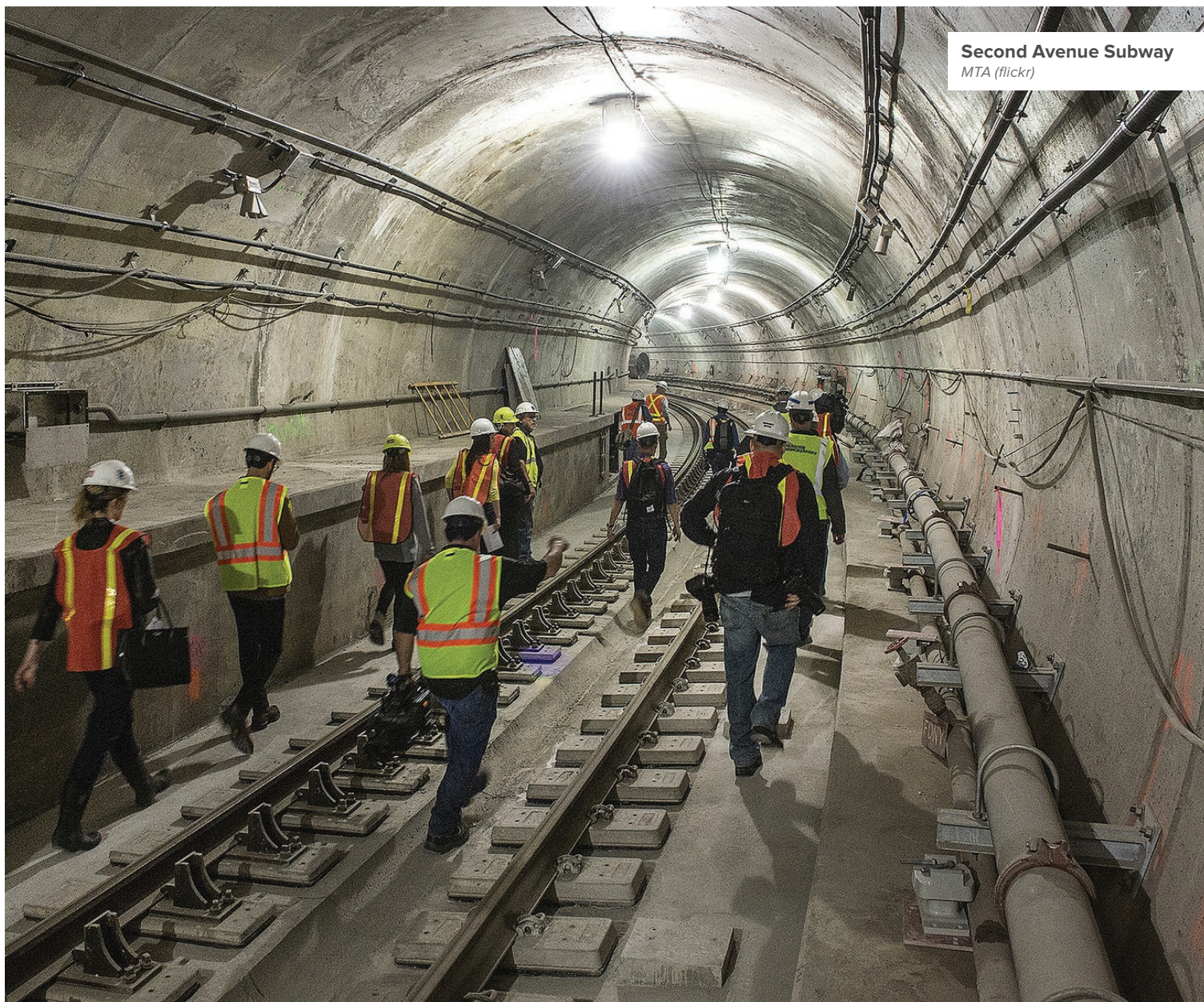
If proven successful, this model could be used to allow the public sector to invest more in infrastructure improvements, supplementing its own financial capacity. Airports are some of the more profitable transportation facilities, their only equal being tolled roads and bridges. Currently, their various revenue streams – parking fees, aircraft landing fees, and ground (retail) leases – cross-subsidize other Port Authority operations, especially the PATH service, PA bus terminal and ports. However, these revenues also make airports attractive to private investors and give the public sector the opportunity to more fully leverage these assets. This model would be more difficult, but not impossible, to apply to public transit facilities and other infrastructure that are heavily subsidized. But in an era of increasingly limited resources, DBFOM might be part of a comprehensive financing strategy.

East Side Access

MTA / Rehema Trimiew



MTA Transportation Cost Crisis



Second Avenue Subway
MTA (flickr)

Rail transit projects cost more and take longer to build in the New York region than anywhere else in the world. For transit riders as well as taxpayers, that means higher costs, less reliable service, and a system that fails to reach many areas or provide affordable and frequent connections. Without a world-class transit system, access to jobs, workers, and services becomes limited and efforts to establish sustainable and energy-efficient land use are weakened. To build the next generation of transportation and other infrastructure the region needs, we must reform the entire process of building new infrastructure—from how political leaders set priorities to procurement practices and labor work rules.

The way we build large-scale transit infrastructure is too expensive and takes too long.

The huge cost of new transit infrastructure will make it nearly impossible to expand and modernize the region's overcrowded subways and commuter rails, undermining economic growth and failing to serve outlying communities. Other global cities are pressing their advantages, attracting new business, and building important economically driven infrastructure.

These extraordinarily high costs are not the fault of any single institution or individual. They reflect decades of planning and building practices, such as complicated site logistics, counterpro-

ductive regulations, complex codes, institutional inefficiencies, bonding requirements, and outdated labor practices.

As the high costs contributing to the slow pace of project delivery increase and project schedules are continually stretched, public confidence in government to deliver improvements erodes. Budgets are surpassed, deadlines are missed, and the responsible agencies struggle to complete projects.

Cost overruns and long completion times are particularly onerous when building subways and other rail transit. East Side Access (ESA), for example, cost over \$519 million per mile for tunneling and track, compared to \$107 million per track mile for London's new Crossrail project. With subways and commuter rails already over capacity, and the population expected to grow by four million people and two million jobs by 2040, costs and delays will only add to the frustrations of riders. And completing critical projects such as the Gateway tunnels connecting New York and New Jersey, and extending the Second Avenue Subway (SAS), will be more difficult.

Every aspect of the project-delivery process contributes to high costs and delays. Based on detailed analysis of the MTA's three megaprojects—#7 Line Extension, Second Avenue Subway, and East Side Access—high costs were driven by the political processes that govern construction, agency management and practices, and labor work rules that determine how projects are staffed and built.

- ▶ Politics and public processes lead to inaccurate budgets and timelines, lengthy environmental reviews that undervalue the economic and environmental costs of project delays, and planning decisions that engage community and business stakeholders too late in the process.
- ▶ Institutional practices include limited constructability assessments and excessive customization, fractured construction management, and an overly complex procurement process.
- ▶ Labor practices include out-of-date work rules that lead to excessive staffing and unproductive work time, requirements to use operations workforce on construction projects, and limited training capacity that is worsened by an uneven pipeline of projects that interrupts the flow of steady work.

The entire process of budgeting, designing, bidding, and building transportation megaprojects needs to be reformed.

While the following recommendations pertain specifically to building new rail transit, many are applicable to other types of infrastructure construction.

Achieving these reforms will be difficult, requiring strong political leadership, good-faith labor-management negotiations, and a willingness to re-examine long-standing procedures and practices that have outlived their original purpose. The most critical actions include the following:

- ▶ **Make constructability a top priority of a rationalized environmental review system.** The environmental review often results in project scopes or mitigation that greatly increase construction costs, such as when access to construction sites is limited to locations and times that extend the time it takes to complete the project. While these restrictions are based on legitimate concerns, the costs of mitigation on project timelines and benefits should be weighed against community and environmental impacts; and international best practices should influence reforms that make environmental review simpler and more transparent. Federal, state, and local environmental reviews should include an independent analysis to evaluate the potential costs and disruption to surrounding communities against the costs, both financial and environmental, of the most cost-effective construction plan. Costs to the project should be given equal weight to disruption and other non-project costs.
- ▶ **Engage the public early in sustained, substantive discussion.** Environmental review is not a public-engagement strategy, and is limited to public hearings on technical documents conducted well after projects have been largely selected and designed. To get broad acceptance of system improvements, the MTA must engage the public with greater frequency, clarity, and transparency. The MTA's extensive outreach to stakeholders, as part of the planned 15-month L-train outage, is taking place years before the start of construction—an approach the agency should replicate. Another best practice adopted by the MTA is the early opening of local community outreach and education centers, like the Second Avenue Subway Community Information Center recently opened on 125th Street and Park Avenue. These effective new efforts must be supported and expanded.

- ▶ **Adopt London's project delivery model.** Every megaproject should have a temporary organization with a focused mission of meeting project schedules. This Special Purpose Delivery Vehicle (SPDV) could be modeled on the London Underground's complex Elizabeth Line project, which was delivered on time and on budget. The SPDV would enable construction professionals more authority and accountability to control budgets, such as by giving them the ability to require supplemental funding from any agency that proposes any costly changes.
- ▶ **Maximize the land-use development potential of transportation investments.** Future megaprojects should incorporate land-use and zoning changes to capture the value created through development opportunities, while working with local communities to protect residents from displacement (link to Comm-1). New York did this as part of the #7 Line extension, in which the city prepared a former industrial area to be redeveloped into a mixed-use commercial center. ESA and SAS, whose economic impacts are more diffuse, could have leveraged redevelopment opportunities at new or existing stations to help pay for the project while at the same time addressing the region's housing and job needs.
- ▶ **Mandate design-build for all new rail lines and extensions.** The MTA should replace its traditional multistep procurement process, which is primarily useful for targeted improvements on existing infrastructure, with this increasingly accepted practice. Design-build allows greater creativity, which can lead to budget savings by mixing design and contractor teams, allowing for better and closer collaboration from the outset, and eliminating the need to reconcile designs later. Contractors are able to evaluate the constructability of designs as drawings are produced, offering suggestions on cost savings based on their experience in the field.
- ▶ **Rethink labor practices and work rules.** We should adopt the best practices other cities have demonstrated in maintaining employment and wages while delivering projects faster and at lower costs. Many project managers and contractors say work rules are a major factor driving inefficiency and higher costs. Reforming how work shifts are defined, along with overtime pay and staffing of tunnel-boring machines, could result in significant costs savings. And even wider savings could be achieved by examining the rules embedded in collective bargaining agreements.

Next Steps

Greater productivity and more efficient decision-making and management would result in faster and better project delivery, and allow the MTA to accelerate the construction of megaprojects. The impact of these reforms would depend on how quickly and successfully they are implemented. Delivering projects on time, on budget, and at lower costs should also boost public confidence and result in increased capital funding for infrastruc-

ture. Reforms could help implement a larger capital program with a steady pipeline of projects that could maintain or increase construction-industry employment.

Implementing these reforms would sharply reduce the costs of new rail projects, and could change government rules or industry practices that ultimately reduce costs for other infrastructure projects as well. Some upfront and ongoing administrative costs would be needed to introduce new management and labor processes.

Case Study on One Vanderbilt & Grand Central Station

The region's economy radiates out from New York City and at its center is the commercial district of Midtown Manhattan. East Midtown is at the heart of the central business district, but the older building stock and infrastructure in this neighborhood needs to be regenerated and expanded, to ensure that the region is well positioned to provide the capacity, services, amenities and technology requirements of business.

Beginning in the 1980s, New York City's Department of Planning (DCP) instituted a floor area ratio (FAR) bonus for subway improvements in the Special Midtown District. In 2013, DCP proposed a full rezoning of East Midtown that would have created a new East Midtown subdistrict within the Special Midtown District that statically increased the allowable as of right FAR throughout the subdistrict. The 2013 proposed rezoning failed due to lack of public and political support. But, an innovative engagement process between 2014 and 2015 brought together a range of stakeholders who proposed a special East Midtown subdistrict that would allow FAR bonuses in exchange for developer-operated transit improvements or contributions into an improvement fund. As part of the stakeholder process, the MTA submitted an array of transit improvements within the subdistrict that could be funded by real estate developers in exchange for the increased FAR bonuses above what the previous subway bonus scheme allowed.

As the 2013 proposal failed and the 2014-2015 stakeholder process was underway, SL Green sought floor area ratio bonuses for a series of parcels along 42nd Street along an expedited timeline in exchange for several transit improvements to their properties directly adjacent to Grand Central Terminal. In response, the city introduced the Vanderbilt Corridor rezoning for the five blocks of Vanderbilt between 42nd and 47th Street. After a robust Department of City Planning special permit application process, SL Green received city approval for the FAR bonuses in exchange for transit improvements. The 2014-2015 East Midtown Rezoning stakeholder process, led by City Council Member Daniel Garodnick and Manhattan Borough President Gale Brewer, culminated in a summer 2015 report supporting

the FAR bonuses in exchange for transit improvements akin to those granted to SL Green.

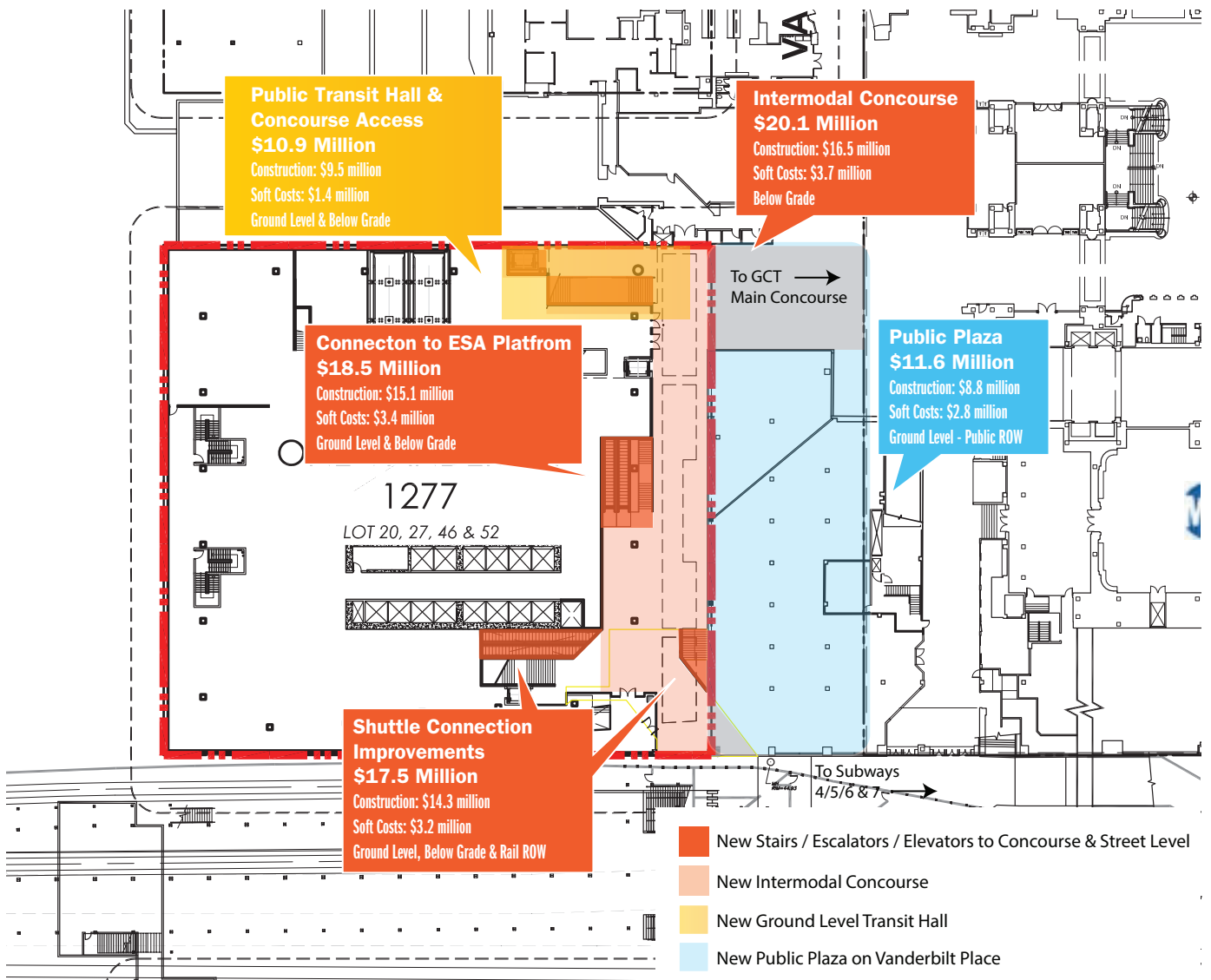
SL Green specifically requested FAR bonuses applied to parcels within the entire city block between Vanderbilt and Madison Avenues fronting 42nd Street. The company had acquired all of the buildings on the block and wanted to demolish them to build a large skyscraper – One Vanderbilt. SL Green proposed funding a series of transit improvements identified by the MTA to obtain an FAR bonus for One Vanderbilt. The site's location between East Side Access and S Shuttle concourses creates an opportunity to better connect the subway to the new LIRR terminal and improve both LIRR and subway connections to Grand Central Terminal's main concourse. Off-site improvements to the 4/5/6/7 subway platform and mezzanine at 42nd Street and Lexington Avenue were later incorporated into the package of investments at MTA's recommendation. The proposed transit investments total \$220 million for an additional FAR of 12.3 at One Vanderbilt, equivalent to \$413 per square foot of additional floor area.

Working with the MTACC, NYCT, LIRR and MNR staff as well as their engineering consultants over 18 months, SL Green completed a project cost estimate, independent cost analysis and project scope refinement. Six months of the cost estimation process involved multiple working sessions with NYCT and their engineering consultants (Parsons Brinkerhoff) to determine:

1. The scope of work involved for each improvement
2. Special conditions and specifications for proposed equipment and finishes
3. Boundaries of proposed work
4. Work hours and restrictions due to active train schedules
5. Schedule and phasing of each project spanning a period of 5-6 years
6. Materials and materials delivery
7. Constructability

The project scope of improvements at One Vanderbilt at the ground level include: a new transit hall and stairs on 42nd Street, giving customers access to an expanded Grand Central concourse that provides direct connections to the new LIRR Terminal, the shuttle and Grand Central Terminal. In addition to the below-grade connection, a street level pedestrian connec-

Figure 2: Transportation Investments at One Vanderbilt & Vanderbilt Place



tion will be created by partially closing Vanderbilt Avenue to vehicular traffic, creating a pedestrian plaza between 42nd and 43rd Streets (Figure 2).

