CASE STUDY: NEW YORK CITY

A Future Platform of U.S. Infrastructure

by Jason Ross

June 6—New York City, the economic, cultural, and intellectual capital of the United States, is an infrastructure disaster! At key choke points in the region's infrastructure network, commuters and travelers pass through tunnels built when the oldest people alive today were born. Continual disruptions plague the overcrowded subway system, which now suffers 70,000 delays per month, compared to 28,000 in 2012. In March and April, major train derailments at Penn Station, the busiest rail station in the western hemisphere, resulted in four days of partial closures, delaying over one million commutes. The planned shutdown of two, century-old tunnels across the East River portends a "Summer of Hell" this July and August, to be followed by the planned shutdown of a key subway line, currently serving a quarter-million passengers, during 2019-2020. Were one of the century-old, cross-Hudson tunnels leading into Penn Station to fail, the quarter-million New Jersey residents they currently bring to New York would be faced with a capacity of 60,000 or less. How could America's greatest city be in such poor condition?

Dan Phiffer

New York City's overstretched subway system serves 5.5 million riders every weekday.

And yet, while New York stands out as a stunning case study, the problems seen there are not unique. They are symptomatic of the profoundly underdeveloped state of infrastructure nationwide, and of the profound errors in thought about infrastructure that have allowed the situation to come about.

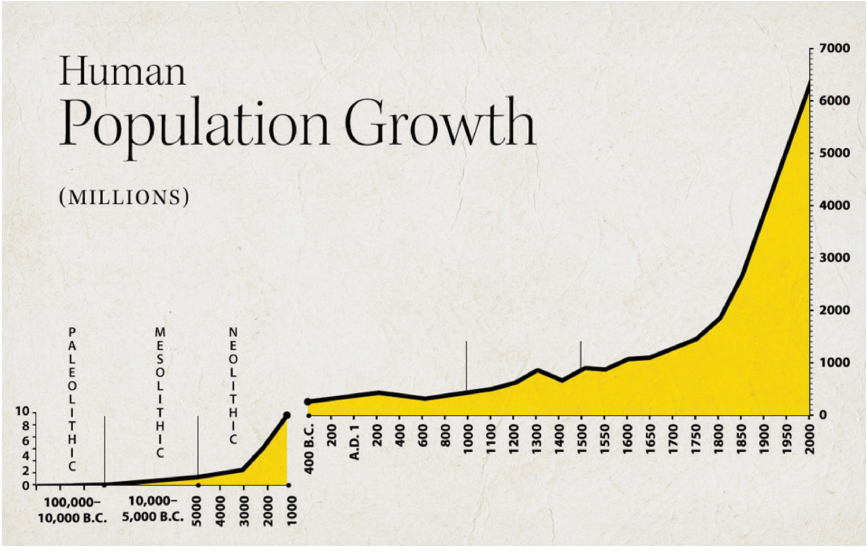
Treating the New York City transportation disaster as a local issue, or even a regional one, would be a grave mistake. Trying to fix one problem at a time, and trying to finance projects on a local or regional basis, would be woefully insufficient, as the current state of affairs amply demonstrates. Instead, we should grasp this opportunity to upgrade our national economic thinking about infrastructure as a platform for higher levels of economic functioning and subsume New York City's needs in a broader context.

Here, we begin by posing answers to overlooked questions about the role of infrastructure in the economy. Equipped with those concepts, we approach U.S. national infrastructure needs in light of international infrastructure developments in China. Finally, we return to New York City, situated in its national and international context, and discuss the necessary next stages of its infrastructure development, looking not ten or

twenty years into the future, but several generations ahead.

The Value of Infrastructure

It is not a surprise that the same economics profession that was oblivious to the coming collapse of the dotcom bubble, the 2007–2008 financial disaster, and the presently looming collapse of corporate debt, is hopelessly wrong about the value of infrastructure. Infrastructure projects are usually treated one at a time, and on a cost-benefit basis. Public-private partnership (PPP) financing is all the rage, with the expectation that private funds can be brought into infrastructure investment, in the hope that income generated by the completed project will be able to directly repay the investment. This approach to the economics of infrastructure is a total disaster, fundamentally failing to assess the true value of infrastructure.[1]



Human population growth over time. If we were merely some type of less hairy ape, our population would never have exceeded a million or two. Not seen in this graphic is the increasing human population potential.

Rather than trying to build up an adequate understanding of infrastructure from components, it is best to begin afresh. To that end, consider infrastructure not as pieces and not only in the present, but as stages of successive platforms for human economic and scientific activity. First, view human history from the economic metric of *population* (rather than, say, GDP):

This change in the population of the human species over historical time reflects a unique characteristic of human beings as a species: the "carrying capacity" or "potential population density" of the human species is not fixed by nature—as it is for all other life—but is changed by the discoveries and practice of the human species itself. The source of this change in human population is our ability to discover principles of nature and of culture, and to implement those discoveries to form communities living at higher physical and cultural standards of living, better able to make the next level of discoveries in the future.

Concurrent with this mental and cultural development comes the transformation of the physical world itself. The importance of "natural" resources diminishes, as human civilization increasingly creates its own resources, liberating new potentials from materials and landscapes that were previously barren or inert—as in the cases of coal, petroleum, natural gas, metal ores, and uranium deposits. The importance of the "natural" state of the landscape fades, as irrigation brings blossoming life to deserts, as roads and canals bring cities and regions closer together, as telegraph wires carry thoughts nearly instantly, and as power lines transform the potential of the area they pass through.

In the words of the great American economist Lyndon LaRouche, writing in April 2010:

> We should then recognize that the development of basic economic infrastructure had always been a needed creation of what is required as a "habitable" development of a "synthetic," rather than a presumably "natural" environment for the enhancement, or even the possibility of human life and practice at some time in the existence of our human species.... Man as a creator in the likeness of the great Creator, is expressed by humanity's creation of the "artificial environments" we sometimes call "infrastructure," on which both the progress, and even the merely

1. Estimates of the U.S. infrastructure deficit range from a $2 trillion gap out of $4.5 trillion required over ten years (ASCE) to $8 trillion as assessed by head of the China Investment Corporation, Ding Xuedong.

continued existence of civilized society depends.[2]

And in September of that year:

> The fact of the matter is, that the precondition for the rise of cultures to revolutionary changes to higher qualities of regions of sustainable, potential relative population-density, depends on virtual leaps in potential relative, human population-density which, in turn, require a higher quality of physical-cultural "platform" within which to operate… In other words, the level of achievable productivity depends upon raising the "platform," through revolutions in infrastructure, on which successful general advances in potential relative population-densities depend. Without those advances in basic economic infrastructure, merely particular technological progress locally applied will fail in attempted performance of the truly vital mission of physical-economic program, failing for lack of the progress in advancement of the quality of the infrastructural platform on which the success of the society as a whole depends.[3]

Considered on the long scale, we think of the platforms of ocean navigation by the stars and of coastal civilizations, of the development of irrigation and moves further inland, of canals and roadways, of the development of the rail transport made possible by the steam engine, of the electromagnetic revolution launched in the 1800s to 1900s, of the aborted potentials of the nuclear era, and of expanding our reach to space.

The *value* of the development of the steam engine and rail transport cannot be measured by adding up savings on freight charges, or the reduced expense of coal for steam engines compared to oats for horses. The value lies in the expanded potential of the human species as a whole, a value that is not captured by adding the components.[4]

Rather than approaching infrastructure projects one at a time to determine whether they would bring back a "return on investment," we must consider our national needs as a whole.[5] In doing so, it is useful to first take a brief survey of the stunning achievements of Chinese infrastructure development in the last few decades.

China

China's explosive growth over the past several decades has brought 700 million people out of poverty and transformed a nation with among the lowest per capita GDP levels in the world, to be an international leader in an expanding array of advanced fields. What lessons can be learned from China's rise, particularly from its transportation infrastructure growth?

China's expansion of its rail transportation network could not be more dramatic. In 1997, when China began to focus on upgrading and speeding up its rail network, the nation's railroads operated at an average speed of only 48 km/h (30 mph). Over ten years, new trainsets and rail upgrades brought the speeds of some lines up to 160 km/h and 200 km/h. In the last decade, China has gone from having no high-speed trains (defined as achieving at least 250 km/h), to being the world leader, with 22,000 km (14,000 mi) installed, more than all of the high-speed rail in the rest of the world combined.[6] This astonishing development of high-speed rail took less time than the typical decade-long planning and approval process for a new highway in the United States. By 2035, China plans to have an eight-by-eight, 45,000-km high-speed rail grid stretching across the nation. Due to the twin difficulties of right-of-way acquisition in developed areas and the need for track to be rela-

2. *"What Your Accountant Never Understood: The Secret Economy"* *EIR*, April 17, 2010.