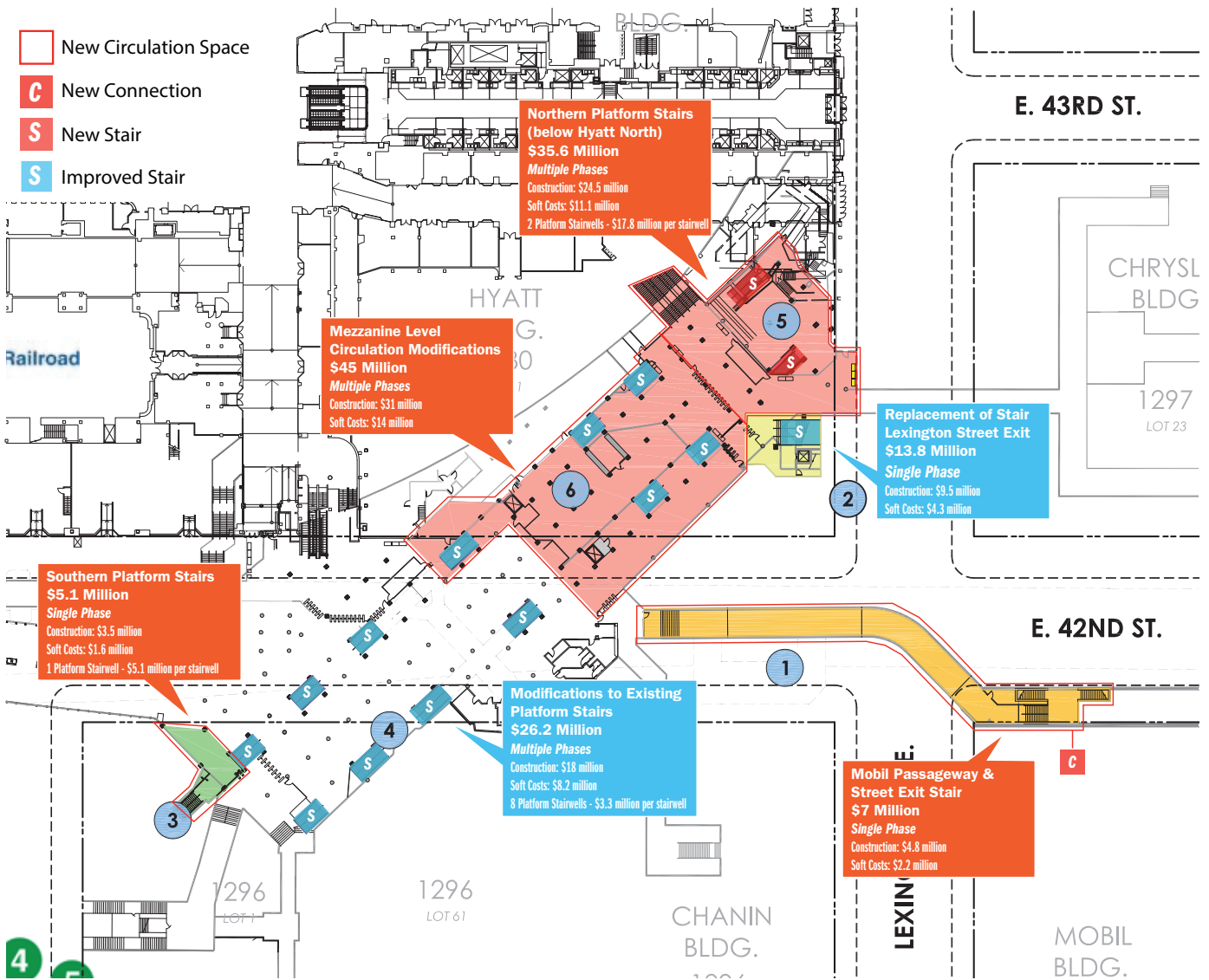
Additionally, SL Green incorporated into the scope of transit investments off-site improvements to the Lexington Avenue (4/5/6) subway platform and mezzanine at 42nd Street, streamlining pedestrian flows, and improving connections to the Flushing Line (7) subway.

At the Grand Central subway station modifications are to be made to the pedestrian circulation at the mezzanine level for the 4/5/6 Lexington Avenue and 7 Flushing lines, as well as changes to existing passageways and stairs to the train platform. It will include expansion of the mezzanine (removing Hyatt basement and making the space contiguous) and the installation of new stairways to the platforms. These are modifications and upgrades of existing infrastructure, most requiring utility relocation. Some tasks require construction to be done by hand, given confined conditions (Figure 3). All of these tasks are to be completed below-grade. Several tasks require work on the platform level with MTA supplied flagmen on the subway tracks.

In scoping the tasks with NYCT, work at the platform level is estimated to be done over multiple phases to accommodate active train schedules. Restrictions are placed on the delivery of materials to work sites to mitigate impacts on passengers.

SL Green has defined their soft costs - non-construction based tasks, design and engineering consultants, city permit reviews, insurance and force account labor required to be done by MTA personnel. The city permit review budget includes all costs incurred during ULURP's approval stage. Insurance line item budgets cover the costs of builder risk, general liability, property, professional liability, and railroad protective insurance. The latter is a NYCT/MTA required policy that must be in place anytime work is performed within 200 feet of an NYCT or MTA railroad. Force account budget line items are broken into separate categories of engineering force account and MTA labor. Costs associated with engineering force account include project management and design review during the design and construction phases of the project. MTA Labor includes the cost of due diligence inspection of existing services and equipment relocation costs required to enable the special permit work to be

Figure 3: Off-Site Improvements at Grand Central Subway Station



performed. Soft costs vary substantially between tasks based on the level of engineering review. (The Vanderbilt Plaza streetscape project imposes soft costs as high as 55% of the overall task cost¹.) Another driver of soft cost increases is the MTA's force account labor. This cost includes engineering fees to attain project approvals, inspections and surveys to identify existing services to be modified by the improvements, for platform work, track flagmen, and outages associated with working alongside an active railway. Soft costs increase based on the frequency of work being performed on the platform and whether the MTA will authorize a general outage, bypass outage, or mandate continuing service under flagger protection. For example, the soft costs for tasks on the 4/5/6 platform and mezzanine are estimated to be 30% of the total project cost and are 18% higher per task than construction work on the ESA or Shuttle mezzanines.

The scale of work for each individual task varies. But, one of the more obvious cost drivers in the One Vanderbilt project was between new construction and modifications of existing infrastructure; and whether work is being done at surface level,

below grade or on the track platform. As shown in Figure 3, the cost difference between building new platform stairwells and modifying existing platform stairs can be as much as several million dollars.

Breaking tasks into multiple phases increases costs for construction and soft costs. However, multi-phased work is unavoidable at major hubs like Grand Central Terminal where closing the station for an extended duration would likely be unfeasible. In the case of the One Vanderbilt project, soft costs for the multiple phase tasks are \$1 million for each existing platform stair upgrade and \$5.6 million for the new northern platform stairwells (below Hyatt North). The soft costs for the new southern platform stairwell (beneath 125 Park Avenue), which is not multiphase, is estimated at \$1.6 million, more than what is estimated for upgrading each existing platform stair but dramatically lower cost than the multiphase work for the new platform stairs at the north end. Additionally, soft costs increase for tasks requiring utility relocation because of multi-agency coordination with actors such as ConEd and the Department of Environmental Protection. In addition, city permitting to com-

¹ All costs cited are without contingency added.

plete these tasks creates additional lead time before construction can begin.

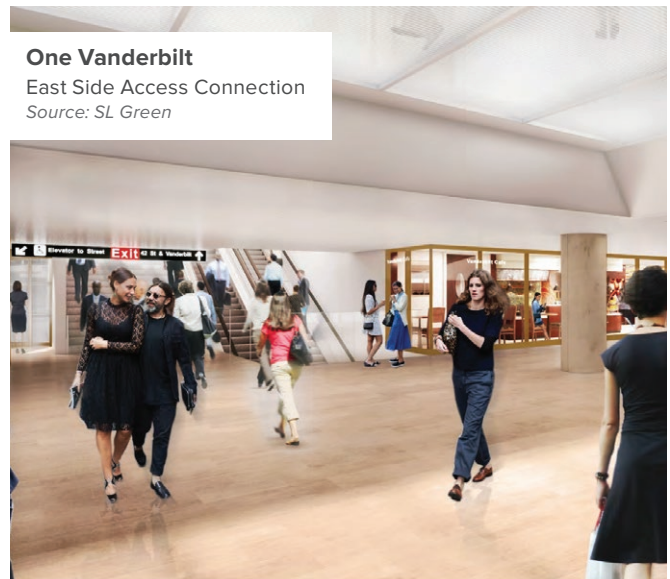
Construction of the One Vanderbilt project is just underway, precluding a full evaluation of this model. However, there are early takeaways based on the extensive collaboration between the MTA and SL Green and a review of the overall concept.

One innovation concerns the city's use of certificate of occupancy to ensure that developers deliver the agreed upon improvements. The occupancy of the "bonused" space has been directly tied to the delivery of the transit improvements. This ensures that the developer will be highly motivated to complete the improvements in a timely manner. For example, SL Green used its own engineers to devise alternatives for the column "thinning" and stair modifications on the 4/5/6 train platform – ultimately shaving months off the project.

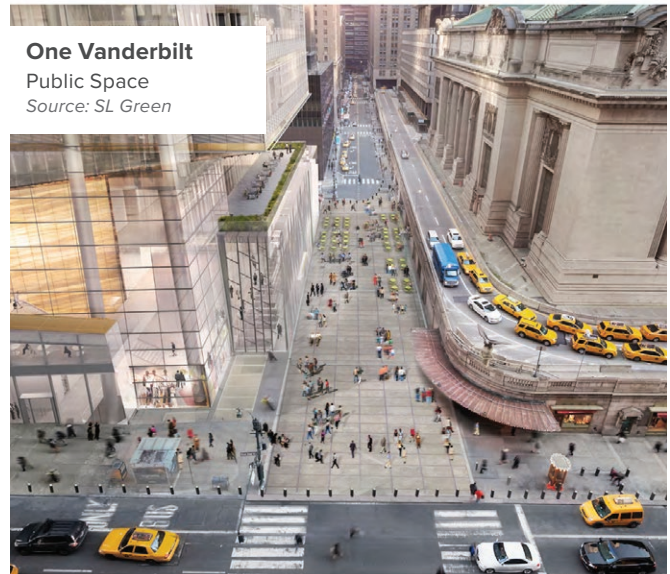
Takeaways

The project documents also offered greater insights into the cost drivers of capital construction. For example, while the scale of work for each individual task varies, one of the more obvious cost drivers appears to be between new construction and modifications of existing infrastructure, and whether work is being done at surface level, below grade, or on the track platform. Also, breaking tasks into multiple phases typically increased costs for construction and soft costs. Additionally, the soft costs for the project increased substantially for tasks requiring utility relocation because of the necessary multi-agency coordination required with various actors such as ConEd and the Department of Environmental Protection, along with city permitting procedures, creating additional lead time before construction work can begin.

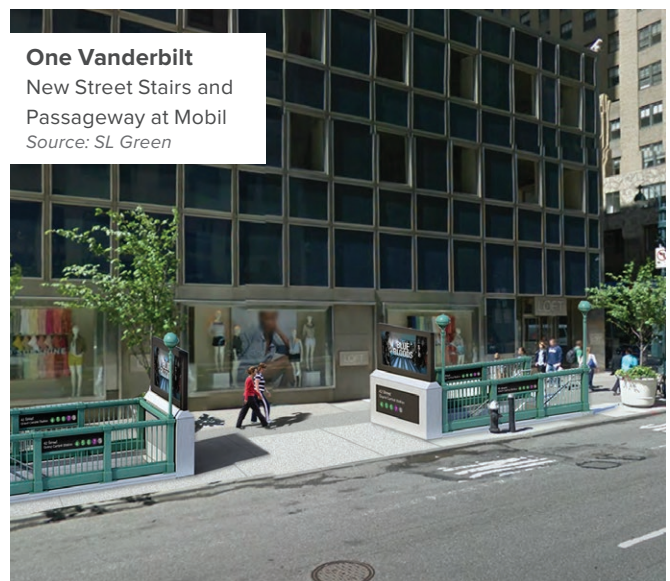
The One Vanderbilt project was a collaboration between private developers, city agencies and the MTA's Capital Construction division and operating entities to develop a project scope. This model is one that should be evaluated for future new developments throughout the region, no matter the scale. Incorporating complete and longer closures of stations for subway modifications and upgrades would improve upon this new project delivery model. These closures would reduce phasing, extending the hours for construction in between staging and tear down. Getting workers access to the platforms and tracks to complete construction work in longer but fewer phases is crucial to build projects more efficiently and reduce capital costs.



One Vanderbilt
East Side Access Connection
Source: SL Green



One Vanderbilt
Public Space
Source: SL Green



One Vanderbilt
New Street Stairs and
Passageway at Mobil
Source: SL Green

Fix and Expand the Region's Airports



Newark Liberty
International Airport
Concourse C
Source: Port Authority

Our three airports must be significantly improved in order to meet growing demand and keep the region globally competitive. John F. Kennedy International Airport should be expanded and modernized to include two additional runways, larger and more customer-friendly terminals, and significantly better transit access. Newark International Airport should be reconfigured, moving the main terminal closer to the train station on the Northeast rail corridor and freeing up more space to eventually construct a new runway. These improvements could accommodate a 60 percent increase in airline passengers, and reduce delays by 33 percent.

The region's airports have the worst delays in the nation and do not have the capacity for the expected growth in passengers.

Today, our three major airports rank first, third, and fourth for worst delays in the nation. And while air passenger travel demand could increase 60 percent in 2040 (and double by 2060), it is obvious that our airports will not be able to meet that demand and keep us competitive on the global scale. Unfortunately, expanding any of these airports presents major environmental challenges for adjacent communities and natural ecosystems.

The customer experience—from access to the airport to amenities inside the terminals—is also uneven and subpar when compared with international peers. Even with the success of AirTrain at JFK and Newark, transit access to the airports is not optimal, and traffic congestion on nearby roads and highways makes flying even more uncertain and time-consuming.

Climate change poses an additional challenge to our airports. Teterboro Airport, currently the airport of choice for general aviation flights (primarily corporate business flights), will likely need to close later this century due to the risk of rising sea levels.

Airport expansion is needed to bring delays down to the national average of ten minutes and accommodate future growth.

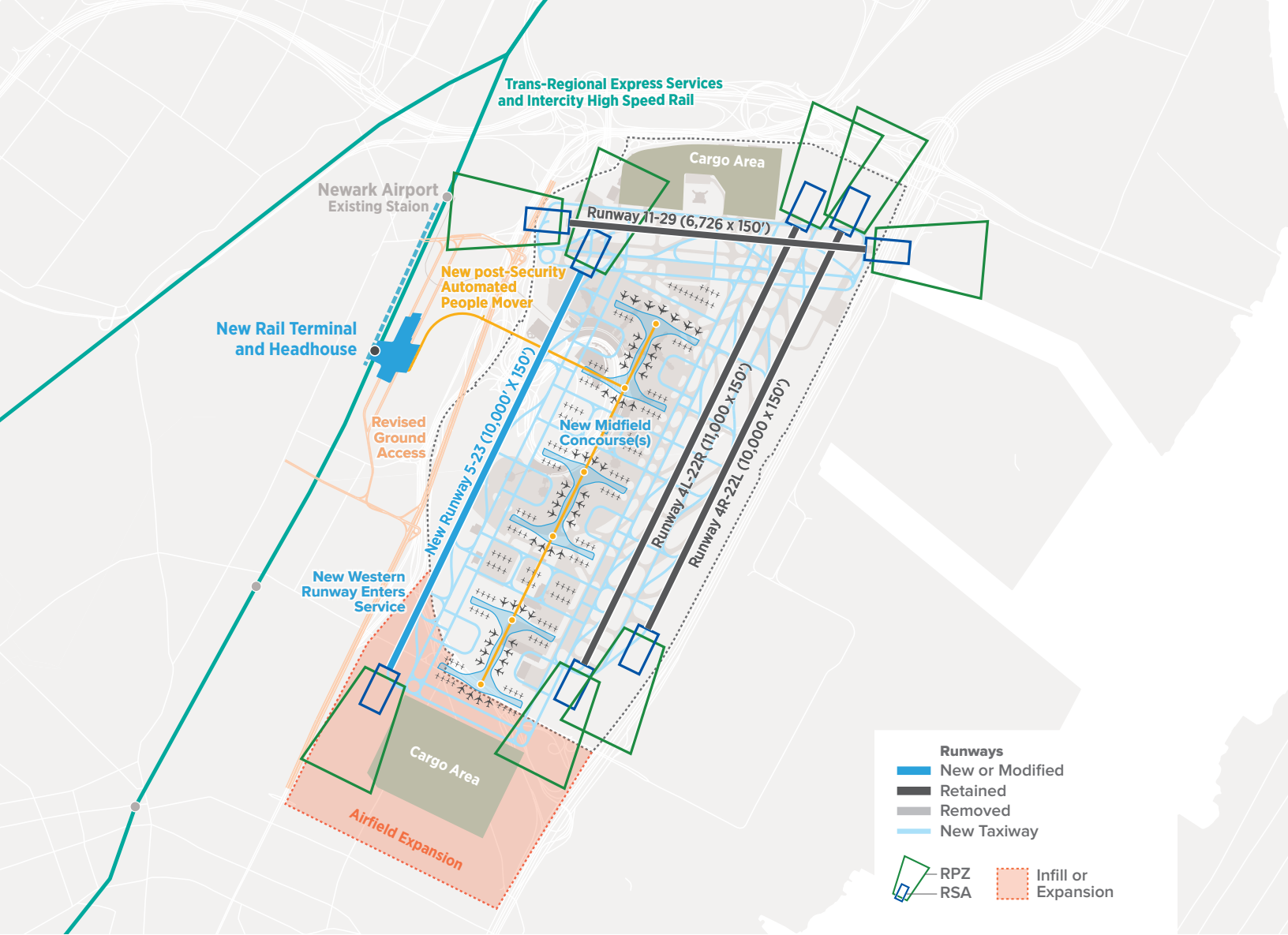
Many improvements could help reduce delays and handle additional passengers at JFK, Newark, and LaGuardia, including implementing new air traffic control technology, improving intercity rail service, and expanding service at other airports in the region. But the only thing that would significantly increase capacity at these major airports is building new runways.

Of the three airports, LaGuardia is the most land-constrained and lacks the facilities for international service, while JFK and Newark are better suited for expansion—which will be necessary to accommodate the anticipated overall growth in air travel, and to absorb both the many commercial flights from LaGuardia and those displaced by the closing of Teterboro.

Expand JFK on both the airside and landside.

JFK will eventually need two new runways, larger, better-designed terminals, and new transit service that supports a one-seat ride through to Manhattan. The plan must include protection from storm surges, and the restoration of Jamaica Bay.

- ▶ **Construct a new 9,000-foot departure and arrival runway west of the terminal area.** A second 7,000- to 8,000-foot arrival runway will eventually be needed either adjacent to this western runway or between the two eastern runways. All new runways should be built to minimize the impact on Jamaica Bay.
- ▶ **Consolidate the six existing terminals into four larger common-use facilities,** with all gates available to all airlines.
- ▶ **Reconfigure the central terminal area** to improve service with open and spacious terminals, business centers, and customer amenities that would be competitive with cities such as Singapore, Amsterdam, Madrid, and London.
- ▶ **Rebuild and expand on-airport AirTrain stations at JFK:** Parts of the existing AirTrain alignment could be rebuilt in the central terminal area to better integrate it with the existing or new terminals, giving passengers better or equal access to the check-in hall as well as curbside. The rebuilt station would be designed to accommodate longer trainsets and to facilitate one-seat ride service to the central business district (CBD).
- ▶ **Create an express one-seat ride to Manhattan instead of extending the existing AirTrain.** The new

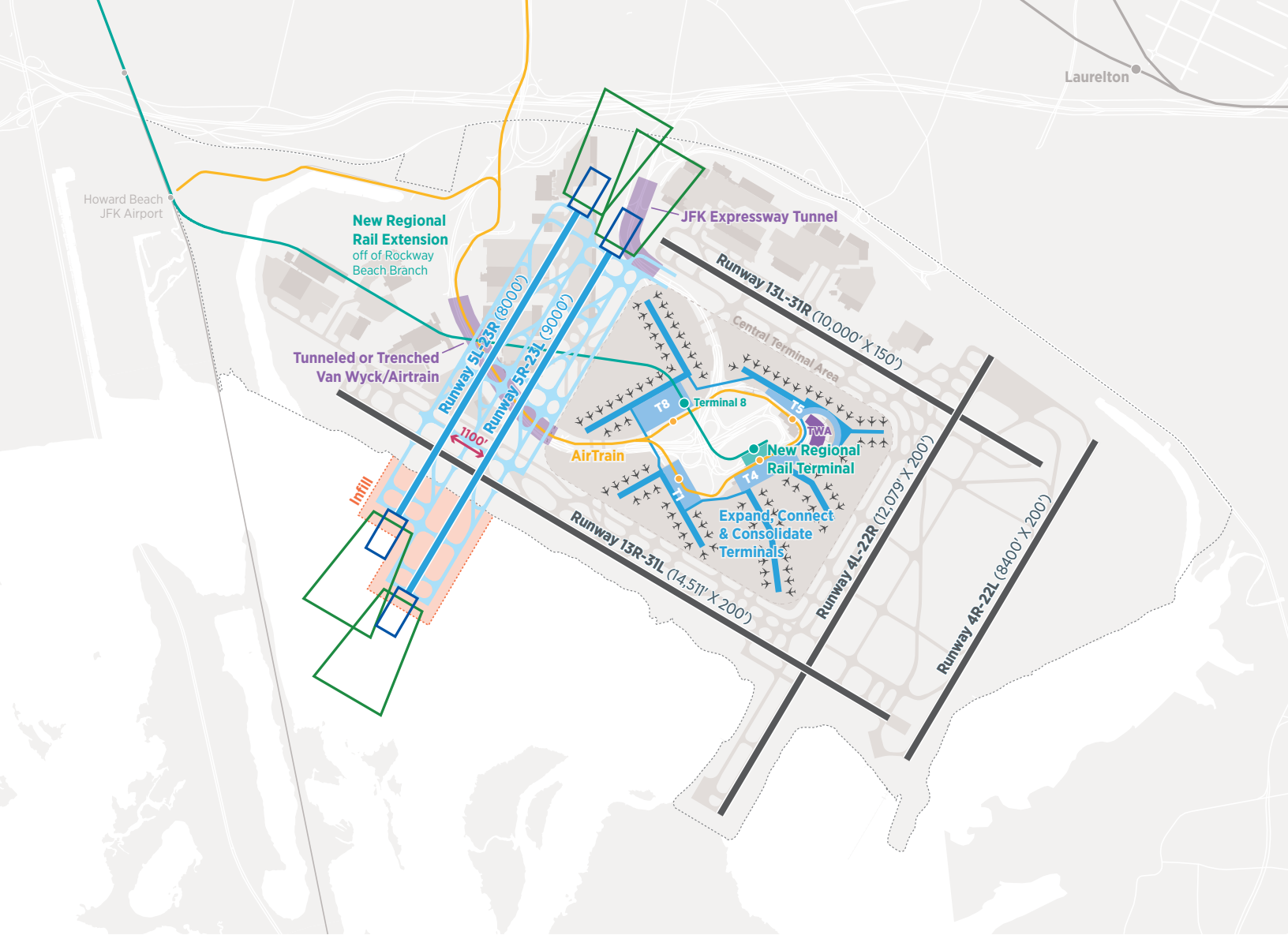


After a rebuilt Terminal A reach the end of their useful life, Newark Airport should be reconfigured to bring the terminals directly to the rail station served by Amtrak, New Jersey Transit and PATH. The airport will need to be extended south for new cargo operations, and a new runway on the western side of the terminal will soon be needed.

Source: RPA

airport service would be an outgrowth of RPA's regional rail plan. The Rockaway Beach Branch would be reactivated for passenger service from Atlantic Avenue, where it would connect to the new regional rail line at Howard Beach with two dedicated tracks for the airport service. The new airport express service would provide a quick one-seat ride from Midtown Manhattan, Lower Manhattan, and Downtown Brooklyn to JFK utilizing a new East River crossing. There would be at least four trains per hour with an average wait time of seven minutes.

- ▶ **Protect JFK from storm surges:** Unlike LaGuardia and Newark airports, JFK Airport is not significantly affected by sea-level rise, although the entire airport is vulnerable to flooding and therefore requires protection from storm surges.
- ▶ **Strengthen connections between JFK and downtown Jamaica:** Downtown Jamaica should be redeveloped in tandem with the airport. In particular, hotels and other hospitality services should be located downtown, preserving on-airport capacity for terminals, runways, and freight facilities.



► **Protect and restore Jamaica Bay:** Given the environmental impact of constructing one or two new runways into Jamaica Bay, various mitigation measures should be implemented by the Port Authority. First, every acre of habitat affected by the construction of runways should be restored elsewhere throughout the bay. Emphasis should be placed on restoring the salt marshes and maritime forests, as well as filling the holes made by excavations and restoring other bird sanctuaries away from flight paths. Further, the Port Authority should establish a Jamaica Bay Restoration & Resilience Mitigation Fund that will serve to fund research, restoration, and adaptation efforts to make Jamaica Bay and its communities more resilient. The fund could be managed in cooperation with a group such as the Science and Resilience Institute at Jamaica Bay or the NY-NJ Harbor Estuary Program. Funds could be raised out of the Port Authority's general budget or a dedicated per-flight user fee. Further, the Port Authority should ensure the airport is among the most sustainable in the world, from including green infrastructure to carbon offsetting programs.

To reduce delays, handle expected growth and improve the customer experience, Kennedy airport will need to expand. A new departure-and-arrival runway west of the terminal area will eventually need to be joined by a second runway. A reconfigured central terminal area with open, spacious terminals would be linked to a rebuilt AirTrain that would connect to a one-seat train ride from Midtown, Lower Manhattan and Downtown Brooklyn. *Source: RPA*

Reimagine Newark Airport.

Newark Airport should be reconfigured with a new main-terminal entry connected to public transit, a new western runway, and a midfield concourse. The airport should also be extended south for aircraft parking, add a modernized and more accessible air cargo area, and reduce noise impacts from the new western runway. Comprehensive adaptation solutions would address the risk of flooding of Newark Airport, the I-95 corridor, and the New York and New Jersey port facilities.

- ▶ **Build Terminal A and AirTrain with a maximum 30-year design life:** Construct the new Terminal A to operate for the next 30 years or more, until it would eventually need to be razed to make way for the construction of a new runway. The AirTrain system could be a short-term solution, or be replaced by a more-frequent bus service until a new system is in place in 10 to 20 years.
- ▶ **Extend Newark Airport south to create a new cargo area and improve airfield operations:** At only half the size of JFK's, Newark Airport's airfield is constrained. To accommodate future expansion, a portion of the new midfield concourse, and cargo operations, the airport will need to expand its footprint. The logical place for this expansion is to the south of the existing airfield, using a 600-acre industrial/commercial area between the airport and the old Central New Jersey rail line.
- ▶ **Consolidate the existing Terminals C and B at the Northeast Corridor (NEC) rail station,** with either one or two midfield concourses for boarding planes, and a new people mover serving the midfield concourses. Terminal A would be served by buses in the interim and eventually phased out after its useful lifespan, with terminal services moved to the NEC rail station. This new multi-modal hub will streamline the customer experience and result in more passengers getting to and from the airport by public transit.
- ▶ **Extend the Port Authority Trans-Hudson rapid transit system (PATH) to Newark Airport.** The new NEC headhouse would place the PATH at the entrance of the airport, making it effortless to transport baggage from transit to check-in. An extension further south to Elizabeth should be explored, which would open access to the airport to surrounding communities for travel and employment.
- ▶ **Construct a new 9,000-ft runway on the western side of the airfield** after terminal consolidation to the new headhouse on the Northeast Corridor is complete and the central terminal area is reconfigured.
- ▶ **Adapt Newark Airport for storm surges and sea-level rise:** Along with the Port of New York and New Jersey and the I-95 corridor, Newark is at risk of frequent flooding, with certain areas becoming permanently flooded once sea-level rise reaches six feet.

Outcomes

The JFK and Newark airport expansions will greatly improve the overall flying experience and accommodate more passengers. Expected outcomes include:

- ▶ Direct one-seat ride access to the Manhattan CBD in 30 minutes or less
- ▶ 104 million passengers served annually at JFK
- ▶ 69 million passengers served annually at Newark Airport
- ▶ Delays reduced from an average of 15 minutes today to the national average of 10 minutes
- ▶ Expanded job opportunities in downtown Jamaica and Newark, and at both airports
- ▶ Improved protection from storms and sea-level rise
- ▶ Replacement of every acre of habitat in Jamaica Bay lost during construction

Next Steps

Airport expansion will be one of the most expensive infrastructure projects the region will need to undertake over the coming decades. Total costs for both airports are estimated at \$48 billion—\$27 billion for Newark Airport and \$21 billion for JFK—which would be paid for by Port Authority airport revenues derived primarily from airline fees and passenger facility charges. This level of investment would only be possible if airport subsidies to other Port Authority operations are phased out over time. Few major airports around the world subsidize other activities as New York does.

Airport expansion will likely require a buyout of a few dozen residential properties to the north of the JFK runways, and industrial and residential properties to the south of Newark Airport.

Mitigation measures should include a one-for-one replacement of any acres of natural habitat lost as the result of construction, with emphasis placed on restoring salt marshes and maritime forests, as well as filling holes made by excavations to fill the bay. A Jamaica Bay mitigation fund should also be established to fund research, restoration, and adaptation efforts.

Crossing the Hudson: How to Increase Transit Capacity and Improve Commutes



The transportation networks that cross the Hudson River and link New Jersey and New York are critical to the economy of both states. The transit connections, which carry nearly 400,000 people a day, are at serious risk. They are old, deteriorating, and unable to handle current and anticipated demands.

Two of the key elements of this network are especially at risk: the rail tunnel under the Hudson River that leads into Penn Station, and the Port Authority Bus Terminal (PABT). Each weekday the Hudson River Tunnel (HRT) carries some 330 NJ Transit commuter trains and 150,000 people — triple the number of passengers since 1990. Amtrak's Northeast Corridor, which is the heart of Amtrak's national network and its only profitable market, runs another 100, intercity trains carrying 21,000 people a day.

Superstorm Sandy badly damaged both tubes of this aging tunnel, which is threatened by a shutdown if conditions worsen. Each year it becomes more likely that one of these tubes will need to be closed for significant repairs, forcing tens of thousands of workers and visitors to find alternative means of travel in a system that is already over capacity. Huge disruptions to all who travel across the Hudson would follow, with disastrous effects to the economies of both states and the entire Northeast Megaregion.

Meanwhile, the PABT is succumbing to years of heavy bus traffic in the terminal and on the ramps leading to it. It was not designed for today's larger and wider buses. Many of the 14,000 buses traveling through the Lincoln Tunnel each weekday overflow onto the city streets surrounding the terminal. The capacity limitations affect the 350,000 passengers daily, up from 233,000 in 1990. Each morning, long lines of buses try to enter the overtaxed Exclusive Bus Lane (XBL) leading to the Lincoln Tunnel, and long lines of passengers wait impatiently to board buses in the evening.

The New York Metropolitan Transportation Council (NYMTC) and the North Jersey Transportation Planning Authority (NJTPA) produce long-range forecasts for the city and region. They both project that population and job growth will result in an increase in work trips of 26% from communities west of the Hudson to New York City by 2040, adding 103,000 trips each way on an average weekday. RPA's more ambitious growth forecasts estimate that demand could grow by 38%, or 148,000 trips. But the current system does not have spare capacity to handle either of these projections.

Many possible solutions have been suggested, generally starting with new rail capacity under the Hudson River. Amtrak's proposed Gateway project would enable transit agencies to divert trains from the existing rail tunnels to make repairs and eventually double trans-Hudson rail capacity. Most business, civic and political leaders agree that Gateway should proceed, but funds for the project — which will cost in excess of \$20 billion — are not in place.

At the same time, the search for a replacement to the PABT is hampered because the existing facility has two critical features that are difficult to duplicate: direct connections via ramps to the Lincoln Tunnel and the close proximity to ten subway lines. Any replacement not at the current site would forfeit either or both of those advantages. Moreover, the high cost and local impacts raise issues as to whether other solutions might be preferable. For example, the New York City subway #7 or L trains could be extended to add trans-Hudson capacity and relieve bus and rail demand on existing facilities.

All these solutions require consensus among the affected parties — the State of New Jersey and NJ Transit (NJT); Amtrak; the Port Authority of New York and New Jersey; the City and State of New York; the ferry operators; and even the MTA and federal government. All of these alternatives are expensive and require close examination, including agreement on how the solutions will be paid for.

Figure 1: Existing Trans-Hudson Transportation System

Source: Regional Plan Association



Trans-Hudson Travel Today

Trans-Hudson travel includes many markets — commuters to Manhattan by train, bus, auto and ferry; commuters to other destinations in both directions; through traffic on autos, buses and trains traveling on the Northeast Corridor; and freight moving across bridges, tunnels and barges.

The New York metropolitan area is central to the economy of its three states and to the economy of the nation. Its 23 million people generate \$1.8 trillion in gross domestic product, one-fifth of the nation's economy. At the center of that economy is the Manhattan central business district (CBD), the nine square miles south of 60th Street, where over two million people work.

Trans-Hudson travel is accommodated by several vehicular and rail crossings, as shown in Figure 1. The three rail crossings were built more than 100 years ago during a three-year period from 1907 to 1910, the two PATH tubes in 1908 and 1909 and the Pennsylvania Railroad's Hudson River tunnel (HRT) in 1910, now used by New Jersey Transit and Amtrak. These were followed by a series of motor vehicle crossings — the Holland Tunnel (1922), George Washington Bridge (1931 and 1962), and the Lincoln Tunnel (three tubes constructed in 1937, 1945 and 1957). The PABT was built in 1950 and expanded in 1979.

New Jersey has only handful of crossings when compared to the numerous bridges and tunnels that connect Manhattan to communities to the north and east, as shown in Figure 2. A few ferry routes, ubiquitous before 1910 still remain to complement these facilities, connecting Manhattan with waterfront communities, with PATH in Hudson County and with NJT in Hoboken.

Each day 7.9 million trips are made into and out of this core from all directions. Three-quarters of these trips use public transit, which makes the enormous concentration known as the

6 Hudson River
1 Bridge / 5 Tunnels

Figure 2: Tunnel and Bridge Crossings into Manhattan Island

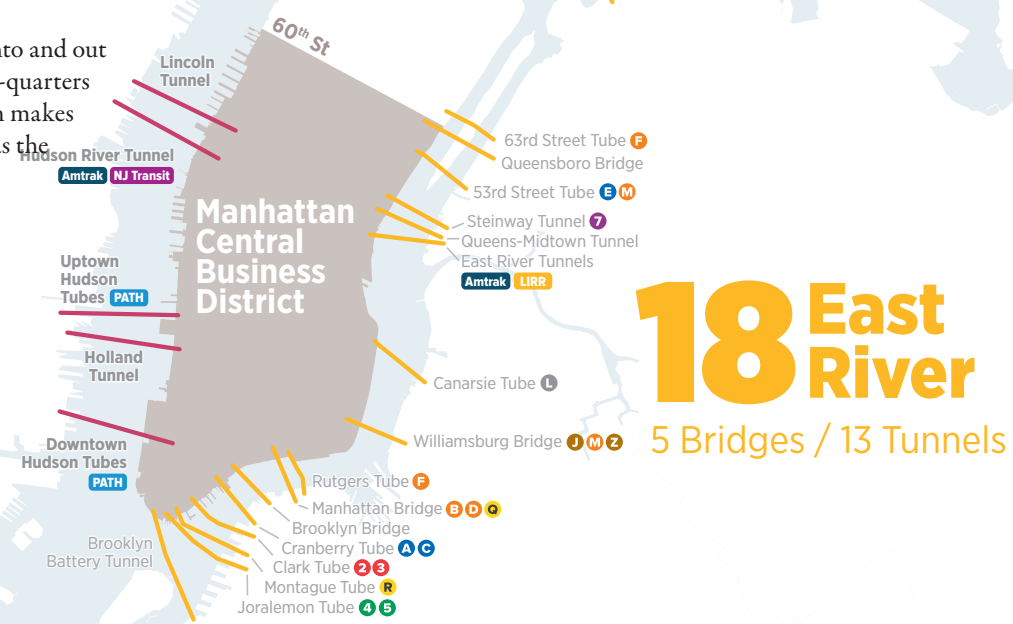


Table 1: Changes in Trans-Hudson Travel: 1990 to 2015

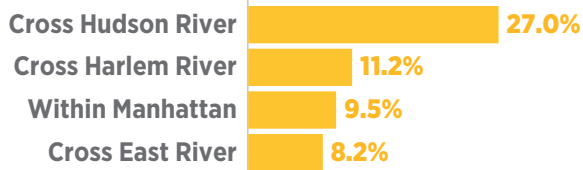
Daily Trips (Both Ways)

	Crossing/Facility	1990	% Share	2015	% Share	Absolute Change	Percent Change
Auto	Holland Tunnel	121,982	14.9	106,165	9.0	-15,817	-12.97
	Lincoln Tunnel	167,383	20.5	142,484	12.1	-24,899	-14.88
	Total	289,365	35.4	248,649	21.1	-40,716	-14.07
Bus	Holland Tunnel Bus	15,162	1.9	29,243	2.5	14,081	92.87
	Lincoln Tunnel Bus	233,777	28.6	426,931	36.2	193,154	82.62
	Total	248,939	30.4	456,174	38.7	207,235	83.25
Hudson Rail Tunnel	NJT	52,698	6.4	172,419	14.6	119,721	227.18
	Amtrak	19,196	2.3	21,958	1.9	2,762	14.39
	Total	71,894	8.8	194,377	16.5	122,483	170.37
PATH	Downtown	118,205	14.4	109,785	9.3	-8,420	-7.12
	Uptown	75,778	9.3	135,752	11.5	59,974	79.14
	Total	193,983	23.7	245,537	20.8	51,554	26.58
Ferry	Total	14,109	1.7	34,887	3.0	20,778	147.27
Total Transit		528,925	64.6	930,975	78.9	402,050	76.01
Total Trips		818,290	100.0	1,179,624	100.0	361,334	44.16

Source: New York Metropolitan Transportation Council. Hub Bound Travel Data, 1990 and 2015.