3. The Economic Past Is Now Behind Us! Money or Credit?

4. In an April 7 presentation at the New York University Tandon School of Engineering, I considered three specific failures of economists to comprehend the value of infrastructure: its incommensurable value, its non-local effects, and the inherently indirect nature of the return on investment. See "The Economic Value of Infrastructure."

5. Consider the proposal to upgrade the Soo Locks at Sault Ste. Marie. Currently, only one of the locks, Poe Lock, is capable of allowing passage for large lake freighters between Lake Superior and the lower Great Lakes. A 2005 study on upgrading the lock system to have a second lock capable of handling these larger ships recommended against its construction, reasoning that the return on investment would only be 75 cents of benefit for each dollar spent. Yet, according to the Department of Homeland Security, the failure of Poe Lock would result in a loss of 11 million jobs!

6. For more on the lessons to be learned from China's rapid development, see Bob Ingraham's article in the June 2, 2017 *EIR*, "Don't 'Repair' the System: Join the Belt and Road Initiative."

Li Chao

By 2035, China plans to have an advanced, top-of-the-line high-speed rail grid serving the nation.

tively straight to achieve high speeds, some of these lines lead to stations outside the most-developed downtown areas of the cities they serve. This provides an opportunity for new growth in these areas.

One stunning accomplishment was the completion of the Beijing-Shanghai High-Speed Railway, a 1,318-km (819-mi) high-speed railway that connects China's two largest cities. Construction began on April 18, 2008, and the line opened on June 30, 2011, just over three years later. Currently, the non-stop train from Beijing to Shanghai operates at an average speed of 300 km/h, and the trip takes less than five hours, compared to seventeen hours two decades ago.

Intra-city rail has also seen tremendous growth. In 1990, only Beijing, Tianjin, and Hong Kong had subway systems. By 2020, forty cities will have subway systems. At present, the top two subway systems in the world, measured in terms of ridership, are those of Shanghai and Beijing.

The next level of rail technology is magnetic levitation. Such trains leave behind the friction wheel-on-rail design altogether, instead being levitated and propelled by electromagnets. The world's first commercial maglev high-speed rail line, which runs at over 400 km/h, was built in Shanghai, by the German firm Transrapid. The line opened for operation in 2004. Since then, China has developed its own domestic expertise in maglev construction, with a low-medium speed line currently operating in Changsha since 2016, and a maglev extension to the Beijing metro system slated to open later this year. As domestic technology further matures, it can be expected that China will be eager to export maglev trainsets.

Moving beyond transportation, consider another economic metric: energy use. Total per capita energy consumption in China has increased five-fold in the past quarter century. Even more dramatic than the overall increase in energy use has been the increase in electricity consumption per capita. Electrical power generally represents a higher capability to accomplish work than other forms of energy, and this value has increased an astonishing *25 times* over the same period. The availability of plentiful energy is an essential component of China's infrastructure platform.

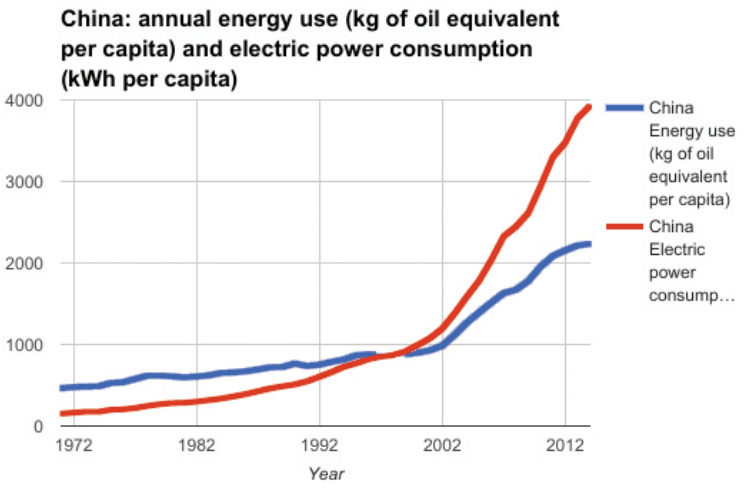
Wikipedia user BayCrest

The domestically engineered and manufactured maglev train in Changsha, China, has been in operation since 2016.

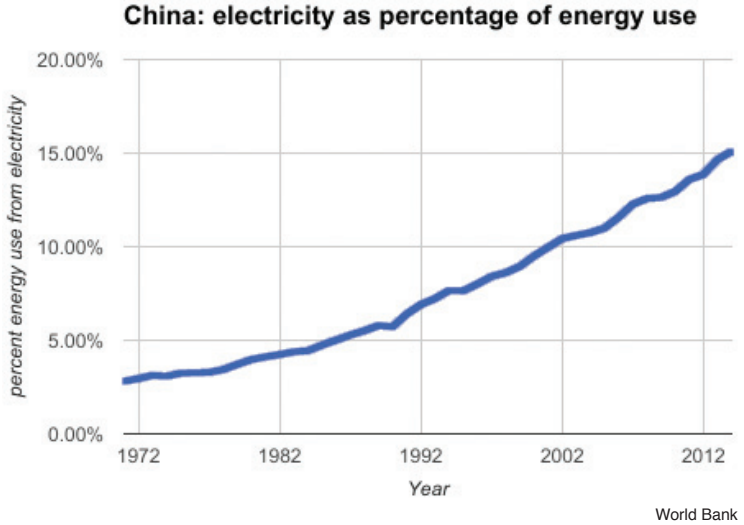
Exporting the Chinese Miracle

Perhaps most significantly, China is now acting to export this economic miracle via the Belt and Road Initiative. This proposal, launched by President Xi Jinping in September 2013, reflects decades of organizing work by Lyndon and Helga LaRouche and their collaborators. Through its own state institutions, and via new international financial institutions, such as the Asian Infrastructure Investment Bank, the Silk Road Economic Fund, and the New Development Bank, China has created the financing and technical potential for a tremendous boom of cross-national infrastructure and business development. Chinese state institutions have lent the equivalent of over $300 billion for infrastructure projects internationally since the Belt and Road Initiative began. Examples of recent international successes are the Addis Ababa-Djibouti Railway (completed in 2016), the Mombasa-Nairobi Standard Gauge Railway project (completed in 2017), and the new Karakoram highway and Gwadar Port (currently under construction in Pakistan).[7]

China stands poised to engage internationally on large infrastructure projects both through its developed technical and manufacturing expertise and base (particularly for rail and trainsets) and through its extensive financing abilities. For example, Ding Xuedong, the chairman of Chinese Investment Corporation, which holds tens of billions in U.S. Treasuries, announced in January that the fund would be eager to invest a portion in U.S. development projects.



World Bank



World Bank

Our National Needs

We must ask "what are the total infrastructure needs for the United States, in the increasingly interconnected world, as viewed several generations into the future?"[8] As we sketch out an answer to this question, there are several categories of infrastructure platforms to consider.