Manhattan CBD possible. Any loss of transit capacity threatens its survival.

Figure 3: Growth of Manhattan-Bound Workers, by Place of Residence, 1990-2010



Source: 2010 U.S. Census

The sector west of the Hudson, which includes the northern two-thirds of New Jersey and a number of counties in New York State west of the Hudson, is the fastest growing commuting sector to the CBD. As shown in Figure 3, since 1990 this sector has grown three times faster than the all other sectors that feed workers to Manhattan — growing by 27% versus an average of 9% — and now accounts for 323,000 work trips each day, or about one in seven workers in Manhattan. Seventy thousand more people cross the Hudson to reach jobs in Manhattan today than did in 1990.

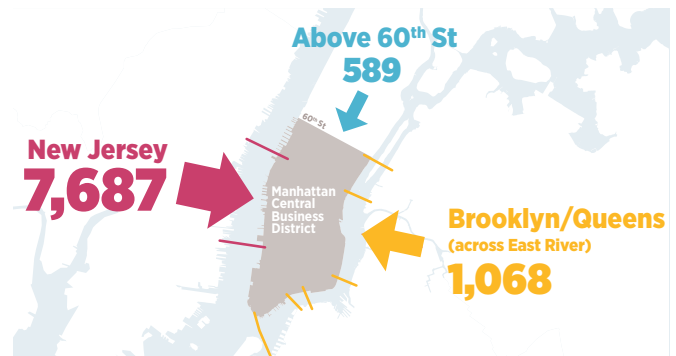
Commuters to Manhattan are not the only markets served by trans-Hudson crossings. People travel for other purposes and to other places. All these markets are growing as indicated by Table 1, which shows that the total trans-Hudson growth in the 1990 to 2015 period has been just under 45%, adding slightly over 360,000 daily (two-way) trips in that 25-year period.

This growth includes a striking shift away from the automobile and toward public transit, reversing earlier trends. Auto riders are down 14%; transit trips are up 76%. Rail trips in and out of Penn Station have almost tripled, adding just about 120,000 trips. Bus trips have grown rapidly too, up by 207,235 daily, or 83% since 1990. PATH is up 27%, especially on the uptown

branch that serves a growing commercial market on Manhattan’s west side south of 34th Street. Meanwhile, ridership on the World Trade Center branch dropped as lower Manhattan’s land uses have become more residential. Ferry travel is up by 147%, but on a much smaller base.

Commuter buses make up a disproportionately large amount of the trips entering the CBD from west of the Hudson relative to travel from Lower Hudson Valley and Long Island. As shown in Figure 4, the bus volumes are over six times greater from New Jersey than other parts of the region.

Figure 4: Commuter Buses Entering the CBD from All Sectors



Source: New York Metropolitan Transportation Council. Hub Bound Travel Data, 1990 and 2015.

What Drove the Growth in Trans-Hudson Travel?

Several developments can explain the growth in bus travel at the Lincoln Tunnel and rail travel in the HRT Tunnel. In 1970, the Port Authority initiated the innovative and highly successful Exclusive Bus Lane (XBL), which converted an underused outbound lane in the

morning for the exclusive use of buses destined for the PABT. Today this 2.5-mile lane carries 30,000 people in the peak hour, more than three times the number of passengers in automobiles in the parallel three inbound lanes. New Jersey Transit constructed the Kearny Connection (now Midtown Direct) in 1996, the Montclair Connection (now Montclair Direct) in 2002, and the Secaucus Transfer (now Secaucus Junction) in 2003. The purpose of these projects was to provide either a one- or two-seat ride to Penn Station in Midtown Manhattan for all NJT rail riders. Each project accomplished the goal of reducing travel times and improving the convenience for tens of thousands of riders and elevating the property values through much of northern New Jersey. It also dramatically increased the number of NJT trips through the Hudson River tunnel each day, from 53,000 in 1990 to 172,000 today. Now over 350 NJT trains use the Hudson River tunnel, more than double the 1990 level.

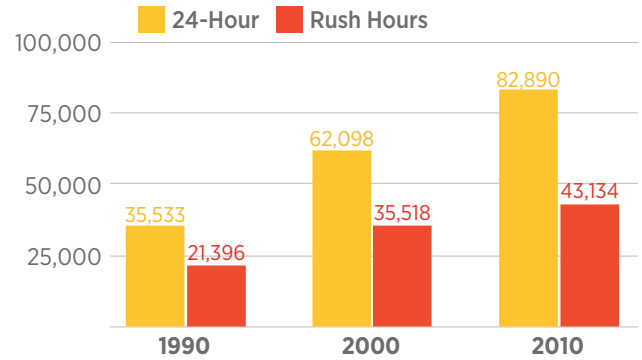
Figure 5 highlights the growth at Penn Station during peak periods when its inadequacies are most acute. In the 20-year period, ridership has doubled in the peak period, adding more than 21,000 riders.

Figure 6 traces the inexorable climb in number of buses traveling through the Lincoln Tunnel in the morning peak hour, up from 700 to 1,000, adding five more buses on average for each minute in the peak hour.

The growth of service and use of Penn Station and the PABT have pushed them to and beyond their limits. At Penn Station, reliability has suffered with delays a daily occurrence and crowding at the station reaching intolerable and dangerous levels. At the Port Authority Bus Terminal crowding conditions take many forms during both morning and evening commuter periods. In the morning peak, the XBL has reached its maximum capacity and leaves little margin for error. In the evening the difficulty of deploying buses in an outmoded terminal leads to long lines each day as commuters wait to board buses. Making matters even worse, much of the physical infrastructure at both facilities has reached the end of its life and must be replaced or extensively rehabilitated, as demonstrated by failures in and near Penn Station in the summer of 2017.

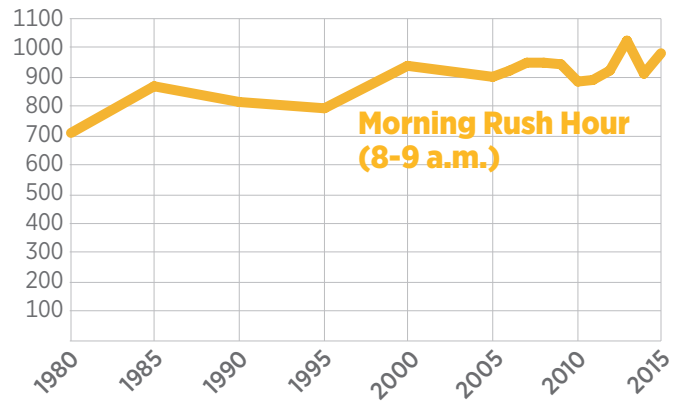
The distribution of current users of Penn Station is shown in Figure 7. The largest concentrations of these Penn Station bound commuters are in Union, Middlesex, Mercer and Monmouth counties, and to a lesser extent in Morris and Essex (influenced

Figure 5: Trans-Hudson Rail Ridership to Penn Station, Inbound Only: 1990 to 2010



New York Metropolitan Transportation Council. Hub Bound Travel Data. 1990-2010.

Figure 6: Lincoln Tunnel Bus Movements, 8-9 a.m., inbound only



Source: New York Metropolitan Transportation Council. Hub Bound Travel Data. 1980-2015.

by Midtown Direct) and in Bergen County (influenced by Secaucus Junction).

The transportation facilities across the Hudson River are used to their maximum. Any loss of transit capacity represents a profound crisis and would put intolerable pressure on the remaining facilities used by nearly half million people each day. Such a loss is quite possible and would require one of the two Hudson River Tunnel (HRT) tubes to be closed for extensive multi-year repairs.

Future Demand Will Exacerbate the Crisis

These critical transit facilities are operating above their capacity today. The picture will only become bleaker with the likely increase in demand for trans-Hudson travel and the impact that demand will have in the absence of action. Both the Port Authority and NJT have spent considerable effort in trying to project how much trans-Hudson travel will occur in the next 30 to 40 years, by what mode, on which facilities and during what time of day. New population, labor force and employment projections have been adopted by both New York and New Jersey metropolitan planning agencies and RPA has developed its own projections.

The projection of travel requires making assumptions to address several questions, including:

- ▶ How much will we grow? The rate of population and employment growth depends on long-term national and international changes in productivity, migration and relative competitiveness.
- ▶ Will people and business continue to choose cities? The recent shift to more recentralized growth patterns, including both job and residential growth in New York City, may or may not continue.
- ▶ What about technology? New technologies are changing the frequency and timing of work trips, but how much this will continue is uncertain. More people are working from home or traveling during the off-peak hours.
- ▶ Is congestion pushing people away? Recent historical data suggests that some people have shifted their time of travel because of congested conditions at peak times. If congestion is relieved, will these travelers convert to their old habits?
- ▶ Will the transit service be provided to meet the growth patterns? If the problems persist in crossing the Hudson by transit, will potential riders choose to locate their homes and businesses elsewhere, to the detriment of both states?
- ▶ Where will people live? The relative growth of the labor force living on the two sides of the Hudson is affected by the extent to which housing can be expanded in both urban and suburban areas. The less housing is built in New York City, Long Island and other areas east of the Hudson relative to New Jersey and west of Hudson locations, the greater the growth of trans-Hudson travel is likely to be.

Past Agency Demand Projections

An examination of past projections shows a range of possible results, but under any scenario, transit trips across the Hudson River will grow considerably.

The Access to the Region's Core (ARC) forecasts made in 2007 with a horizon year of 2030 indicated that even without a new rail tunnel there would be 38% more people crossing the Hudson on transit each weekday than there were in 2005. These forecasts also

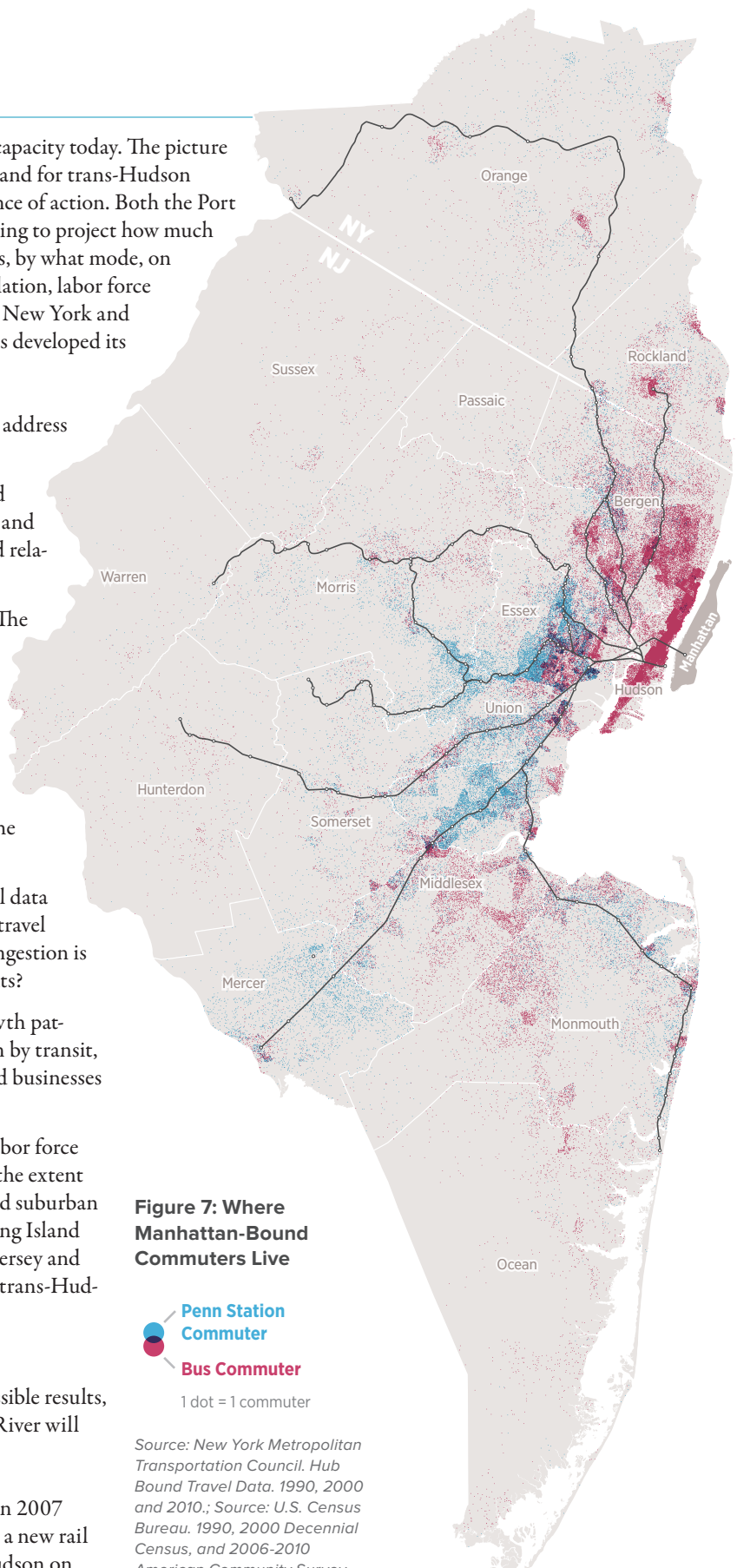


Figure 7: Where Manhattan-Bound Commuters Live

● Penn Station Commuter
● Bus Commuter
 1 dot = 1 commuter

Source: New York Metropolitan Transportation Council. *Hub Bound Travel Data. 1990, 2000 and 2010.*; Source: U.S. Census Bureau. *1990, 2000 Decennial Census, and 2006-2010 American Community Survey.*

projected 29% more people using (or trying to use) the existing HRT tunnel and 20% trying to use buses through the Lincoln Tunnel. Remarkably, the growth from 2005 to 2015 has already met this projection to 2030. Penn Station volumes since 2005 are up by 37%, most of it in the last two years. The ARC project forecast that the growth in Penn Station if the ARC tunnel were built would have been 88% more in the course of the day and 133% more in a four hour morning peak period in the 2005-2030 period.

The Port Authority has estimated that the four-hour peak will see between 38% and 50% growth on transit from 2010 to 2040. It also estimated that by 2050 there will be demand for 50% more bus riders in the evening peak hour.

These data are presented in Table 2 with the annual rate of growth for easier comparisons. The overriding message is clear: substantial growth in travel across the Hudson River into Penn Station, into the PABT, on PATH and during all time periods, peak and off peak. This growth, when added to the highly congested current conditions, cannot be met without new capacity. The limited number of crossings and finite roadway capacity in Manhattan inhibit potential surface transportation options, such as on-demand car services and autonomous vehicles. Corridors for public transit that could include these technologies could be designated in the future but a wall of buses or autonomous vehicles would conflict with pedestrian mobility, add to congestion and detract from the city's environment.

RPA Projections

RPA developed its own trans-Hudson models as described in the Appendix. The mode choice model was applied for the trips from west of the Hudson, including the 14 counties in New Jersey and four in New York State west of the Hudson and the census tracts in Manhattan as far north as 125th Street on the west side and 96th Street in the east side. This area was chosen to be representative of the impacts of various proposals on modal use. Because of this limitation and because the model only considers work trips, the data presented here should not be used to estimate the total number of trips or to evaluate specific transit capacity options, but rather to be illustrative of the direction and magnitude that would result from changes in land uses and transportation services during the peak period.

Inputs to these models were developed from population and employment projections described in *Charting a New Course: A Vision for a Successful Region*. Two socioeconomic scenarios were developed in this report. A Current Trends scenario concluded that future job and population growth will slow to half its rate of the last 25 years without significant increases in the rate of housing production and infrastructure capacity. By contrast, RPA's Vision scenario projected growth at approximately the same rate as the last 25 years — 16% for both jobs and population — if the right housing, commercial space and transportation infrastructure were built to support sustainable and equitable economic growth. Using the RPA Vision scenario, but without including specific transportation improvements, the travel demand model predicts a 24% increase in work trips to Manhattan (south of

Table 2: Trans Hudson Projections Comparison

Agency	Circumstance	Range	Time Period	Mode	Annual Rate of Growth
NJT	Without ARC	2005 to 2030	Daily	All Transit	1.5
NJT	Without ARC	2005 to 2030	Daily	HRT	1.1
NJT	Without ARC	2005 to 2030	Daily	Bus/LT	0.8
NJT	Actual	2005 to 2015	Daily	HRT	3.2
NJT	With ARC	2005 to 2030	Daily	HRT	2.6
NJT	With ARC	2005 to 2030	4 hour pm peak	HRT	3.5
PA	Unconstrained	2010 to 2040	4 hour pm peak	All Transit	1.1 to 1.4
PA	Unconstrained	2010 to 2040	1 hour pm peak	Bus/LT	1.02

Sources: New Jersey Transit. Access to the Region's Core (ARC) Final Environmental Impact Statement. 2008. Port Authority of New York and New Jersey. Midtown Bus Master Planning Update Presentation. 2015.

Table 3: Work Trips from West of the Hudson River to Manhattan and New York City, 2015 & 2040

	2015	2040	Change	% Change
Manhattan	301,869	374,526	72,657	24%
New York City	394,165	542,004	147,839	38%

Source: Regional Plan Association Vision Scenario

Harlem) across the Hudson by 2040. Trips would grow even faster to all of New York City, by 38% over 2015, primarily because of rapid job growth in the other New York City boroughs. As described below, including improvements to rail and bus capacity make significant differences in both the level and modal distribution of trans-Hudson travel. This reinforces agency projections for both substantial increases in Trans-Hudson travel and impact of proposed solutions.

Known Deficiencies and Planned Improvements

Table 4: Trans-Hudson Crossings and Facilities

Name	Mode	Built	Daily Trips (Both Ways) 2015	Inbound 8am to 9am 2015	Daily Trips Inbound 2015	Daily Trips Outbound 2015
Penn Station/HRT	Rail	1910	194,377	24,662	97,090	97,287
PATH – Uptown	Rail	1908	135,752	16,712	67,274	68,478
PATH – Downtown	Rail	1909	109,785	14,230	54,908	54,877
Lincoln Tunnel/PABT	Bus	1937-1957	426,931	38,275	198,279	228,652
Ferry	Ferry	NA	34,887	5,005	16,997	17,890

Source: New York Metropolitan Transportation Council. Hub Bound Travel Data. 2015.

In addition to sheer lack of capacity to handle demand, the aging trans-Hudson facilities have significant deficiencies that affect service and reliability. Table 5 shows the age and ridership for these facilities. In the following sections, their individual problems are described, current plans discussed and some suggestions are made as to how to address remaining deficiencies.



Port Authority Bus Terminal
 Photo: Nancy Borowick



Hudson River Tunnel
Photo: Amtrak

Hudson River Tunnel

The tunnels are comprised of two parallel single-track tubes¹. The New Jersey portals are west of the Palisades, where the tracks emerge and travel along an elevated embankment through the Meadowlands, called the “Highline.”

All these facilities have insufficient capacity for current use and future growth. The tunnels suffer from over 100 years of heavy use, and more recently from damage caused by Superstorm Sandy. To keep the tunnels in safe working condition, Amtrak currently takes one tube out of service every weekend and many evenings for repairs and operates train service in only one tube. However, there is no longer enough time on nights and weekends for all of the maintenance work that needs to be done. In 2014 Amtrak stated that the tunnels had less than 20 years left before they must be closed for rehabilitation, which will take several years. If new tunnel capacity is not built to accommodate the trains that will have to be diverted from the existing tunnel, major service disruptions will ensue.