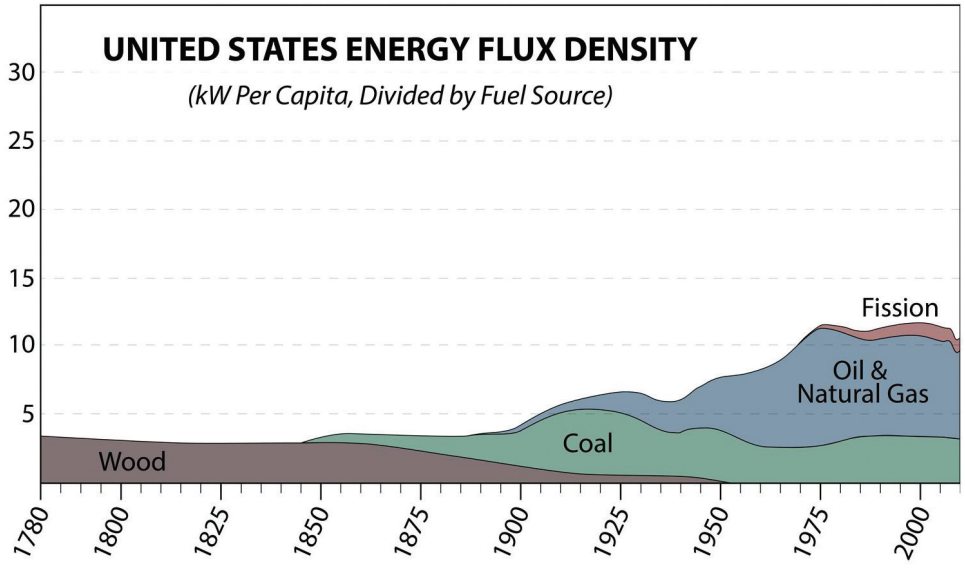
Power and Energy

Through most of U.S. history, power use increased on a per-capita basis, and the source of that power changed. Wood gave way to coal, preserving forests and bringing down the cost of providing power, and making steam engines possible. Coal lost its pre-eminence to fluid hydrocarbons. Nuclear technology, poised to become a major source of power, had an abortive growth. Its spread was sabotaged, preventing it from fulfilling its potential as a higher level of power.

In startling contrast to the overall rise in per-capita power use throughout our nation's earlier history, this

7. Thanks in large part to China-based financing, Africa is leading the world in its rate of new rail development.

8. We emphatically do *not* ask "What can the United States, on its own, afford at present?"



The per-mass energy content of various energy sources. Wood, coal, and petroleum are burned to release their chemical energy. Uranium is made to undergo fission in a nuclear reactor to release nuclear energy, as does deuterium in the process of nuclear fusion. Anti-matter can be converted directly to energy as expressed by Einstein's famous relationship that $E = mc^2$.

value peaked in the 1960s,[9] and has stagnated since, reflecting the shift to a physically less productive economy.

When higher levels of power per capita and per square kilometer can be created at the same relative physical cost to society, the cost for existing applications is lowered, new processes with higher total power requirements become economical, and new physical reactions, associated with new domains of physical chemistry, become possible.

This was seen in the electrochemical revolution, whereby previously inaccessible or enormously expensive materials (such as aluminum) were made a common part of production, and the new principles of electromagnetism themselves replaced the simple motion of the steam engines they supplanted, as in today's computer-controlled machining, electron-beam welding, and electric discharge machining. Just as steam power freed mechanical production from dependence on geography (wind or running water), electricity allows production to be sited anywhere. And unlike steam engines, which require coal on-site to power them, electric motors require only wiring to connect them to power plants.

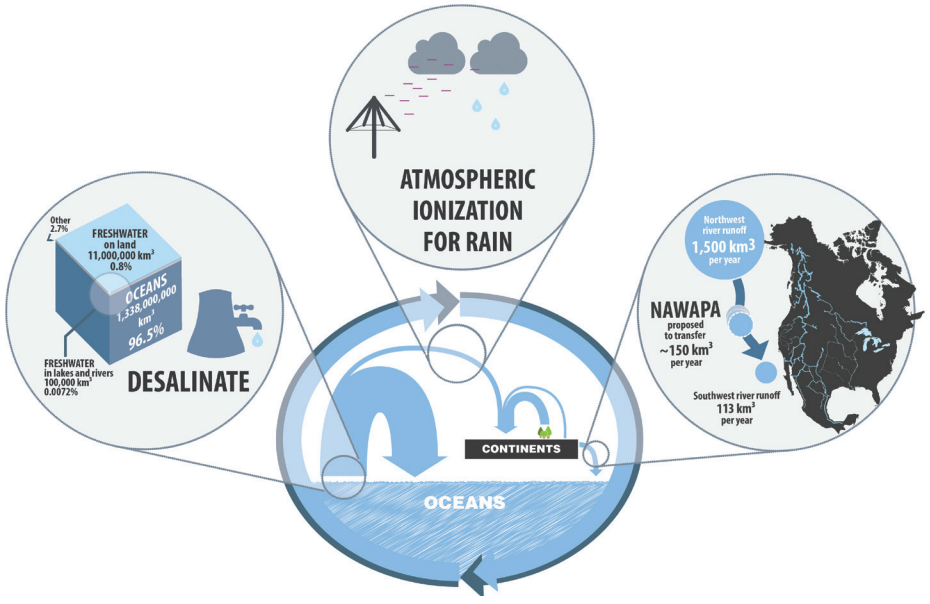
The next level requires a crash effort for the full realization of the long-delayed nuclear economy, starting with mass production of cheaper and safer fourth-generation nuclear fission reactors (including the medium-term development of the thorium fuel cycle), and moving rapidly to the development of nuclear fusion. There is a fundamental limit to the capabilities of physical power sources (such as wind or hydro power) and chemical power sources (such as hydrocarbons). Nuclear forces are inherently five to six orders of magnitude greater than chemical forces, and will be the absolutely essential next stage of power development for the future of the human species. The development of controlled fusion will be the greatest of achievements, comparable to the creation of steam power.

Water

Water is the most ancient among the resources created by human beings, through the irrigation and dams of the ancient past, and through the future potential of large-scale water transfer, desalination, and weather modification projects. By adopting a continental-scale approach, with new technologies and scientific principles at our disposal, we can ensure the North American water cycle provides ample water for growing economic and biospheric needs.

Instead of hoping that rain will fall, we can mimic the cosmic-ray influences on cloud nucleation and improve the weather. Rather than looking forlornly out at the Pacific Ocean while lacking fresh water for human use, we can desalinate seawater. We need not look with powerless dismay at the imbalance of over-abundant water in the Northwest and droughts in the southwestern regions. The grand design of the North American Water and Power Alliance (NAWAPA) would divert

9. During which time the Eisenhower Interstate Highway System was taking shape, the Civil Rights movement was scoring major victories, and the nation was fulfilling Kennedy's goal of sending man to the moon.



Technologies exist to intervene at all stages of the water cycle: desalinating seawater, causing rain by atmospheric ionization, and by rerouting water that has fallen as precipitation, as demonstrated by the proposed North American Water and Power Alliance.

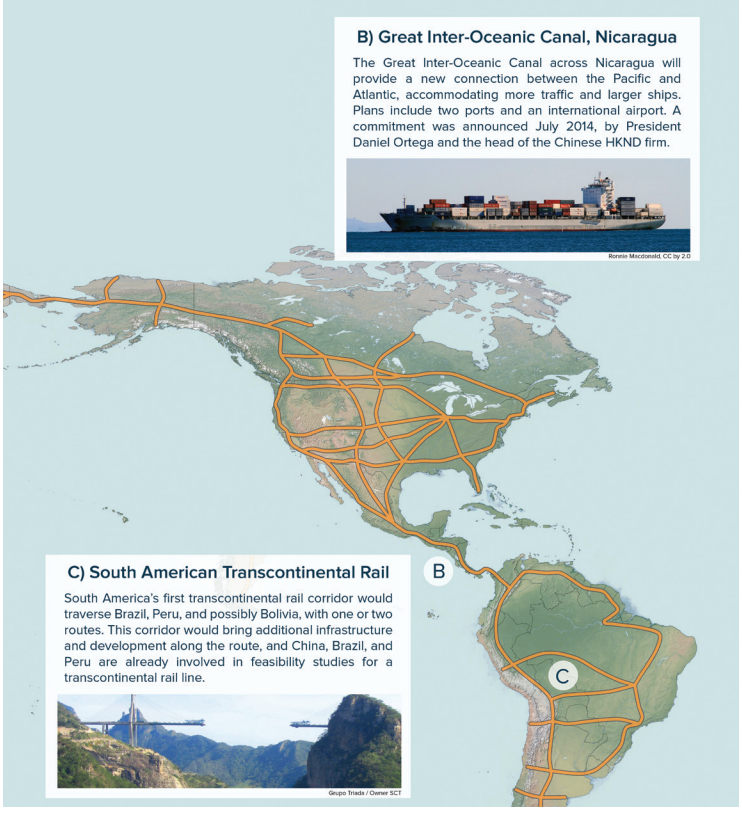
5% to 10% of the abundant freshwater runoff where it is in excess, and transfer it to drier climes.

Existing water shortages and mounting water crises, typified by the conditions of California and the High Plains Ogallala Aquifer, will be overcome, and new territories will be opened for development.

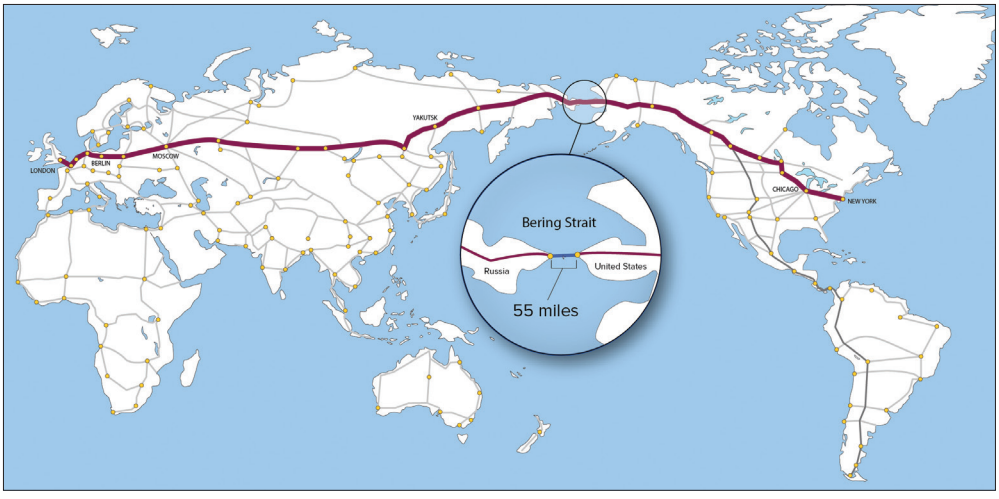
Transportation

A modern high-speed and magnetic levitation rail system does more than increase speed and convenience of transportation: It changes the entire physical-economic space-time characteristics of the economic system. More extensive areas become accessible in less time, ensuring that more diverse population centers, manufacturing capabilities, and agricultural regions can all be economically accessible to the individual or productive process. The nineteenth-century construction of the railroads did much more than make shipping faster and cheaper: it allowed new types of production to occur, made otherwise useless resources viable, and sped the social interchange of ideas and people in the nation. Looking to the future, advanced systems of vacuum tube transport could provide supersonic access between selected regions.

In the full context of the proposed World Land-Bridge, the U.S. transportation network would be connected with other continents: with the Belt and Road Initiative in Asia via Canada and the Bering Strait connection that will link Russia and Alaska, and with Central and South America by building through the Darién Gap. The Bering Strait connection will not only allow the exploitation of the plentiful mineral and other Arctic resources, which are currently inaccessible; it will mean quicker freight transport between the continents, cutting in half the time taken for ocean-borne transportation. Closing the Darién Gap will, for the first time, allow land routes to connect the Americas as a whole. Considered in the context of the new canal across Nicaragua, currently under construction, and the bi-oceanic rail corridor passing through Bolivia as it stretches from Peru to



Examples of Inter-Oceanic and Transcontinental transportation modes in the Americas.



Via an inter-continental connection at the Bering Strait, the United States can directly join the Belt and Road Initiative. By closing the Central-South American Darién Gap, the Americas as a whole can be integrated.

Brazil, the Darién connection can enable a dramatically upshifted level of connectivity and collaboration among the three Americas: North, Central, and South.

Space

Human infrastructure has extended beyond the confines of the Earth for millennia, in the form of astronomical navigation on the seas. In fact, life itself has developed extraterrestrial resource utilization in the form of the shift from the chemosynthesis of early life to photosynthesis, which provides the vast majority of energy for the biosphere today. With the advent of the space age in the mid-1900s, human space infrastructure has dramatically advanced. Satellites and probes provide us with navigation and imagery on the Earth, with knowledge of our heavenly neighbors and insights into the development of the Solar system, and with the expanding potential for further exploration and resource utilization. But we are running against a fundamental limit to our ability to expand our control over nearby space: the limits of chemical reactions.

The problem presents itself in the immense weight of chemical fuel relative to the travel and thrust of a rocket. A typical payload requires over 10 times its weight in fuel. While different space technologies, such as air-breathing first stages coupled with rockets, can improve this to some degree, there is an inherent limit in the potential energy in chemical bonds. Only by moving to nuclear fuels can a new level of space capabilities be reached. A nuclear-powered rocket could fire continuously on a journey to Mars, reducing the travel time from the better part of a year, down to a week or two. As a simple matter of physics, the nuclear bonds of the atom are 100,000 to 1,000,000 times more energetic than the chemical bonds that hold together the molecules that are the basis of chemical fuels.

A century from now, powered by nuclear fission and fusion rockets, mankind's power over nearby space will include the ability to defend against threatening asteroids and comets, the opportunity of making use of resources on the moon and asteroids, and the dramatic potential of mining lunar helium-3 as the ideal fuel for nuclear fusion reactors back on Earth.

A Return to New York

With these categories of infrastructure platforms in mind, return to New York City from a national, international, and extraterrestrial perspective. What will we wish to have done, a century from now, in New York? In 2117, while New York City will continue to play a unique role in the United States, entirely new cities will have been developed in the region, fostered by the new transportation network that will have been built, and the new productive capabilities unlocked by nuclear fusion. In this context, New York's connectivity with the broader region will be dramatically upgraded, and transportation within the city will be far more efficient.

We begin by assessing the current conditions, and then we will consider proposals for future development.

Current Conditions

First, some basics of the infrastructure.

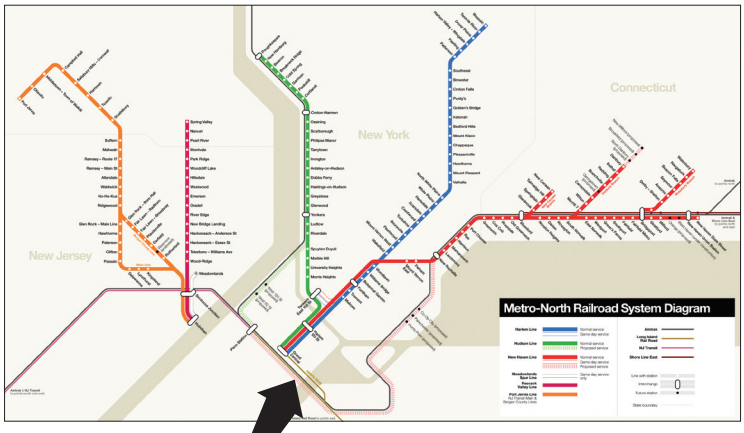
New York's Metropolitan Transit Agency (MTA) subway system comprises 660 miles of customer track; 472 stations (more than any other system in the world), almost all operating 24 hours a day; and an additional 180 miles of other track (such as in rail yards). It currently provides nearly 1.8 billion rides annually, with ridership levels reaching new fifty-year highs.

The Long Island Rail Road (LIRR, owned by the MTA) comprises more than 700 miles of track and 124 stations. It averages one-third of a million passengers every weekday, with major stations at Penn Station, Atlantic Avenue, and Jamaica Station.

Metro-North Railroad (MNR) also comprises more than 700 miles of track and over 100 stations, with its major terminal at Grand Central Terminal, which has 44 platforms, more than any other rail station in the world.

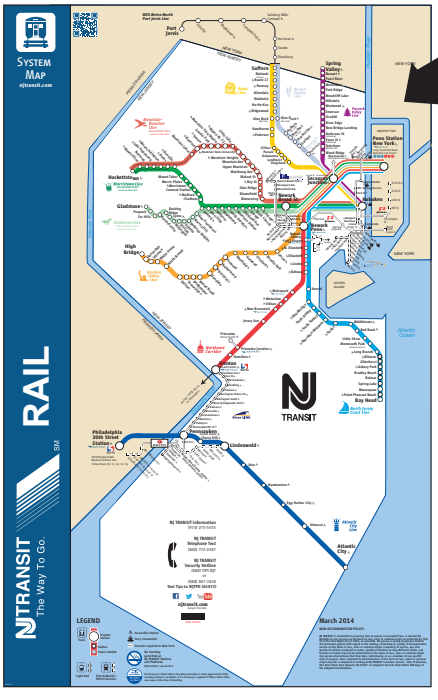
New Jersey Transit (NJ Transit), with 540 track miles, runs an average of 700 trains every weekday. NJ Transit buses benefit from the exclusive bus lane at the Lincoln Tunnel, leading to the Port Authority Bus Terminal, which averages nearly a quarter-million passenger rides per day. On average, 1,850 buses per hour use the exclusive lane during peak commuting time on weekdays, totaling nearly 20 million passenger rides per year. This exclusive bus lane is at full capacity, as determined by the ability to move buses through the Port Authority Bus Terminal.