Major Deficiencies

- ▶ The Tunnels and Highline (a series of structures that elevate the NEC over the Meadowlands from Secaucus Junction to Newark Penn Station) reached their maximum rush hour capacity years ago and cannot accommodate more trains and passengers. Until new capacity is built to supplement trans-Hudson train travel, the region’s economic growth will be artificially capped.
- ▶ Several bridges on the Highline are long past the end of their useful life and must be replaced.
- ▶ The weight of the Hudson River fluctuates with the tides and as a result, the tunnels compress at high tide and expand at

¹ Each tube has one track supported by a trough of loose-rock ballast with concrete bench walls alongside it containing electrical and communications conduits. The tubes are built with a 1.5-inch thick cast iron outer ring and a two-foot thick reinforced concrete inner lining.

low tide. More than 100 years of this daily abuse has taken a significant toll on the tunnels’ engineering.

- ▶ In 2012, the tunnels were flooded with water from the Hudson River for the first time ever by the 14-foot storm surge from Superstorm Sandy. The brackish saltwater was quickly pumped out, but left a coating of chlorides and sulfates which cause long-term corrosion to reinforcing steel and concrete. In 2014, an engineering study found that more than \$350 million is needed to fix the damage. Fortunately, the study also found “negligible, if any chemical impact” to the tunnel’s outer cast iron ring, so they can continue to safely support operations for the time being.

Potential Solutions

There have been many actions and plans put forth to address capacity and reliability issues at Penn Station and the Hudson River Tunnels. In 1996, RPA’s Third Regional Plan, “A Region at Risk,” identified a new set of tunnels under the Hudson River as one of the most important priorities for the metropolitan region. Beginning around that time, NJTransit and Amtrak began collaborating on Access to the Region’s Core (ARC). This project was intended to add capacity by building two new deep tunnels into Manhattan with a terminus at 34th Street and 7th Avenue. However, ARC was cancelled by New Jersey Governor Chris Christie in 2010 citing the potential for cost overruns.

Since then, Amtrak has proposed the Gateway Program, a proposal to build new trans-Hudson rail capacity that connects into Penn Station. The planning, design and engineering for the tunnel must proceed rapidly to reduce the probability that the existing tunnels will fail before the new ones tunnels are built. The unresolved issues for Gateway that remain between NJT and Amtrak and funding for the over \$20 billion project must be addressed soon. Meanwhile, the replacement of the Portal Bridge in the New Jersey Meadowlands, a necessary part of the Gateway project and critical to the reliability of the existing corridor, is designed and ready to be constructed once \$1.5 billion in funds is identified.



Penn Station

The original Pennsylvania Station was an architectural landmark that deteriorated over time during the decline of passenger rail service after World War II. To the dismay of many, it was demolished in the 1960s and the Penn Station we know now opened in 1965. Today, it shares space below grade with the foundation columns and structural elements that support Madison Square Garden and an office building.

Penn Station has also reached its maximum practical capacity. The number of daily Amtrak, Long Island Rail Road and NJT passengers that use the station every weekday exceeds 400,000. Countless others pass through the station on foot on their way to one of the four subway lines nearby. The existing Penn Station was only designed for 200,000 daily riders.

Major Deficiencies

- ▶ The capacity constraints and complex layout of Penn Station make commuting and intercity rail travel an anxious and overall unpleasant experience for travelers.
- ▶ Pedestrians typically back up at stairways and escalators to reach the street level, and preventing trains to leave the station quickly, limiting train operations and capacity.
- ▶ Increasing congestion in station and on platforms has raised alarms over safety of passengers; if emergency evacuation was required during the peak, the outcome could be catastrophic.

Potential Solutions

Penn Station must be redesigned. The railroads are engaged in a joint planning study to improve Penn Station, called the New York Penn Station Visioning Study. In a parallel effort, RPA has also been working with the Municipal Art Society in an ambitious collaboration called the Alliance for a New Penn Station, which has recommended that Madison Square Garden be moved to a nearby site to open up Penn Station to a redesign so that many solutions to its circulation problems that are now

precluded by the arena and the adjoining office building can be implemented. The New York City Council has required MSG to have a plan for relocation by 2024. RPA has developed a series of recommendations to improve Penn Station that are further detailed in this report.



In 2016, the New York Times editorial page featured a brilliant proposal by Vishaan Chakrabarti and PAU to move MSG to an adjacent site, strip the Garden structure down to its structural elements, and create a beautiful train station within the existing footprint of the Garden. This provocative and elegant design demonstrated the importance of architecture to solving our transit crisis.

Meanwhile, across Eighth Avenue the first phase of Moynihan Station is complete, improving circulation for users of the western end of Penn Station. The second phase would build a new, grand train hall and shift Amtrak's ticketing and back-end operations from Penn Station, opening up new retail and commercial development opportunities.

Hudson River Tunnel & New York Penn Station

The Pennsylvania Railroad built the Hudson River Tunnels, the original New York Pennsylvania Station and the four East River Tunnels and other connecting infrastructure in Queens. This entire complex opened for service in 1910. The tunnels eliminated the transfer in New Jersey with a direct ride to Midtown and established attractive intercity rail service from points west and south. Today, these tunnels and Penn Station are at the heart of NJT's rail network and the Northeast Corridor, Amtrak's busiest rail line operating between Boston and Washington, D.C.

Port Authority Bus Terminal

Photo: Nancy Borowick



Lincoln Tunnel and Port Authority Bus Terminal

The PABT is the largest bus terminal in the United States. It inhabits prime real estate in Midtown Manhattan, occupying nearly one entire block and half of another bound by 40th and 42nd streets and 8th and 9th avenues. The building is directly connected to ten subway services underground between 8th Avenue and Times Square, the busiest station in the New York City subway system.

This bus service complex includes of a 2.5-mile Exclusive Bus Lane that allows morning peak period buses to bypass auto and truck queues at the Lincoln Tunnel, a helix-shaped roadway at the western portals of the tunnel, the six-lane tunnel, a series of ramps connected to the PABT that is separated for the street grid, and the multi-level Port Authority Bus Terminal with 223 bus gates and an auto parking garage.

The XBL opened in 1970. Each morning it carries more than 1,600 buses, 730 in the peak hour in what is normally a west-bound lane. A lane in the tunnel extends the XBL for exclusive bus use. It is managed by the Port Authority of New York & New Jersey.

The bus terminal's main deficiencies are both structural and operational. Many of the terminal's elements were built more than 60 years ago; they have reached the end of their useful life, and will need to be replaced soon.

Major Deficiencies

- ▶ Recent Port Authority studies have identified several major weaknesses in some of the bus terminal's structural elements, including the foundation slab and ramps to and from the Lincoln Tunnels.
- ▶ The lack of PABT capacity causes overflow operations, including NJT and other bus carriers, plus less formal

("jitney") bus and van services to operate on the neighboring streets. This exposes passengers to the elements, creates congestion on sidewalks and local streets, air and noise pollution and is an eyesore for neighborhood residents.

- ▶ Peak hour bus traffic through the Lincoln Tunnel has grown rapidly and is projected to grow from 730 buses to 1,000 by 2040. This leads to backups and delays at its entrance in the Meadowlands. Passengers are losing time and travel reliability suffers.
- ▶ There is not enough storage and layover space for buses in Manhattan. The result is that many buses must be stored in New Jersey during the day and then battle rush-hour traffic in the evening using only the two eastbound lanes available to access the PABT. This leads to countless delays for buses and for evening peak period passengers.
- ▶ The terminal's operating deficiencies affect the customer experience. Long lines are the result of unreliable deployment of buses and inefficient design of boarding areas. Waiting areas are insufficient and unpleasant, and expose commuters to bus fumes.

Potential Solutions

Currently ongoing, the Port Authority's Midtown Bus Master Plan is evaluating long-term solutions to the infrastructure, operational and capacity issues at the PABT. All the alternatives suggested to date are very costly, estimated on the order of \$10-\$15 billion. In the spring of 2016 the agency launched an international design competition for the bus terminal and five final designs were selected as finalists later that year. Three designs proposed constructing a new 4-5 story terminal on the surface between 9th and 11th Avenues one block from the current site and two suggested subterranean solutions. The most promising scheme proposed repurposing the lower level of the Javits Convention Center as a new terminal and directly tying it directly into the Lincoln tunnel tubes. None of the designs were accepted by the Port Authority Board of Commissioners which has asked staff to explore further less costly options, including revisiting the existing 8th Avenue site. The search for other options is hampered by three realities: the ramps connecting the Lincoln Tunnel and the PABT are immovable and any solutions must keep them in place; any other building site large enough for existing and expanded PABT operations will be enormously expensive; and any relocation will put the PABT passengers further from their destinations and the extraordinary subway connections they now enjoy.

Port Authority Trans-Hudson (PATH)

The Port Authority Trans Hudson (PATH) rapid transit system connects urban areas of Hudson and Essex counties with each other and with Manhattan. It accomplishes the Manhattan



PATH Station

Photo: Nancy Borowick

connections by providing transfers to the NJT rail system in Newark and Hoboken. The two tunnels under the Hudson take riders to the World Trade Center and to 33rd Street and Sixth Avenue via the Uptown branch stopping at five intervening stations in the West Village and Chelsea.

The recent growth in Hudson County is putting pressure on PATH, particularly on the Uptown branch, which will require additional capacity to serve a growing population. In anticipation of this growth and to improve service, the Port Authority is currently replacing the PATH’s antiquated and unreliable fixed-block signal system with a more advanced system using Communications-Based Train Control (CBTC) and has purchased 350 new, modern railcars with advanced features to operate the new signal system. These two improvements will reduce headways and increase the overall capacity of the system. The first contract for the procurement of the railcars was awarded in 2005 and most of these new cars are now in service. A new Harrison station is currently under construction and the agency is planning a major expansion at Grove Street to improve passenger circulation and surface access. These improvements, combined with CBTC will substantially increase capacity on downtown PATH but they will do little to address the needs of those destined for midtown on the uptown PATH line. The Port Authority was planning to extend platforms at Grove Street, Harrison and Exchange Place stations to accommodate 10 car trains (up from 8) on downtown PATH, but these plans have been delayed.

Major Deficiencies

- ▶ Many platforms, especially on uptown PATH, are short and/or narrow reducing the ability to expand to longer trains to add passenger capacity.
- ▶ The track configuration (geometry) and interlockings in Jersey City slow trains down and limit throughput.
- ▶ Lack of peak hour storage at the Newark Penn Station terminal and inability of inefficient terminal to turn trains quickly limits capacity too.

- ▶ PATH is not well integrated with the rest of the region’s urban transit network, especially the NYC subway system. In Manhattan, two Uptown PATH stations lack direct underground connections to nearby NYC subway stations.
- ▶ The two systems have different railcars (even though PATH is compatible with NYCT Division A or the “numbered” line cars) and fares are administered separately.

Potential Solutions

For years, various extensions in New Jersey of PATH have been considered. Most prominent is the extension of service from Newark Penn Station to the Newark Airport station on the Northeast Corridor, recommended by Regional Plan Association. The intent is to provide a one-seat ride from lower Manhattan to the airport. The project would include the construction of a new train yard to expand train storage capacity and permit more frequent PATH service. In December 2014, the Port Authority awarded a contract to study the project’s technical feasibility, costs and benefits. To date there has been little progress on the project with just preliminary planning underway. However, other extensions have been suggested including options to physically connect PATH to the NYC subway system.

Figure 8: PATH Extension to NEC Rail Link Station



Source: Regional Plan Association

World Financial Center Ferry Terminal

Photo: Nancy Borowick



- ▶ Serve a market willing to pay a premium fare.

These conditions are not often met but where they have been, ferries have thrived. In particular, the growth in development in Hudson County provides reason to believe that ferries can have an expanded trans-Hudson role. However, many situations where ferries can meet these conditions already have ferries in place. Therefore, a larger role for trans-Hudson ferries lies with either new or expanded transportation access to the water's edge, with increased development near the water's edge that will expand the market and with public subsidies of ferry operations to keep fares down. In particular, new mobility technologies, such as ride hailing and autonomous vehicles, may provide more convenient access to and from the water's edge, which could promote more ferry ridership in the future.

Hudson River Ferries

Today, there are 16 trans-Hudson ferry routes that serve almost 30,000 two-way passengers on an average day, serving less than 3% of the daily trans-Hudson transit traffic.

Most prominent are:

- ▶ The services from Hoboken where local residents and arriving rail passengers board ferries at the rehabilitated ferry terminal.
- ▶ The Weehawken service to west 38th Street in Manhattan.
- ▶ The services from the Atlantic Highlands that cross Raritan Bay and terminate at the East River near the financial district.

One major advantage of ferries is their ability to serve additional demand in a short period of time. After the 9/11 attacks, the destruction of the World Trade Center and the PATH station below it, and the subsequent suspension of PATH service, ferry ridership nearly doubled. But once PATH service was restored in 2003, ferry ridership returned to earlier levels.

Major Deficiencies

Ferries operate in a private sector environment, at least as far as operations go, but the Port Authority has subsidized the construction of docking facilities. To cover operating costs, ferries have had to raise their fares faster than the PATH system, which has reduced ferry ridership.

Potential Solutions

Ferries have inherent limitations which constrain their ability to take on a more significant role in the trans-Hudson market. To be most successful they should have the following features:

- ▶ Serve a market that conveniently reaches each end of their trip by using ferries and limited last mile connections either by walking or having a ready-made delivery system.
- ▶ Serve a market with poor transit options.

What Would Happen if the Hudson River Tunnel Is Closed for Repairs?

The Northeast Corridor tubes under the Hudson River have the capacity to serve 24 trains per hour in each direction. If one tube is lost and only the remaining one is usable, its capacity would be reduced to just six trains in the peak hour, due to the logistics of operating trains in and out of a single tunnel. Operating the current system with two tunnels is already quite complex; operating it with one tunnel is nearly impossible. In this six-trains-per-hour closure scenario, difficult choices will be necessary as to which services are allotted this limited capacity.

One scenario would be to assign all six of those slots to NJT; they carry far more people per train than Amtrak does. In the 6am to 11am inbound trains could be configured with a maximum length and as double-deckers they would carry 1,300 people while Amtrak holds only 300 on Acela trains and 400 on the Northeast Regional.

The ramifications of this scenario for Amtrak would be grave. The Northeast Corridor is by far the most successful intercity rail service in the nation. Today, over 100 trains a day carry over 21,000 people through the Hudson River tunnel to and from Penn Station. In addition to Boston to Washington Acela service, more local regional services are provided by Amtrak as well as trains on eight other long-distance routes, most of which rely on the HRT. The disruption to its schedule and to riders would essentially render it useless as a convenient option throughout the corridor from all points south and west of New York. The

loss would add more people at our crowded airports or on highways in the corridor.

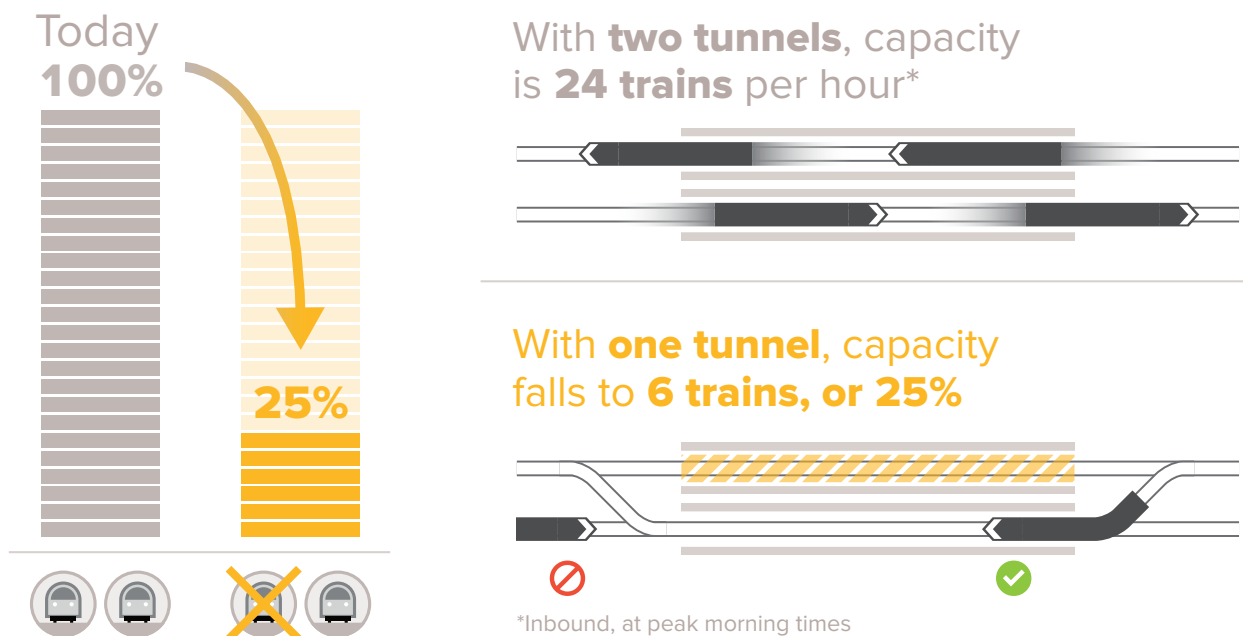
How might the NJT riders cope with the loss of service? Some might consider traveling at other times of the day. If all of the 22,640 people that travel into Penn Station between 7:00 and 10:00 a.m. today (2013) were to continue to ride a train to Penn Station in the morning with one tunnel in operation, 22% would have to shift their commutes by one hour, 18% would have to shift by two hours, and 60%, almost 14,000 people, would have to shift three or more hours to find a space available. All of these people would have their daily schedules substantially changed, leading to major individual disruptions at home and in the work place and for the businesses they work for.

Alternatively, some riders might consider working at home, at least some days in the week. The number of people who are able to do this is likely to be small since many of those that can work at home are probably doing it today. Only 3.8% of NJ workers work at home as of 2010, and others do work at home at least some of the time.

But what about the vast majority who cannot move their times or work at home? Their first choice might be to make use of the six trains if these trains were to operate on the lines they use today. They would have to compete with their fellow passengers for the limited seating. If not, they could seek other transit options including existing or new trains to Newark or Hoboken, where they could transfer to PATH, or in the case of Hoboken, to ferries. They could travel by bus to the already overcrowded PABT or they could drive.

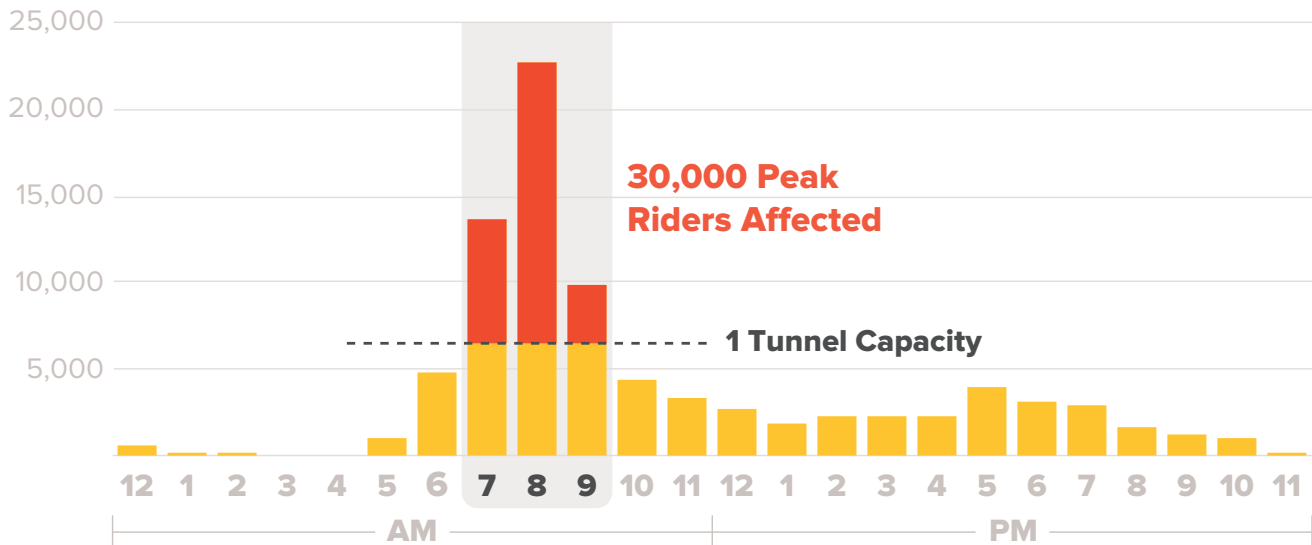
Any of these choices would result in a much poorer trip for the half million people who travel each way across the Hudson each day. For the portion of the 150,000 people traveling to Penn Sta-

Figure 9: The Impact of a Hudson Rail Tunnel Closure



Source: Amtrak; Regional Plan Association

Figure 10: Impact of One Tunnel Capacity on Manhattan Bound Rail Passengers



Source: New York Metropolitan Transportation Council. Hub Bound Travel Data 2012; Regional Plan Association

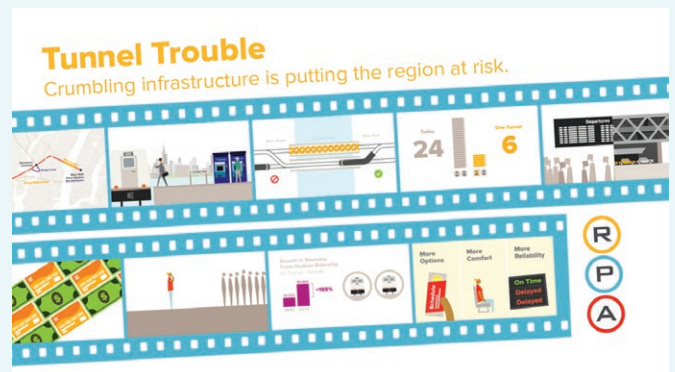
tion each day who are deprived of rail service or who cannot fit on the limited service provided, they would face a more circuitous and time consuming multi-transit trip, resulting in time losses of an hour or more each day. If they chose to drive, their trip would be more unreliable and more expensive. For those who are currently using trains to Hoboken, their trains would be more crowded. If they currently use buses, they will be joined by diverted passengers, worsening the already poor Lincoln Tunnel and PABT experience. And for those now using PATH, crowding would also intensify.

Although this analysis is and should not be definitive as to which rail lines are assigned the precious six trains an hour, a case can be made that the Northeast Corridor trains and possibly the North Jersey Coast line would be the least disruptive choices. But these premium services could be the scene of chaos as passengers swarm to occupy the limited space on trains. The operations on the other lines would revert back to the service they had before the implementation of the three projects that improved their access to Penn Station. In essence, this would be turning the clock back, at least for the duration of the HRT tube closing, to the rail system that existed when NJT took over in 1979. Because ridership has expanded so much, by turning the clock back, the system would no longer accommodate today's riders, and would be particularly ironic and sad for the tens of thousands of people who benefitted from these investments, and disruptive for the many of whom purchased homes to take advantage of these commuting improvements.

Faced with any of these choices, many would choose to no longer work or live in their current locations. Those who continue to work in Manhattan would be on overcrowded trains, switch to a one hour or more a day addition to their commute or shift travel times by two or more hours. Faced with these options, some may change jobs (probably for lower pay) and go to work in New Jersey, with a net loss in income for New Jersey residents

For those visiting New York for the day, they may cancel that visit, robbing them of advantages of living in New Jersey and visiting the City. For those who live in New Jersey and work in New York, they may be without a transit option to reach their job. And employers in New York, faced with loss of access to the New Jersey work force, may move out of the region. In the long run, the loss of trans-Hudson capacity for an extended period would be a profound economic loss for both states.

Watch "Tunnel Trouble: Crumbling infrastructure is putting the region at risk." (October 2015)



<https://vimeo.com/143811940>

A Twenty-Year Plan for Trans-Hudson Mobility

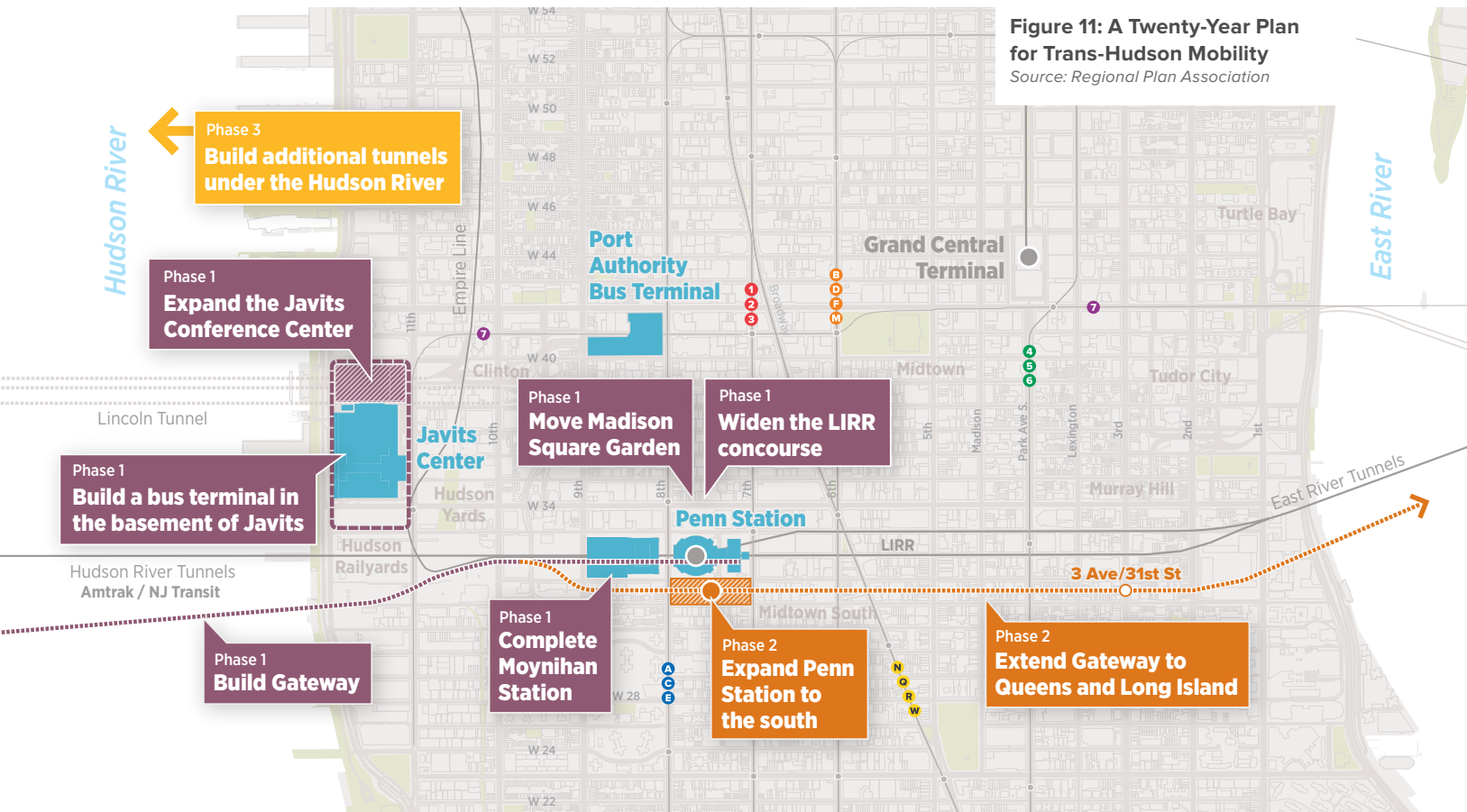


Figure 11: A Twenty-Year Plan for Trans-Hudson Mobility
Source: Regional Plan Association

Transportation across the Hudson River into New York City faces a crisis with several interrelated causes — facilities that are already crowded and over capacity, increasing demand and lack of access and resiliency. Each of the three main trans-Hudson facilities—the rail tunnels that serve all Amtrak and New Jersey Transit trains into Manhattan, Penn Station, and the Port Authority Bus Terminal—are over capacity, experience frequent service failures, and much of their physical structure is reaching the end of its useful life. The most urgent need is to repair the two rail tunnels, which can only be done once new tunnels are built without causing massive service disruptions.

Trans-Hudson travel is expected to increase substantially over the next two decades, creating the need for new capacity well beyond what the existing facilities can offer. Work trips alone could increase by about 25% without needed transit invest-

ment, and could grow by as much as 80% by 2040 with improved transit and land use changes. In addition, the existing network fails to serve many parts of the region, and could be transformed into a much more robust and efficient system. Two problems stand out. Train service from both the west and the east terminates in Manhattan, limiting the destinations that passengers can get to without changing to another train system and constraining the number of trains that operate in periods of peak demand. In many densely-developed parts of New Jersey there is no rail service at all and where it exists service frequencies are often limited. Travel times are slow, resulting in much larger volumes of bus trips than exists from other parts of the region.

Piecemeal solutions have been proposed to address individual problems. The Gateway project would solve the immediate maintenance needs of the rail tunnels and add additional capacity,

but would still be insufficient to accommodate long-term transit demand and limit service options by maintaining Penn Station’s position as a terminus for New Jersey Transit and Long Island Rail Road trains. The Port Authority’s proposals for a much larger Midtown bus terminal would accommodate projected bus passengers, but at a very high cost with major negative impacts in the west midtown neighborhood and without making any improvements in service options. New York State’s current plans for improvements at Penn Station and a new Moynihan Station would improve circulation, amenities and the passenger experience within the stations, but would not be transformative nor provide additional capacity for more service.

Each of these proposals — Gateway, a new bus terminal in Midtown Manhattan, and Moynihan Station — serves a specific purpose, but they fail to address the larger capacity and connectivity challenges facing the region. They haven’t been planned in concert with each other, and they fall short of the region’s long-term needs.

A much better outcome could be achieved through a series of complementary investments that addresses the problems of the system as a whole. These investments can address the inadequacies of the current facilities, create capacity for the economy to grow well beyond existing projections and greatly improve service on both sides of the Hudson River. The investments would be phased to address the most urgent problems first and provide flexibility for the timing and type of future investments.

Phase One: Build Gateway Tunnels and a Bus Terminal in the Basement of the Jacob Javits Convention Center

Construction of two new rail tunnels should begin immediately. At the same time, a second bus terminal in Manhattan can be built in the lowest level of the Jacob Javits Convention Center at a significantly lower cost than replacing the existing Port Authority Bus Terminal. The new Javits terminal could consolidate all intercity buses, taking buses off the streets and freeing up 63 gates at the existing PABT, resulting in an almost 30% increase in gate capacity for commuter buses. This combined with the demand reduction strategies recommended by the Port Authority (see Table 6) would allow the existing PABT to accommodate projected passenger demand to 2040 — the estimated end of its useful life. Some buses could also be diverted to the new Javits terminal, which would provide another option for destinations that could be reached more easily from its location, especially the Hudson Yards. It also creates flexibility and keeps the option of having one or two facilities in Manhattan in the future. This phase could also include a more ambitious overhaul

of Penn Station, potentially moving Madison Square Garden and expanding the LIRR concourse.

Table 6: Summary of Potential PABT Bus Demand Reduction Actions (# of peak hour buses)

Strategy	Buses
Increased Use of Higher-Capacity Buses	15
Holland Tunnel/Lincoln Tunnel Bus Loop	10
Expanded Bus Services to Port Imperial Ferry Terminal	10
Expanded Trans-Hudson Ferry Services	10-20
Expanded Bus Services to the GWBBS	10-30
Increased Use of the Holland Tunnel for Direct Downtown Service	20

Source: *Trans-Hudson Commuting Capacity Study, PANYNJ, 2016*

Phase Two: Build Gateway East with Through Service at Penn South

Instead of terminating Gateway at 7th Avenue, the project should continue across Manhattan, under the East River, and connect into Sunnyside Yards in Queens. Constructing Penn South with fewer, wider platforms and two new East River tunnels would increase throughput at Penn Station by 30% and greatly expand rail service for New Jersey Transit, Long Island Rail Road and Metro North riders. New direct rail service into Penn Station for Bergen and Monmouth counties would reduce travel times and shift bus riders to rail in these under-served counties, relieving highway congestion and pressure on the bus terminals.

Table 7 indicates the impact of phases 1 and 2, including Gateway East, the Bergen loop and the Monmouth/Ocean/Middlesex rail line. It is assumed that these can be in place halfway to the 2040 horizon for the RPA plan, or 2027. For each of the modes (combining commuter rail and PATH), the number of work trips is shown — 2015, 2027 without any transportation improvements and with the RPA proposed improvements in place. The 2027 conditions were based on the interpolated values derived from the RPA land use Vision for 2040. The “no build” condition in 2027 shows the auto trips growing or “unconstrained.” In reality, auto trips across the Hudson (Lincoln and Holland Tunnels) and auto trips down the Henry Hudson Parkway (many from west of the Hudson) have declined in the peak period over the 2005 to 2015 period and capacity constraints make the unconstrained growth unrealistic. Accordingly, the RPA plan alternative distributes the auto trips proportionately across the other modes.

With the RPA plan in place by 2027, the share of trips by rail will grow from 38% today to almost 50%, while bus shares would decline from 33% to 25%. The absolute volume of bus

Table 7: Work Trips to Manhattan (south of Harlem) Across the Hudson River by Mode — 2015 2027 and 2040, RPA Plan

	Year	Description	Total	Rail	Bus	Ferry	Auto
Ridership	2015	Base	301,869	115,487	100,801	8,667	76,914
	2027	No Action	335,791	124,351	97,704	9,641	104,095
	2027	RPA Plan (Phases 1 & 2)	345,476	170,082	87,618	10,862	76,914
	2040	No Action	373,526	139,360	110,178	10,724	113,264
	2040	RPA Plan (Phases 1 & 2)	395,383	202,924	104,193	11,352	76,914
Modal Shares	2015	Base	100.0	38.3	33.4	2.9	25.5
	2040	No Action	100.0	37.3	29.5	2.9	30.3
	2040	RPA Plan (Phases 1 & 2)	100.0	51.3	26.4	2.9	19.5
Percent Growth from 2015 to 2040	2040	No Action	23.7	20.7	9.3	23.7	47.3
	2040	RPA Plan (Phases 1 & 2)	31.0	75.7	3.4	31.0	0.0

Source: RPA Regional Demand Model

trips would decline by 13% going from 100,000 work trips to Manhattan (south of Harlem) to 88,000. Meanwhile rail trips increase by 47%, which can be accommodated by Gateway. The total trips would grow by 14%, spurred a combination of population expansion assumed for the west of Hudson communities and by the improved transit which encourages travel to Manhattan. With these investments, trans-Hudson travel would increase by 31% by 2040. The demand for rail service would grow by an estimated 76%.

underserved communities, and sustainable development patterns for the next century.

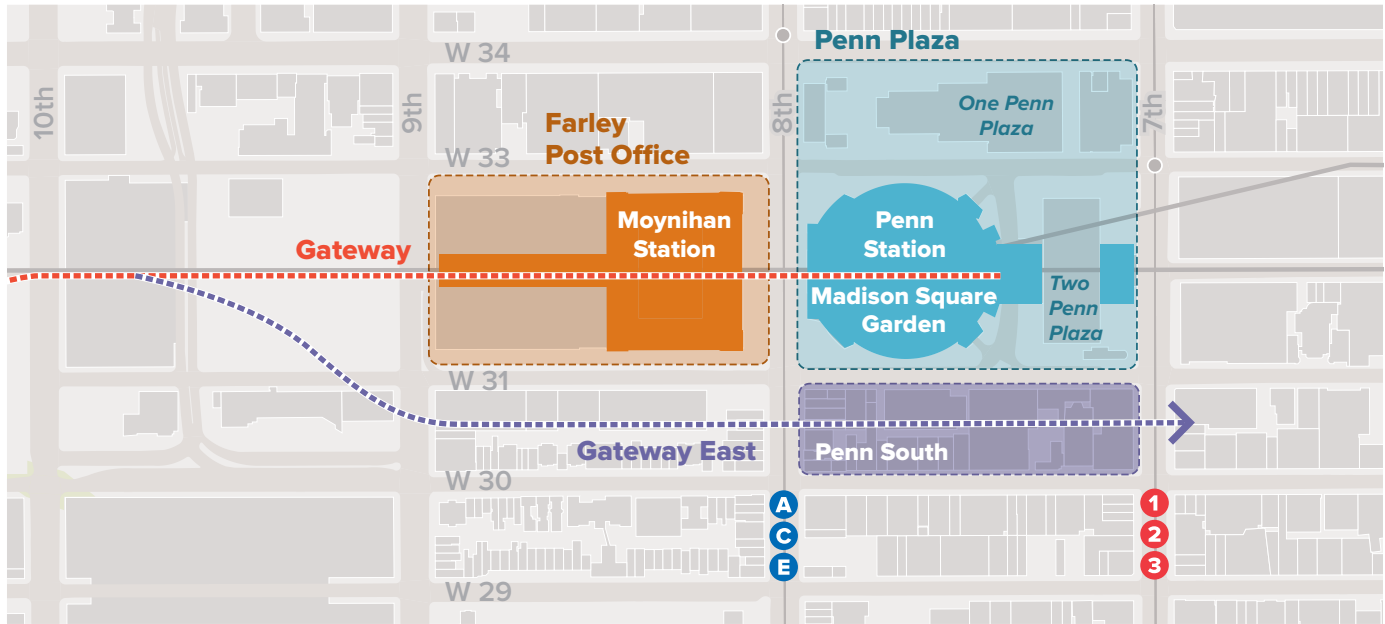
Phase Three: Build New Rail Tunnels to Expand Service and Meet Future Capacity Needs

Phases one and two would likely meet capacity needs for the next 20 years. Beyond then, trans-Hudson demand will begin to surpass combined rail and bus capacity, and the existing PABT will have surpassed its useful life, requiring replacement. While a decision does not need to be made at this time, a better option than replacing the bus terminal would be to construct new rail tunnels between New Jersey and Manhattan. This would provide sufficient trans-Hudson capacity for the foreseeable future, divert more passengers from buses, and eliminate the need to rebuild the 42nd Street bus terminal, since the Javits bus terminal would be able to handle the bus demand from New Jersey. Bus riders would be a far smaller share of the total, and anyone using the existing facility would have much better rail options.