Metro-North Railroad System

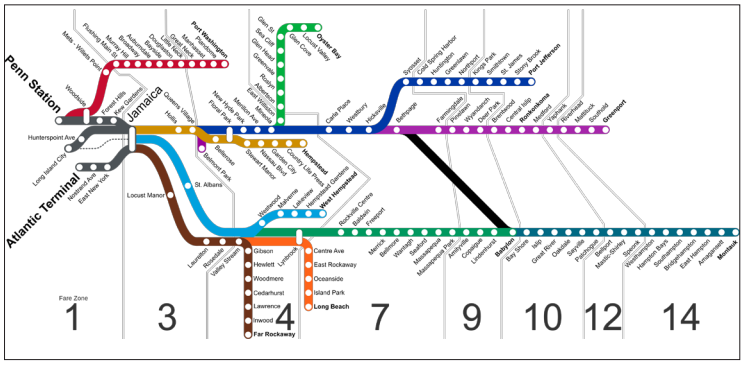


New York City Subway

NJ Transit



Long Island Rail Road



New York City Subway system (left)connects in Manhattan with NJ Transit (lower left), the Long Island Rail Road (below), and the Metro-North Railroad system (above).

Pennsylvania Station, located between 31st and 33rd Streets and 7th and 8th Avenues, serves as a terminal for NJ Transit trains arriving via a dual tunnel under the Hudson River, as a terminal for Long Island Rail Road trains arriving via four tunnels under the East River, and as a station for Amtrak trains. During peak commuting times, Penn Station's 21 tracks service 20 NJ Transit trains, two dozen LIRR trains, and 4 Amtrak trains per hour. These levels are significantly higher than they were one or two decades ago, as more mass-transit commuters are added than car commuters every year. Overall, NJ Transit ridership into New York has tripled over the past three decades, and the growth is continuing. The infrastructure cannot handle these loads.

The Hudson tunnels and the East River tunnels are a century old and in desperate need of repair. This summer, two of the four East River tunnels will be closed for an estimated two months for necessary maintenance, while the only possible respite for the Hudson tunnels would be the building of entirely new Hudson tunnels, allowing the current ones to be closed for extensive maintenance. The major maintenance required on the L Train line, whose East River tunnels were flooded during Superstorm Sandy, will require closing that line for an estimated 15 months over 2019-2020.

Because of differences in power supply (different means of transmission—catenary versus third rail, and different third-rail configurations—and different voltages) and railcar height and width, it is not presently possible to fully inter-operate NJ Transit, LIRR, Amtrak, and Metro-North trains. For this reason, and due to differences among the operating agencies, Penn Station does not currently function as a through-station, which would allow LIRR trains to continue west to New Jersey and NJ Transit trains to continue east. This would require a standardization or double-powering approach, as well as adjustable platforms capable of accommodating different types of railcars. These separate rail lines could be consolidated under a broader regional network.

Two other Hudson crossings exist for the Port Authority Trans-Hudson (PATH) train system: one that crosses from Hoboken, NJ to Greenwich Village and then travels up 6th Avenue to 33rd Street, and one that crosses to Manhattan further south, providing service to the World Trade Center. At present, there is no underground mass-transit connection between the PATH station at 33rd, the MTA subway station at 34th St.-Herald Square, and Penn Station, one block further west.

A significant change to the region's transportation network, scheduled for completion in 2022, is the East Side Access project, the construction of a new tunnel under the East River at 63rd Street to connect the LIRR to additional tracks built below Grand Central Terminal. It is hoped that this would reduce the pressure on Penn Station from the LIRR.

The New York MTA subway system currently serves 5.5 million riders every workday, with the numbers sometimes swelling above 6 million per day. The subway system, relying in places on switch electronics that date back to the Franklin Roosevelt Administration, is an amazing engineering accomplishment of the past, but one that is presently operating far beyond its design capacity and is being pushed to beyond the breaking point. Over one-third of all train delays are due to overcrowding, which lengthens station dwell times and reduces system throughput.

Trains move slowly: Following a 1995 deadly train collision on the Williamsburg Bridge, the entire system has been running at reduced speeds, now averaging only 17 miles per hour. Besides the upgraded L and 7 trains, the entire subway network uses the outdated block-signaling approach for train distancing. The more modern technology, communication-based train control (CBTC), could enable safe operation of trains at closer distances, increasing capacity by up to 15%.

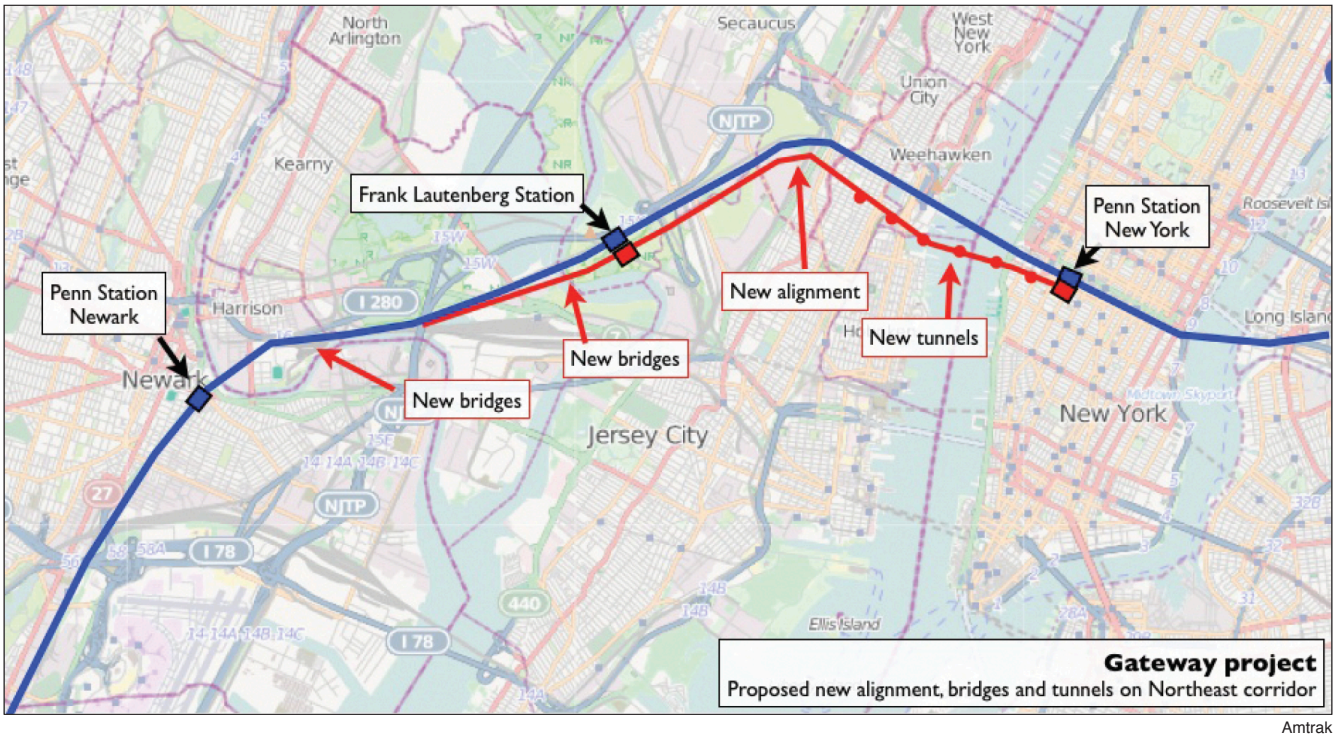
The open nature of the platforms presents additional difficulties. Trash discarded onto the tracks leads to track fires that cause hundreds of delays every year. Similarly, the lack of platform doors between the platform and the tracks makes it difficult to effectively air-condition the stations or to provide safety against falling onto the tracks.