Future phases of the RPA plan for regional rail improvements will be described in *A Region Transformed*, RPA's fourth plan for the New York-New Jersey-Connecticut metropolitan area. These improvements will not only expand trans-Hudson capacity. They will also dramatically improve rail service throughout the tri-state region, creating the circulation system to support a growing economy, greater access to transit and jobs for low-income and

What to Do About Penn Station

Figure 12: Penn Station Focus Areas



Source: Regional Plan Association

Note: Penn Station consists of four levels: the C-level/street-level, the B-level/Amtrak waiting room, A-level/LIRR concourse and platform/track level. There are four main east-west concourses, 7th Avenue/Main Gate, Central, Exit and West End.

Penn Station New York is overcrowded and a dysfunctional collection of fragmented spaces. The concourses and platforms are too narrow; access to the platforms and vertical circulation elements are inadequate. The station lacks basic amenities like legible uniform signage and sufficient space for waiting passengers. There is little to no presence at the street-level and poor pedestrian circulation on surrounding streets and sidewalks. RPA’s projected increase of an additional 72,000 trans-Hudson work trips to Manhattan by 2040 (much higher when non-work added) would only further compound these problems and push the existing PSNY complex well beyond its ability to serve these commuters and intercity passengers.

The Plan

The New York Penn Station is not a single structure but instead a vast complex encompassing a super-block that extends from 34th Street to 31st Street and 7th to 8th Avenues. This is the core of the station, from where all the tracks are accessible. Over the past several years many plans have been proposed to address these deficiencies and also to expand Penn Station’s footprint. Much of the work underway or that has been completed targets

improvements to passenger concourse area and street level, with some limited improvements to the track/platform level. RPA further builds on these proposals, including additional capacity improvement and interventions at the track level. The map below highlights the four areas that are covered in this proposal.

The Penn Station Complex: Four Focus Areas

7th Avenue — Penn Station

A substantial intervention on 7th Avenue is critical to creating a new “front door” for the Penn Station complex. The scheme would create a large indoor-outdoor space centered on 33rd Street, closing part of the street and creating a new plaza that has entrances directly down to a reconfigured A-level LIRR east-west concourse. The reimagined LIRR concourse would be widened and shifted to the north and relocated under the building line allowing for higher ceilings and more light. The new entrance on 7th Avenue would include design cues found in traditional train sheds and create a uniform frontage that extends from 31st Street to 34th Street. The current cramped main entrance

at 32nd Street would also be widened along with the Hilton passageway (which is only 12 feet in wide in some places). This intervention envisions keeping 2 Penn Plaza, a 50-story office building and its many columns that impact circulation on the eastern side of the station. The central concourse would also be extended to track one (and later to Penn South) and widened and the B-level removed on 2 Penn Plaza, reconfiguring the existing NJT concourse to conform with the elevation at A-level.

8th Avenue — Madison Square Garden

Removal of the sports arena and theatre above the central part of Penn Station has been a long-standing position of RPA. There are many reasons that justify this course of action, ranging from security concerns to bringing much needed natural light and air to the lower levels of the complex. Many of the proposals in the past have suggested relocating Madison Square Garden, demolishing the existing structure and building a new head house with retail and office space (tower).

A proposal by Vishaan Chakrabarti and PAU envisions gutting MSG, removing the floors and exterior curtain wall, and keeping just the structural skeleton of the building clad in glass. This intervention, combined with the complete removal of the B-level concourse beneath MSG, would eliminate over 200 columns from the platforms — freeing up more space for vertical access and passenger queuing. This would open up and remove all of the barriers between the tracks and platforms, retaining only the three north/south transverse concourses (7th Ave, exit and central) and two or eventually three east/west corridors (LIRR concourse and Hilton passageway). The transverse concourses would be completely extended across all tracks. The glass curtain wall would be open at street level to provide 360° access to the station, similar to many traditional stations. The 33rd Street plaza would be extended to 8th Avenue.

RPA also envisions extending the elimination of B-level concourse elimination to 7th Avenue to better distribute passengers. The transverse concourses and Hilton passageway would be widened to open up this congested corridor. Additional vertical circulation drops to the platform to reduce queues and long waits in leaving the platform and the impact of reducing distance from upper concourse must also be evaluated. These schemes must be integrated with Penn South to create a unified experience.

West — Moynihan Station

The plans to convert the Farley post-office building to a new waiting area for intercity passengers were proposed by Senator Daniel Patrick Moynihan in 1993. To date, Phase 1 of the project, which extended and widened the existing LIRR western concourse and add new street-level entrances at the corners of the Farley building is complete. Phase 2, which recently celebrated a groundbreaking, will include conversion of the Farley courtyard into the new waiting room with drops to some of the platforms. It's location at the western end of the complex limits the number of platforms that will be accessible from the waiting room. However, the future Moynihan station will play a critical role in freeing up space at the existing Penn Station by becoming a receiving site for many of Amtrak's back-office functions and the

main space for those waiting to board intercity trains. It must also include a passageway to 9th Avenue, even if this improvement occurs before the redevelopment of the Farley Annex on the western half of the block.

South — Penn South Expansion

Amtrak has been studying extending Penn Station south to block 780, between 31st and 30th Streets. The most recent proposal would be a station with approximately 8 tracks and 5 platforms of varying widths (there are several configurations). It would be designed initially as a stub-end terminal with 4 out of 8 of its tracks able to run-through to Queens if two tunnels were constructed further to the east at some point in the future. This hybrid approach will limit the capacity benefits of through-running, which could be as high as 33 trains per hour (similar to other systems such as London's planned CrossRail), and makes it even more unlikely that the tunnels to the east would ever be built. While it is critical that something is done to expand Penn Station's capacity to take full advantage of the two new tubes that will be constructed, the current approach and segmentation of the project makes it unlikely that the tunnels will ever provide their full potential.

RPA Alterations to Penn South Expansion

- ▶ Penn South should be designed with fewer tracks and platforms, which would be much wider than the current proposal. RPA evaluated two configurations, one with 6 track and 3 to 4 platforms and another with two very wide platforms (over 60ft) and 4 tracks.
- ▶ The two new East River tubes to Sunnyside Yards and connecting tunnels through 31st Street should be constructed as part of the Penn South project to enable through-running from day one.
- ▶ A station shell should be constructed at 31st Street and 3rd Avenue
- ▶ Penn South should integrate into the revised PSNY configuration at the A-level concourse.
- ▶ These improvements would increase throughput to as much as 30 to 33 trains per hour rather than 22 to 24 — a 30% increase in capacity.
- ▶ A new southern east-west concourse should be constructed running the length of the extension — bookending the enlarged existing LIRR/northern east-west concourse.
- ▶ Penn South should be constructed to accommodate higher F-plate and H-plate rail cars, with a height clearance of up to 21 feet to enable the operation of freight in off hours. This might require just one track (the most southern) to reach this vertical clearance, but these dimensions should be extended through at least one of the new eastern tube to Queens. This tube should also include a spur that would allow freight trains to access the Lower Montauk line in Queens.

Platform/Track Level Improvements

RPA believes that the following additional improvements should also be taken to increase station capacity, reduce congestion at the platform level and enable through-running regional rail:

- ▶ Widen select existing PSNY platforms (central and southern platforms, eastern LIRR platforms remain the same). This would result in the removal of a number of tracks.
- ▶ Replace escalators with stairs and elevators on the narrowest platforms to allow for greater vertical capacity. Elevators are also better and safer for passengers with luggage and strollers.
- ▶ Maximize vertical circulation, remove B-level and create a uniform A-level across the entire station complex.
- ▶ Remove as much structural artifacts as possible to increase existing platform capacity.
- ▶ Install high-density signaling system in East River tunnels.
- ▶ Create a unified station complex with modern amenities.

The result of these series of investments would be a unified Penn Station complex with modern amenities and the capacity to serve a growing region. New York City and the region would finally have a station that would reflect its status as the economic engine of the nation and gateway to the world. Commuters and intercity riders would finally be treated in a humane fashion, with plenty of space to move around with light and air that will transform Penn Station from a dreary and unpleasant experience to a place to linger and enjoy.

Appendices



Second Avenue Subway
Source: Wikimedia Commons

Agency Profiles

There are ten unique agencies that oversee the New York metropolitan area's complex transportation system: two large transit agencies, one of which also oversees bridges and tunnels (the MTA); a bi-state agency that manages a vast infrastructure portfolio, including the region's airports and ports (PANYNJ); three state DOTs that oversee the majority of roadways and in some cases transit; a city DOT in charge of most of New York City's local surface transportation assets; two toll-collecting highway authorities (NJ Turnpike Authority and NYS Thruway Authority); and a federal for-profit corporation that operates intercity rail (Amtrak). There are also several transportation Metropolitan Planning Organizations (MPO), which were created to help coordinate regional transportation investments and act as conduits for federal funding.

In addition to varying modes and jurisdictions, the agencies also rely on a diverse mix of funding sources and financing mechanisms to support their operating and capital budgets. Funding mostly comes from fares/tolls which are supplemented by additional revenues and subsidies. Additional funds and financing are provided by various local, state, federal and private actors – some outlined below:

1. Local – Municipal contributions through general funds and development (limited)
2. State – Regional taxes and fees; general obligation bonds; general funds

3. Federal – Direct grants; financing, low-interest loans with favorable repayment terms
4. Private – Capital markets, public-private partnerships

Most of the agencies also have the capacity to issue their own debt (bonds), with some having very high credit ratings. Public bonds typically have more favorable borrowing terms than private debt, one of the reasons why public authorities in the region have not typically accessed private markets. However, as the region's capacity to fund projects publicly wanes, the private sector, through public-private partnerships (P3), is becoming an increasingly more attractive alternative.

The following chart summarizes the major features of each institution. The profiles give an overview of each institution, detailing its size, responsibilities, achievements and funding sources.



New York Region's Transportation Agencies Comparison

Agency	Services	Customers	Annual Operating Budget (\$ millions)	Capital Budget (\$ billions)	Revenue Sources	Subsidiaries
MTA	Bus, Commuter Rail, Heavy Rail, Bridges & Tunnels	2,720,000,000	15,800	32 (5 years)	Federal grants; State service contracts/Bond act; State appropriations; City appropriations; MTA bonds; MAC surplus; Debt restructuring	NYCT, LIRR, MNR, MTA Bus, MTA B&T
PANYNJ	Airports, Heliports, Bus, Heavy Rail, Seaports, Bridges & Tunnels	271,939,983	2,900	27.6 (10 years)	Operating revenues, including: tolls, fees, fares, and rental income from facilities	PATH
NJT	Bus, Heavy Rail, Light Rail	254,779,200	2,100	2.1 (1 year, FY 2016)	Federal & State program reimbursements; State operating assistance Fares; Commercial revenues;	
ConnDOT	Roadways, Bus, Commuter Rail	n/a	604		Dedicated taxes and fees; Federal grants and appropriations; State Special Transportation fund (primarily bond authorizations); Local funds (small amount)	
NJ DOT	Roadways	n/a		2.9 (1 year, FY 2016)	State Transportation Trust Fund (TTF); Federal, and third-party resources	
NYS DOT	Roadways	n/a		3.5 (1 year, FY 2015)	Federal aid; State capital project funds; Dedicated taxes and fees deposited in DHBTFF; Significant subsidy from General Fund	
NYC DOT	Roadways, SI Ferry	n/a	900	6.3 (5 years)	NYC Executive Budget funded by: State and Federal grants; Dedicated taxes; Other non-tax revenues	
Amtrak	Intercity Rail	Over 250 million		52.3 (20 years)	Federal appropriations; Fares	
NYS Thruway	Limited access toll roads; Canals	250 million		0.214 (1 year)	Federal funds; NY State Executive Budget; Bond, notes and reserves; Toll revenue	
NJ Turnpike	Limited access toll roads	594 million	486	7 (10 years)	Toll revenue; Concession revenue;	





Metropolitan Transportation Authority

Role

The Metropolitan Transportation Authority (MTA) is responsible for the busiest and most extensive transit network in North America. The MTA's multimodal transit system operates across twelve counties in downstate New York and two counties in southwestern Connecticut, offering service for 15 million residents and the majority of transit riders in the New York metropolitan area.

Today, the MTA is expanding the system again for the first time in over a generation. An extension of the 7 Line from Times Square to the far west side recently opened in September 2015 and two other expansion projects are currently under construction. Phase I of the Second Avenue Subway on Manhattan's east side from 63rd Street to 96th Street opened at the end of December 2016. East Side Access, a new terminal that will provide LIRR riders direct access to Manhattan's east side at Grand Central Terminal, is expected to open in 2022. Yet, unlike over a decade ago, there is nothing significant in its pipeline beyond these two projects.

History

The MTA began consolidation into a state mandated agency in the late 1960s, initially driven by the opportunity to use revenues from MTA B&T to cross-subsidize its public transit system.

During the 1970s and 1980s, the subway system was in a state of decay both operationally and physically. Ridership plummeted with an all-time low of below one billion annual users, numbers the system had not seen since the first decade of its operation. In 1982, the MTA introduced the first Capital Program to improve the assets of each of its subsidiaries. The legislatively mandated MTA Capital Program consists of a five-year plan informed by a 20-year needs assessment that is produced every five years. Through the programs, the MTA has invested more than \$100 billion into its network, bringing about a "transit renaissance" and a spectacular rebound in subway ridership, with a 60 percent increase since 1982.

Governance

Through subsidiaries, the MTA both plans and operates the New York City subway and bus systems and two commuter railroads. New York City Transit (NYCT) oversees 656 miles of subway revenue track (842 total track miles) and upwards of 230 bus routes; Staten Island Railway (SIR) operates the rail line on the island and MTA Bus Company operates another 85 or so bus routes. Long Island Rail Road (LIRR) carries passengers on 11 branches from the dense urban core across 700 miles of track on Long Island. Metro North Railroad (MNR) serves 124 stations throughout seven counties in New York and two counties in

Connecticut. The MTA also oversees some roadway infrastructure with MTA Bridge & Tunnel (MTA B&T) jurisdiction over nine toll-collecting bridges and tunnels within New York City.

Funding

Currently, revenue from MTA B&T covers about 12 percent of the MTA's operating budget. The New York State government oversees the MTA's budget and typically contributes about 40 percent to the budget through state-controlled subsidies and tax revenues. A smaller amount of funds come from local subsidies. Another 40 percent of the agency's operating budget is covered by revenues generated from fares.

The MTA's operating budget is by far the largest of any transportation agency in the region and nation. In 2014, the MTA served a record high 2.72 billion customers. NYCT subway experienced its highest demand since 1948 at 1.75 billion rides and its buses carried more than double the number of riders on the second busiest bus network in the U.S. at 793 million annual passengers.¹ The subway operates express services and runs 24/7, making it one of the most unique systems in the world. However, most of the subway network is over, or close to, a century-old having been constructed from 1904 to 1937 and much of it is in need of upgrade or repair.

In recent years, support and funding have wavered. The MTA has been required to rely increasingly on debt to finance its day-to-day operations and maintenance as well as its capital program. Capital programs are traditionally funded through a combination of revenue-backed debt and direct capital support by federal, state and local partners. Funding for the 2015-2019 Capital Plan only came after over a yearlong debate and political brinkmanship – placing the agency in a funding limbo and delaying projects. There is real concern that the long-term stability of the transit system, along with the ability to serve future ridership is at risk if the current institutional and political environment remains unchallenged.

¹ Metropolitan Transportation Authority. Buses Facts. 2015. Web. <<http://web.mta.info/nyct/facts/ffbus.htm>>.

Port Authority of New York and New Jersey

Role

The Port Authority of New York and New Jersey (PANYNJ) oversees a diverse portfolio of operations and assets across a bi-state region. The majority of PANYNJ’s facilities fall within the Port District, an area of about 1,500 square miles centered on New York Harbor (a region within a radius of approximately 25 miles of the Statue of Liberty). PANYNJ plans and operates a range of transportation facilities including airports, heliports, buses, rail, seaports, bridges and tunnels, as well as manages real estate.

The PANYNJ is responsible for the major gateways to the New York metropolitan region, namely three major airports and the largest port on the eastern seaboard. In 2014, PANYNJ experienced record high volumes at both its airports and ports. The three major airports – John F. Kennedy International Airport, LaGuardia Airport, and Newark Liberty International Airport – carried almost 116 million passengers. The Ports, comprised of six terminals in the New York Harbor, saw 3.34 million cargo containers pass through, which is four percent higher than the previous record set in 2012.

PANYNJ also oversees two smaller airports, six vehicular crossings – two tunnels and four bridges that total 41 lane miles –, two bus terminals and the World Trade Center site. Its subsidiary, Port Authority Trans-Hudson (PATH), was established in 1962 to operate the rail transit system between New Jersey and New York that carried 74 million passengers in 2014.

History

The authority was created in 1921 under a clause of the United States Constitution with the intention of operating outside of the constraints of the political process.

Governance

PANYNJ is jointly controlled by the governors of New York and New Jersey. Each governor appoints six members to the Board of Commissioners for overlapping six-year terms, yet retains the right to veto actions of the members for their governing state. The Board of Commissioners elects an Executive Director who is meant to handle daily operations. Since 2001, there have been six Executive Directors, highlighting the instability of the authority.

Funding

Since the authority does not have the ability to levy taxes, it generates revenue through the collection of tolls, fees, fares and rental income from its operations and facilities.



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New Jersey Transit

Role

New Jersey Transit (NJT) is a state-owned public transportation agency that operates the majority of bus, light rail and commuter rail services throughout the state of New Jersey covering a service area of 5,325 square miles. The NJT public transit network is the third largest in the U.S, carrying 915,900 passengers on average per weekday. Its network consists of twelve commuter rail lines that operate in thirteen counties across northern New Jersey and over 260 bus routes throughout most of the state, both of which provide its riders access to the New York market. NJT also operates three light rail lines that serve five counties.

History

NJT was founded in 1979 as an off-shoot of New Jersey DOT. Over the next five years, NJT acquired a number of private bus companies and Consolidated Rail Corporation (Conrail). These operations were at first organized into three subsidiaries: NJ Transit Bus Operations, Inc., NJ Transit Rail Operations, Inc. and NJ Transit Mercer, Inc. (bus service in the Trenton/Mercer County area). NJ Transit reorganized its structure in 1992, unifying the three subsidiaries and significantly streamlining its operations.

Earlier in its existence, the agency made aggressive investments to improve access to Manhattan by connecting many of its lines to the Hudson River tunnels so its customers would have a one-seat ride to Penn Station. These projects – the Kearney and Montclair connections and Secaucus junction – reoriented the commuter rail system in New Jersey and contributed immensely to the growth in ridership over the past 20 years. The construction of the Hudson Bergen Light Rail in 2000, and its future extensions, also revitalized the waterfront of Jersey City – creating entirely new neighborhoods around the new light rail line.