Rail transport from New Jersey to the eastern part of New York is extremely limited. Railcars must either go north and cross the Hudson at Albany, adding nearly 300 miles to the journey, or use the New York New Jersey Rail (NYNJR) float barge, which transports up to 14 railcars each way on its two daily round trips from Jersey City to Brooklyn's 65th Street Rail Yard. This extremely low capacity means that most goods are instead transported by truck. Plans for a rail freight tunnel from New Jersey directly to Brooklyn date back decades.

So much for the present state of affairs of the New York transportation grid. Let's consider proposed improvements.

New York's Future

It must be said outright that it is impossible to satisfy future needs by "fixing" New York's system; the



Amtrak

Amtrak's proposed Gateway Project, which would bring extra rail lines from Newark Penn Station and a Secaucus Loop to Manhattan's Penn Station.

system must instead be re-envisioned from a higher standpoint. In doing so, it is useful to have a sense of the many specific proposals for improvements, proposals made by numerous government agencies and officials, as well as planning and advocacy groups in the New York area. To get a sense of the already ongoing discussion, several of these proposals are discussed here, before we step back to take a larger view of the region from the standpoint of several generations in the future.

Some of the proposals are common-sense upgrades:

• Replace the entire signaling and switching system to the safer and more efficient CBTC technology, discussed earlier. The CBTC upgrade will also require replacing older railcars that are unable to be upgraded to interoperate with it (those purchased before 2000).

• Installing platform screen doors will increase safety, prevent track fires, and shorten train dwell times in stations, increasing throughput. Where space is available for installation of ventilation systems, these also allow for more efficient and effective climate-control of stations.

• At present, only one-fifth of the system's stations meet the accessibility standards of the Americans with Disabilities Act (ADA). While some would be very difficult to retrofit, it is possible to increase this proportion.

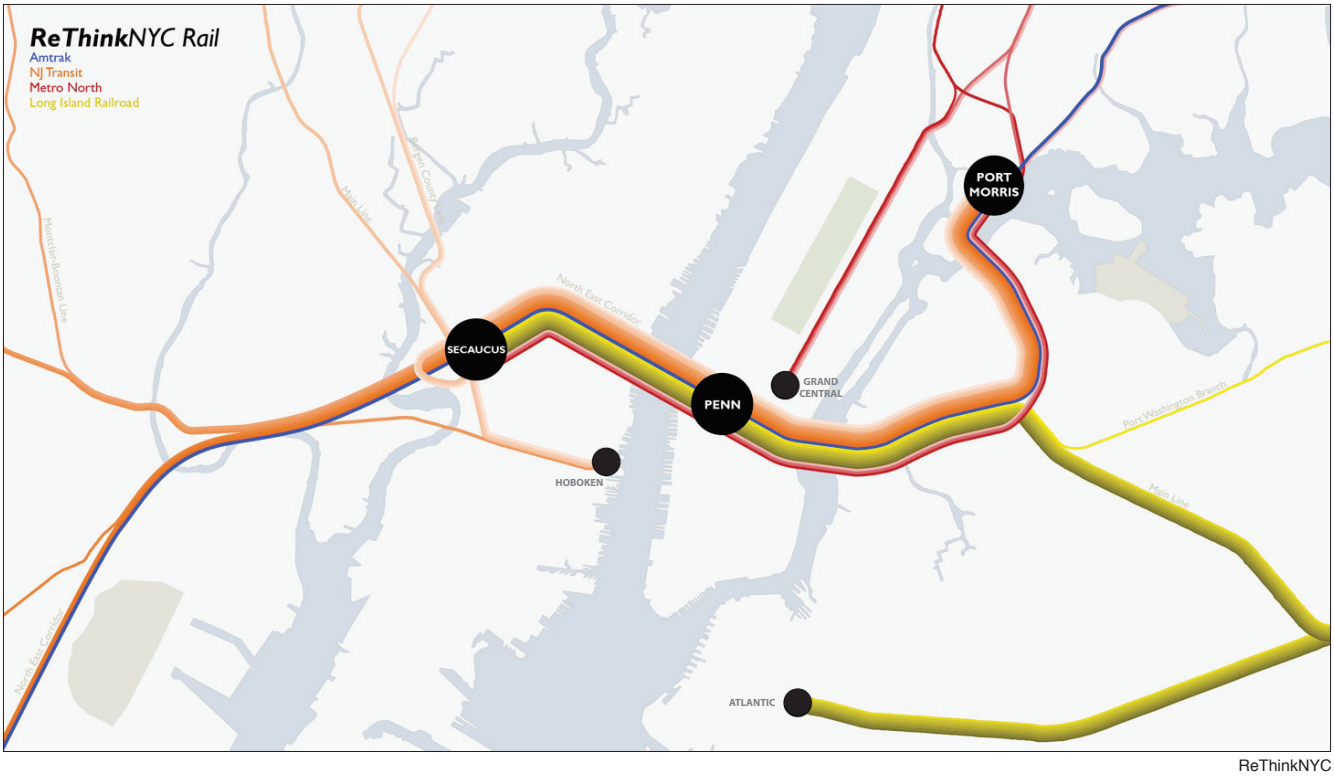
• Upgrading and standardizing the electrical systems of the commuter rail and Amtrak lines will make interoperation possible, and will eliminate the need for Amtrak to maintain dual-system trains (operating on both diesel and electric) for the Empire Line.

The urgent need to increase capacity for trans-Hudson commuters has been addressed in a variety of proposals:

• It has been proposed for years to build two new tunnels to connect to an expanded Penn Station. This is part of the plans of Access to the Region's Core (ARC, construction commenced in 2009, cancelled by New Jersey Governor Chris Christie in 2010), the Amtrak Gateway Project, and proposals by the Regional Plan Association, among many others. This would also involve adding a new connector at Secaucus Junction in New Jersey, to allow passengers to travel directly into New York without having to transfer as they presently must.

• Also proposed is the construction of four tunnels from Hoboken to an entirely new rail terminal in Manhattan on newly in-filled land at 14th Street, connecting to extended L and 7 trains.

• The efficiency of Penn Station can be increased by through-running, and creating new railyards for storage of trains prepared for the commuter rush in the opposite direction in the evening. This could be expanded into a broader regional upgrade with the build-



ReThinkNYC

ReThinkNYC's proposal for how a through-running Penn Station would fit into the City's broader infrastructure network.

ing of expanded and entirely new rail hubs and yards in New Jersey, Queens, and the Bronx, as envisioned by ReThink NYC.

• The 2nd Avenue line, currently slated to reach Harlem, could be extended to the Bronx, as has been proposed since the 1960s, relieving the far-beyond-capacity 4, 5, and 6 lines.

• The region can move beyond the Manhattan-centered approach by building an entirely new Triboro MTA line, connecting the Bronx, Queens, and Brooklyn, as well as providing a denser grid of new lines throughout the City.

Regarding movement of goods, the need for east-of-Hudson freight rail access, which could dramatically reduce the vehicle-miles of truck traffic in the region (by over 100,000 truck-miles per day), has been addressed in proposals by the Cross Harbor Freight Program.

Regional Plan Association

Recognizing the need to move beyond Manhattan-centered transportation, the Regional Plan Association has proposed a new Triboro subway line.

The Cooper Proposal

Dr. Hal Cooper is a rail transportation expert who has developed engineering pro-

MTAß

New York City's Hudson Yards, where the two tunnels from New Jersey enter Manhattan.

posals for, and lectured extensively on large-scale connectivity projects, such as the Bering Strait crossing with required rail connections in the Arctic, and bridging the Darién Gap to connect the Americas. He has served as a key catalyst in the development of the World Land-Bridge. Asked for his input, he has made the following proposals:

1. Build an underground rail connection from 37th Street to 32th Street between the Grand Central Terminal southern spur track in a north-south direction to the east-west main rail line under 32nd Street from the east end of Penn Station to the East River rail tunnel, to provide a direct rail connection between Penn Station and Grand Central Terminal for intercity passenger trains (Amtrak) and local commuter trains (LIRR, MNR, NJ Transit).

2. Make an above-ground rail connection from the rail line on the east end of the East River railroad tunnel from 32nd Street to the southern end of the Sunnyside railroad yard in Queens, to the western end of the Newton Branch rail commuter line of the LIRR, to connect LIRR and Amtrak.

3. Complete the conversion of the Farley Post Office to the west of Penn Station to make it the Amtrak rail passenger terminal, while Penn Station will continue to serve as a commuter rail station for NJ Transit and the LIRR.[10]

4. Build the new Alternative Rail Tunnel (ART) from New Jersey to the north and west of the existing Farley Post Office and Penn Station as previously proposed, to provide four-track rail tunnel access from New Jersey to Penn Station in Manhattan, immediately parallel to the existing two-track tunnel.

5. Then completely refurbish and replace the existing two-track rail tunnel from Secaucus in New Jersey to the west end of Penn Station.

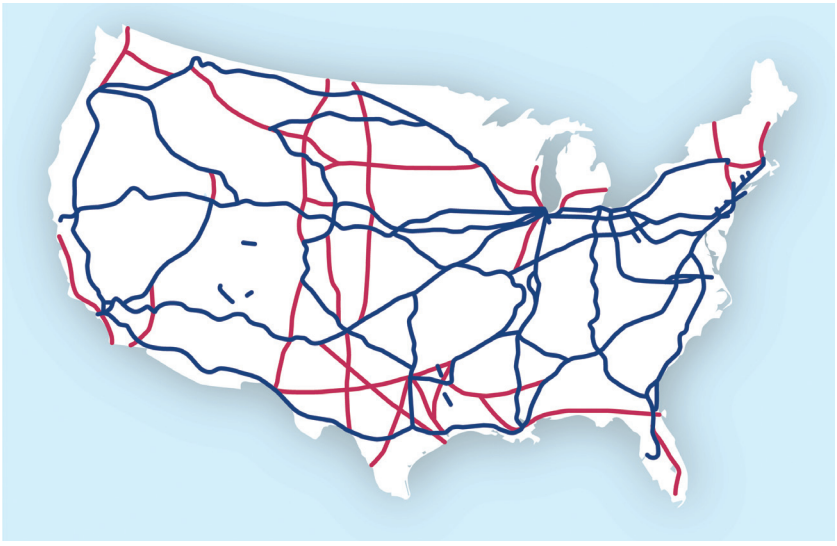
6. Connect the existing PATH commuter rail transit line from Newark, New Jersey's Penn Station to the Newark Airport on the west, to the southern PATH line

10. Currently, the three rail lines using Penn Station (Amtrak, NJ Transit, and LIRR) each have their own concourses, ticketing, and waiting areas, all jammed in the same station.

to the World Trade Center in lower Manhattan, and then to the east to the Brooklyn Borough Hall and the Atlantic Avenue LIRR/subway station, so that a rail connection is possible between Newark and JFK airports.

7. As suggested by New York Governor Andrew Cuomo, build a rail connection (AirTrain) from LaGuardia Airport to the Mets-Willets Point Subway Station, potentially extending the connection all the way to the JFK AirTrain at Jamaica Station, providing a direct link between these two airports.

8. Build the subway connector from Bay Ridge, 95th Street, in Brooklyn under the Verrazano Narrows to connect with the existing Staten Island Rapid Transit (SIRT) rail link to a new Fox Hills station on Staten Island.



Cooper Consulting, *EIR*

Plans for an upgraded national rail network, including high-speed rail.

9. Construct a new freight railroad tunnel under the Lower New York Harbor, between the Greenville Yard in Bayonne, New Jersey, and the Fort Hamilton freight rail spur along the Bay Ridge railroad line through Brooklyn, to connect with the LIRR to transport trucks and other freight to a major intermodal terminal in Brooklyn or Queens.[11]

10. Expand the West Side rail line from the Henry Hudson Bridge in Upper Manhattan to Penn Station in Midtown for direct commuter and intercity railroad passenger service from Upstate New York.

11. Provide loop tracks or passenger train service centers at Secaucus in New Jersey, Woodlawn in the Bronx (MNR), and at Sunnyside Yard in Queens (LIRR).

12. Rebuild and refurbish the MTA subway signaling and communications systems and electrification/third-rail system infrastructure.

Dr. Cooper's proposals will be elaborated in a future article.

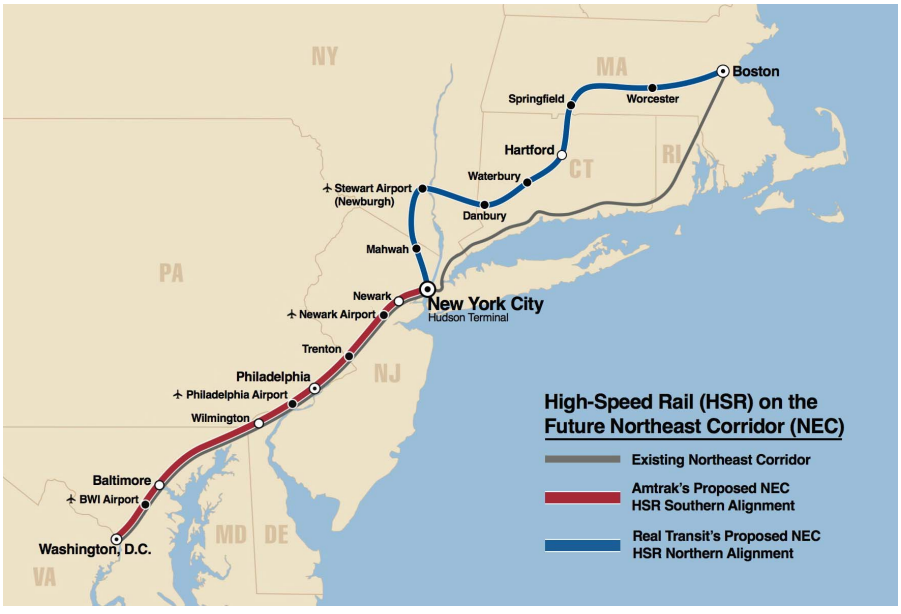
A Broader View

With the currently existing infrastructure and current upgrade proposals on the table, think of New York from the broader national and international context. The population of the United States is now around 320 million. What will it be in one hundred years? The New York Metropolitan region has over 20 million inhabitants. How many will live in the area in a century? The world's population presently stands at 7.5 billion. What will it be four generations from now? The path to the future does not lie in cleaning up and improving a transportation network that was built for a smaller population and a lower level of technology. To try to extend the present into the future is absolute incompetence. Start, rather, from a new, better future.

Resist the temptation to think of future New Jersey, Westchester, or Connecticut commuters reaching Manhattan in order to engage in occupations typical of the present. Instead, imagine travelers from Shanghai coming to New York by rail, stopping along the way to enjoy the Asian and American sides of the Arctic, as well as Chicago and the Great Lakes. Witness a railcar containing precision-manufactured optical components whizz by, as it travels from Brooklyn to Boise, Idaho for use in a new national laboratory there. Experience an integrated region as a whole, whereby the social, cultural, and educational opportunities for residents are dramatically increased by the ease of reaching multiple urban centers. Picture efficient rail lines carrying travelers on all routes less than several hundred miles, at which point accessible airports would be used. See the new cities developed by the confluence of new transportation, energy, and water corridors, their growth based on an upgradable, sustainable network of infrastructure.

In this future, the newly great New York City serves as a major hub, served by a nationwide high-speed or maglev rail network. The new lines built between New

11. Consult the map of the "Cross-Harbor Rail Tunnel."



Real Transit, "Planning for a New Northeast Corridor," October 2014

RealTransit's proposal for a new, high-speed Northeast Corridor would abandon the current right-of-way north of New York City, adopting a new route to allow for straighter, faster tracks and service to areas neglected by current rail.

York and Boston, bypassing the old Northeast Corridor, bring new areas into prominence, and serve as a backbone for the next generation of development. Air travel is a breeze, with rail reducing demand on the City's three main airports, and with the expanded Stewart International Airport in Newburgh, NY (owned by the Port Authority of New York and New Jersey), less than half an hour from Manhattan by smooth and comfortable maglev rail. Future connectivity must be a process of leapfrogging.

While the specifics of future infrastructure are beyond the scope of this report, some principles of infrastructure development can be stated:

• New infrastructure platforms will be built in a way that can have the greatest impact for the future. This may mean building hubs, new universities, and high-speed connectivity in areas that are not currently densely populated. The infrastructure of the future, while planned with today's situation in mind, must emphatically be *for the future*.