Governance

NJT is governed by an eight member Board of Directors whose members are appointed by the Governor. However, the Governor has the power to veto board actions. The Board elects an Executive Director and Chief Operating Officer, who oversee the administration and operations of the agency, respectively.

Funding

The New Jersey Transportation Trust Fund (TTF) is the main source of funding for New Jersey transportation projects. The TTF is responsible for funding the state portion of NJT’s capital program. However, the TTF has been stuck in a spiral of debt for decades and is insolvent again. The TTF relies primarily on gas tax revenue. However, the gas tax has remained unchanged at 10.5 cents per gallon since 1989 – 16.2 cents lower than its

neighboring state, New York – and thus does not provide sufficient revenues. Consequently, 95 percent of the TTF’s revenues in 2013 went toward debt service payments.

NJT has looked to other revenue sources to support the maintenance of its system, including steep fare increases. In 2010, NJ Transit increased passenger fares by 22 percent. In October 2015, passengers experienced another fare hike of nine percent on average.



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New York City Department of Transportation

Role

New York City Department of Transportation (NYC DOT) is responsible for the vast majority of the city's surface transportation infrastructure. This includes oversight of 6,000 miles of streets and highways, over 12,000 miles of sidewalk and 789 bridges and tunnels, including the four iconic, toll-free East River Bridges: Brooklyn Bridge, Queensboro Bridge, Manhattan Bridge and Williamsburg Bridge. With these assets comes the maintenance of over one million street signs, 12,700 signalized intersections, over 315,000 street lights and 69 million linear feet of markings.¹ NYC DOT also operates the Staten Island Ferry that serves over 22 million people per year free of charge, requiring a subsidy of close to \$7 per passenger.

Since New York City's streets serve a wide range of users – including drivers, bicyclists, pedestrians, bus riders and truck drivers – all of them need to be taken into account when designing and planning for the city's streets. During the Bloomberg administration, NYC DOT released the Street Design Manual that stressed the importance of design elements such as bus bulbs, protected bike lanes and pedestrian plazas. The current DeBlasio administration continues to stress the importance of safety with the Vision Zero Action Plan aimed to end traffic fatalities.

NYC DOT is also one of the most progressive U.S. DOTs in terms of goods movement policies. The agency maintains a truck route network that covers nearly 10 percent of the city's streets, most of which has been in place since 1981. In 2010, NYC DOT piloted an initiative where over 400 businesses in Manhattan shifted some of their deliveries to the off hours to avoid daytime congestion and parking conflicts. As a result, 40 to 50 daily tours have now shifted to the off hours.² NYC DOT has also been working to develop delivery windows in commercial corridors where adequate curbs space for deliveries is few and far between.

Governance

NYC DOT is run by a commissioner who is appointed by the Mayor of New York City.

Funding

The NYC DOT budget is included in The City of New York Executive Budget. The City's operating budget is funded by state and federal grants, dedicated taxes (property, personal income, general sales, business income, real estate-related and other) and other non-tax revenues. DOT receives less than 2

percent of the City's overall operating funds.³ The City's capital budget is primarily debt-financed with some PAYGO funds. DOT receives about 15 percent of the City's overall capital funds.⁴ NYC DOT also generates revenues from parking meters, parking garages, franchises, concessions and street opening permits.



¹ New York City Department of Transportation. About DOT. 2015. Web. <<http://www.nyc.gov/html/dot/html/about/about.shtml>>.

² New York City Department of Transportation. "Urban Freight Initiatives." 2015. Web. <<http://www.nyc.gov/html/dot/downloads/pdf/2015-09-14-urban-freight-initiatives.pdf>>.

³ New York City's Independent Budget Office. "Understanding New York City's Budget: A Guide." 2013. Web. <<http://www.ibo.nyc.ny.us/iboreports/understandingthebudget.pdf>>.

⁴ New York City's Independent Budget Office. 2013.



The New York State Thruway Authority and New Jersey Turnpike Authority

Role

The New York State Thruway Authority (NYSTA) and the New Jersey Turnpike Authority (NJTA) are the two toll-collecting agencies in the New York metropolitan region responsible for the construction, maintenance, repairs and operations of hundreds of miles of roadways and bridges throughout the two states. Both authorities were created over 60 years ago, NYSTA in 1949 and NJTA in 1951.

NYSTA thruways consist of 570 miles of roadway that connects major cities from the Atlantic Ocean to Canada and the Great Lakes. In 2013, NYSTA saw 250 million customers on its roadways that travelled 7.8 billion miles. Since 1992, NYSTA has also been responsible for operating and maintaining New York State's inland waterway network that consists of 524 miles of canals. The Authority is currently undertaking a \$3.9 billion project to replace the Tappan Zee Bridge.

NJTA owns and operates two major limited-access toll roads that run north-south through the state – the New Jersey Turnpike (part of the Interstate-95 corridor) and the Garden State Parkway. NJTA has owned and operated the New Jersey Turnpike since it opened in 1951, and more recently acquired ownership and operation of the Garden State Parkway when the New Jersey Highway Authority was abolished in 2003. In 2013, NJTA carried close to 594 million vehicles on its 295 miles of roadway.

Governance

Both authorities are governed by a Board of Commissioners appointed by their respective Governor. The Governors do not serve on either Board, but they have the authority to veto actions put forth by their authority.

Funding

Tolls generate a significant amount of revenue for both NYSTA and NJTA. Close to half of NYSTA's funds are typically generated through toll charges; the majority of its remaining funds are generated through bonds, notes and reserves with a small percentage of funds from the federal government (2 percent in 2014).¹ Only 20 percent of the total funds generated are put toward thruway operations; the outstanding funds are used for debt service payments and capital projects.² In 2014, toll revenue comprised 88 percent of NJTA's total revenue.³ Other operating revenue is gener-

ated through E-ZPass fees and concessions. The remainder of NJTA's revenue comes from federal subsidy for Build America Bonds, interest income and art center revenues.⁴



Doug Kerr (flickr)



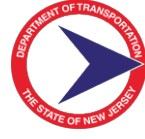
Bobby Hidy (flickr)

1 New York State Thruway Authority. 2014 Budget. 2013. Web. <<http://www.thruway.ny.gov/about/financial/budgetbooks/books/2014-budget.pdf>>.

2 New York State Thruway Authority. 2013.

3 New Jersey Turnpike Authority. Annual Budget. 2015. Web. <<https://dspace.njstatelib.org/xmlui/bitstream/handle/10929/35147/2015-Budget-Final-1.pdf?sequence=1&isAllowed=y>>.

4 New York State Thruway Authority. 2015.



State Departments of Transportation

Role

The three state Departments of Transportation (DOTs) in the NY-NJ-CT metropolitan area serve as the primary means for allocating federal funding for their respective transportation systems. The agencies are also responsible for the oversight and funding of their states' respective intermodal systems. While each state's transportation infrastructure differs, each DOT is involved in the oversight of rail, airport, freight, maritime, bicycle and pedestrian programs and assets to varying degrees.

The significant difference between the three state DOTs is their involvement in public transportation. ConnDOT is the only state agency that manages (through concessions) its railroads and bus networks, including oversight of Metro-North Railroad New Haven Mainline and eight CTTRANSIT districts' operations, as well as funding for Amtrak's Shore Line East system.. ConnDOT supplies most of the capital assets and covers the majority of the difference between the cost of service and fare revenue, while also managing operational contracts.

History

The three state DOTs were each formed in the mid 1960s: NYSDOT in 1967, ConnDOT in 1965 and NJ DOT in 1966.

Governance

State DOTs are run by a commissioner appointed by the state's respective governor.

Funding

Each state is required by federal law to produce a Transportation Improvement Program (TIP) in conjunction with the state's metropolitan planning organizations (MPO). The TIP lays out each area's short-term capital needs within at least a four-year horizon. Each TIP feeds into the larger Statewide Transportation Improvement Program (STIP) that presents the capital investment goals and strategies for the state as a whole. U.S. DOT authorizes federal funds accordingly, requiring that each state DOT obligate all funds in any given fiscal year in order to be eligible to ask for more.

State DOTs capital programs have been historically dependent on federal funding, including Federal Transit, Highway, Railroad and Highway Safety Administrations. In the case of ConnDOT, federal funds have account for 70-80 percent of the capital program. Much of the funding typically comes from Federal Highway Administration (FHWA), resulting in the majority of effort being put toward maintenance and operations of highways and bridges. However, they have seen a recent increase in state investments. This change is likely a result of

the federal government shifting from grants toward financing as well as the insolvency of the Highway Trust Fund.



Amtrak

Role

Amtrak is a public benefit corporation created by the federal government to operate intercity passenger rail city across the United States. Amtrak's two busiest services in the country, Northeast Regional and Acela Express, operate along the Northeast Corridor (NEC) that consists of 457 miles of main line track spanning from Washington D.C. to Boston (Amtrak controls and is directly responsible for the condition of 363 of these miles).¹ Amtrak assumed control of NEC in 1976, serving five major metropolitan areas: Washington D.C., Baltimore, Philadelphia, New York and Boston.

The NEC carries about 260 million passenger trips annually, of which 17.1 million are made on Amtrak.² The corridor sees 2,100 passenger trains and 60 freight trains on some portion of the route per day.³ The remaining trips are made by the eight commuter railroads that operate on NEC right-of-way, including the three commuter rail services in the New York metropolitan area: Metro-North Railroad, Long Island Rail Road and New Jersey Transit. The workforce that utilizes the NEC contributes \$50 billion annually to the national GDP.⁴

The majority of the NEC in the region is owned by Amtrak, although New York State and the Connecticut Department of Transportation operate portions of the line in their respective states. At the heart of this network lie the Hudson River tunnels that feed into Penn Station, the busiest rail station in the country. Penn Station sees over 400,000 daily Amtrak, LIRR and NJT passengers per day, far exceeding its capacity of 200,000 people per day. Not only is the station bursting at its seams, but the tunnels are in critical condition. Amtrak estimates that the tunnels, built in 1910, have less than 20 years of life left in them, which poses serious concerns for the 330 NJT commuter trains (around 150,000 people) and 100 Amtrak intercity trains (around 21,000 people) that travel through the tunnels every weekday.

Funding

In May 2010, a corridor-wide working group whose members represented Amtrak, every state and commuter railroad between Maine and Washington, D.C., as well as freight operators completed an infrastructure master plan for the Northeast Corridor. The Northeast Corridor Infrastructure Master Plan called for \$52 billion capital investments necessary to achieve a state of good repair, improve trip times, and expand capacity

enough to handle projected increases in ridership on existing services through 2030. This estimate includes about \$7.2 billion worth of needs on the Connecticut and New York owned infrastructure assets on the main line and \$960 million worth of needs on the Hell Gate Line. The master plan does not include critical investments needed in the Hudson River tunnels, now estimated at \$20 billion, and the East River tunnels. The NEC Five-Year Capital Plan, released in 2014, builds upon the Master Plan and identified \$21.1 billion worth of state-of-good-repair backlog needs.

The NEC is Amtrak's only profitable market, cross-subsidizing Amtrak's long-distance and state-supported operations. Although NEC operations generated over \$480 million in revenue in FY 2014, these funds were put into a general fund that invests in the entire system, not just the NEC.⁵ Furthermore, Amtrak relies on federal appropriations for operations and capital investments; yet Amtrak has directed less than \$300 million per year from its federal capital grants to NEC infrastructure.⁶ Long-term capital planning is also difficult since the agency does not necessarily know the amount of funding that will be available the next year or the timing of when it will receive appropriated funds.⁷



Chuck Gomez (Amtrak)

1 Amtrak. Fiscal Year 2014 Budget Request Justification. 2013. Web. <<http://www.amtrak.com/ccurl/851/32/AmtrakFY14-Budget-Request-Justification,0.pdf>>.

2 Amtrak. About the NEC. 2015. Web. <<http://nec.amtrak.com/about>>.

3 Amtrak. 2015.

4 Northeast Corridor Infrastructure and Operations Advisory Commission. Northeast Corridor Five-Year Capital Plan Fiscal Years 2016-2020. 2015. Print.

5 Northeast Corridor Commission. Northeast Corridor Commuter and Intercity Rail Cost Allocation Policy: Passenger Rail Investment and Improvement Act as of 2008 Section 212 (c). Amended Dec. 2014. Web. <http://www.nec-commission.com/wp-content/uploads/2012/11/2014-12-17_NEC-Commuter-and-Intercity-Rail-Cost-Allocation-Policy_distributed.pdf>.

6 Northeast Corridor Commission. 2014.

7 Northeast Corridor Commission. 2014.

Peer System Comparative Analysis

There are no accurate, comprehensive, publicly available comparisons of public transit construction costs. To address this deficiency RPA is developing its own comparatives. The first step in this process was to determine what transit systems are the most similar to New York to ensure a more accurate cost comparison. RPA screened dozens of possible cities, focusing on transit systems that were in similar urban and operational contexts as the MTA, including higher population densities, ridership per capita and distribution of regional to metropolitan rail. While most of the domestic transit providers fell short, many international systems met the criterion of operating in a similar operational and land use context. The following is the list of transit systems that made the final cut, four national and nineteen international cities:

1. Los Angeles Metropolitan Transportation Authority (LA Metro) in Los Angeles, California, USA
2. Massachusetts Bay Transportation Authority (MBTA) in Boston, Massachusetts, USA
3. Regional Transportation Authority (RTA) in Chicago, Illinois, USA
4. Washington Metropolitan Area Transit Authority (WMATA) in Washington, District of Columbia, USA
5. Agence Métropolitaine de Transport (AMT) in Montreal, Canada
6. Barcelona Autoritat del Transport Metropolità (ATM), in Barcelona, Spain
7. Berliner Verkehrsbetriebe in Berlin, Germany
8. Consorcio Regional de Transportes de Madrid (CRTM) in Madrid, Spain
9. Directorio de Transporte Público Metropolitano (DTPM) in Santiago, Chile
10. East Japan Railway Company (JR East) in Tokyo, Japan
11. Hong Kong Mass Transit Railway (MTR) in Hong Kong, China
12. Mexico City Department of Planning and Transport in Mexico City, Mexico
13. München Verkehrs Gesellschaft (MVG) in Munich, Germany
14. Public Transport Victoria in Melbourne, Australia
15. Régie Autonome des Transports Parisiens (RATP) in Paris, France
16. São Paulo Metrô in São Paulo, Brazil
17. Seoul Metropolitan Government (SMG) in Seoul, South Korea
18. Singapore Land Transport Authority (LTA) in Singapore
19. Storstockholms Lokaltrafik (SL) in Stockholm, Sweden
20. Toronto Transit Commission (TTC) and Metrolinx in Toronto, Ontario, Canada
21. TransLink in Vancouver, British Columbia, Canada
22. Transport for London (TfL) in London, UK
23. Wiener Linien in Vienna, Austria

Moscow’s Metro and Mosgortrans (SUE) was initially slated for screening but on basic metrics for the commuter, regional and metro services is limited. Additionally, because the Bay Area has over five different operating agencies for rail alone, the highly fractured operations of regional transit in the Bay Area excluded it from screening. Not all of the cities that passed the screening have implemented new capital construction in the past two decades.

RPA is currently collecting data for each of the 23 cities, several of which are likely to be eliminated due to data availability issues. Aside from each exemplar project’s component costs, kilometers of tunnels, stations, fit and finishes, design, project management, RPA also plans to collect and array information for each comparative system’s labor practices which includes information on unionization and work rules as well as permitting and environmental review processes. The goal of this effort is to develop more valid cost comparisons as well as to better understand the cost variations among the projects through rigorous documentation of the costs attributed to each of the project components.

RPA will compare capital projects for costs specific to the project assessment, design and construction phases. Similarities and divergences from the MTA’s capital construction cost drivers will be articulated for each transit system and capital project.



Crossrail
Transport for London
Source: Crossrail Flickr



Silver Line Ext
WMATA
Source: Dulles Metro

Transit Agency

- Barcelona Autoritat del Transport Metropolità (ATM)
- Consorcio Regional de Transportes de Madrid (CRTM)
- Directorio de Transporte Público Metropolitano (DTPM)
- East Japan Railway Company (JR East)
- Massachusetts Bay Transportation Authority (MBTA)
- Los Angeles Metropolitan Transportation Authority (LA Metro)
- Régie Autonome des Transports Parisiens (RATP)
- Seoul Metropolitan Government (SMG)
- Singapore Land Transport Authority (LTA)
- Toronto Transit Commission (TTC) & Metrolinx
- TransLink
- Transport for London (TfL)
- WMATA

Comparative Projects

- Sants-La Sagrera HSR Tunnel
- Madrid Metro Extensions (1995 – 2003)
- Metro Line 3, Metro Line 6
- Tokyo Metro Fukutoshin Line, Toei Oedo Line - Subway Ext.
- Central Artery/Tunnel Project (CA/T)
- Purple Line
- Grand Paris Express
- AREX Incheon Airport Extension, Sin Bundang Line Extension
- Circle MRT Line
- Toronto-York Spadina Subway Extension, Ellington Crosstown LRT
- Canada Line, Evergreen Line
- Crossrail, Jubilee Line Extension
- Silver Line Extension

Glossary

Term	Acronym
ARC	Access to the Region’s Core project
BRT	Bus Rapid Transit
CBD	Central Business District
CEQR	City Environmental Quality Review
DBEOM	Design Build Finance Operate and Maintain
DIA	Denver International Airport
EIS	Environmental impact statement
ESA	Eastside Access
EWR	Newark Liberty International Airport
FWS	Far West Side
GDP	Gross domestic product
HPN	Westchester County White Plains Airport
HRT	Hudson River Tunnels
HS1/ HS2	High Speed 1 / High Speed 2
HVAC	heating ventilation and air conditioning
JFK	John F. Kennedy International Airport
LGA	La Guardia Airport
LORAL	Deutsche Bahn
MTA	Metropolitan Transit Authority
MTACC	MTA Capital Construction

Term	Acronym
NJT	New Jersey Transit
NYCT	New York City Transit
PABT	Metropolitan Transportation Authority
PATH	Port Authority Trans-Hudson
PBN	performance based navigation
PPPs	Public–private partnership
RFP	request for proposal
RPA	Regional Plan Association
RTD	Denver Regional Transit District
SAR	Special Administrative Region
SEQR	State Environmental Quality Review
SLR	Sea Level Rise
TBMs	Tunnel Boring Machines
TEB	Teterboro Airport
TfL	Transport for London
TIFIA	Transportation Infrastructure Finance and Innovation Act
TTF	Transportation Trust Fund
TZB	Tappan Zee Bridge
ULURP	Uniform Land Use Review Procedure
XBL	Exclusive Bus Lane



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HOWARD & ABBY **Milstein**
FOUNDATION

Regional Plan Association is an independent, not-for-profit civic organization that develops and promotes ideas to improve the economic health, environmental resiliency and quality of life of the New York metropolitan area. We conduct research on transportation, land use, housing, good governance and the environment. We advise cities, communities and public agencies. And we advocate for change that will contribute to the prosperity of all residents of the region. Since the 1920s, RPA has produced four landmark plans for the region, the most recent was released in November 2017. For more information, please visit www.rpa.org or fourthplan.org.

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