• The most productive and densely utilized areas of today may not be the most important areas in the future. For example, the emphasis on connectivity to Midtown Manhattan exists today *because of past investments* in the area. It is Midtown's relatively excellent connectivity to the surrounding areas that has brought about its significant growth relative to the area between it and Downtown Manhattan. New infrastructure will make new centers, and this process should not be avoided! In the past, the location and spacing of cities were determined by both the natural and synthetic environment, by natural geography and by improvements in it, as well as transportation technologies. As we create a new platform of a synthetic, nurturing environment suited to our future needs, we will create new locations for development and entirely new cities.

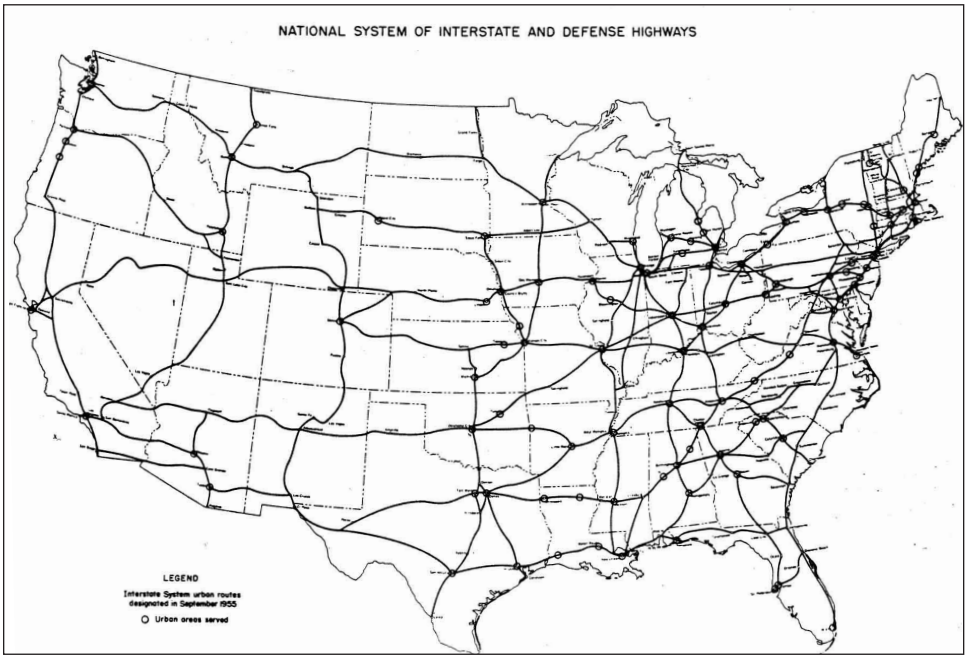
• A process of leapfrogging must be the goal. While unsafe conditions should be repaired, the true vision of a national infrastructure renaissance must be setting the conditions for a qualitatively higher level of productivity for the future. Efficient movement of goods and people in urban centers oriented around productive employment, provided with plentiful and reliable energy and water—this is what is required.

• Higher technologies must be employed. For example, maglev transport is fundamentally superior to wheel-on-rail trains, and should be promoted both for its direct economic benefit, as well as to further research on the underlying technology.

• Government agencies and authorities capable of effective regional planning are required. For example, consider China's plans for the integration of the 100 million-person "Jingjinji" area, linking Bei*jing*, Tian*jin*, and parts of Hebei province (*Ji*). Through rail and roadway connections, and improved connectivity, this entire area will function as a single unit from a broad infrastructure standpoint.

• We require an active improvement in the productivity of the land. Bringing water, power, and transportation to isolated, parched, or otherwise impoverished areas instantly increases the relative potential of the area, making possible further investments in productive ventures and social life.

• Currently dilapidated and unsafe conditions requiring urgent repairs must be addressed. This includes such structures as dams, locks, bridges, levees, tunnels, and any other vulnerable infrastructure whose failure



The Interstate Highway System, as planned in 1955. In 1956, President Eisenhower separated this capital investment from the annual appropriation process, by setting up a special trust fund with a dedicated funding stream.

would have devastating effects.

• International cooperation is essential. At present, Chinese engineering, manufacturing, and financing all play a major role in infrastructure around the world. The United States stands to benefit greatly from U.S.-Chinese cooperation on such projects.

• Projects must be built with their future sustainability in mind.[12]

• A higher platform of national infrastructure must meet the needs of scientific research and of space exploration and settlement.

The best proposals from national, regional, and local perspectives can be developed anew by empowered and energized planning bodies able to count on sufficient credit.

Conclusions for Action

"How will we pay for all of this?" The simple truth is that current funding mechanisms will not work. If they were sufficient, New York, for example, would not be the transportation disaster it currently is. What is required is a national banking approach, whereby financing will not be through short-term appropriations, depending on annual legislative reapproval, but rather by longer term loans and through trust funds with dedicated, non-appropriations based funding. Unlike public-private partnerships, a national bank could properly reflect the indirect returns on such investments. Briefly, through specific taxes (such as an increased gasoline tax) or other revenue streams (in addition to user fees), such a national bank could capture the indirect benefits of infrastructure upgrades and finance long-term projects at reasonable interest rates.

In contrast, the attempt to treat the problem locally, in the context of a collapsing economy, has led to the situation where debt service is nearly as large as the entirety of the New Jersey Transportation Trust Fund's $1.2 billion incoming funds every year, and the MTA is $35 billion in debt. The long-term nature of the projects, and the non-localized, indirect nature of the benefits, demand appropriate means of financing. A national banking approach serves this function.

China's spectacular infrastructure success, fueled by government credit and credit guarantees, shows what can be done, and at what speed it can be accomplished, when there is a national mobilization for its achievement and a financial system that allows credit to flow to productive investments. In the United States, we desperately require the reinstatement of Glass-Steagall to stem the flow of funds into non-productive speculation, and a national credit program to invest in the future, in cooperation with international partners.

The call for $1 trillion in infrastructure investment over ten years, via public-private partnership financing mechanisms, will not work. A national *mission* is required—a mission for a more productive (and *happier*) United States, playing a positive role for the world's future. Under the right leadership, and with a healthy economic structure, the United States has much to offer the world!

12. See Richard Trifan's presentation on "Sustainability Needs of the New Silk Road Infrastructure" at an April 7 Schiller Institute–NYU Tandon School of Engineering event in Brooklyn.

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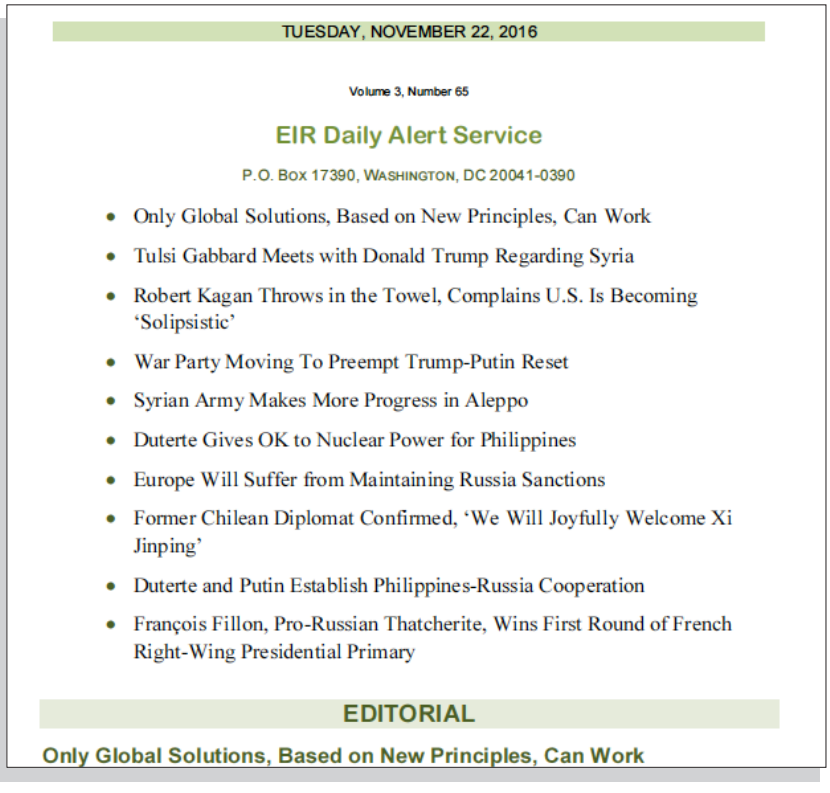

TUESDAY, NOVEMBER 22, 2016

Volume 3, Number 65

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