

THE I³ PLAN

How to Future-Proof a
Generational Investment



**Innovative
Infrastructure
Initiative**

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An Unprecedented Crisis — and the Need for a Smart Response

With COVID-19, the United States has faced an unprecedented crisis. The federal government's urgent priorities are ensuring distribution of vaccines, supporting hospitals and health care facilities, protecting people's health and safety, assisting the millions who are unemployed or struggling, and bolstering state budgets, among other immediate responses. At the same time, even with widespread vaccination and a potential end to the crisis in sight, there will be long-lasting consequences and lessons, and the government recognizes the need for measures that fuel long-term economic growth and create well-paying jobs as we recover.

With a new administration in Washington and historically narrow majorities in Congress, a large-scale investment in American infrastructure could be viewed as a rare nonpartisan opportunity, especially if a relief package harnesses private sector ingenuity and capital — a Republican priority — and focuses on the climate crisis — a Democratic priority. In the near-term, there is an urgent need to support transit systems, airports, ports, and other transportation infrastructure that has been directly affected by the crisis. Taking the long view, broader investment in infrastructure has the potential not only to help our economy recover but also to strengthen critical systems like broadband connectivity and make our transportation, energy, water, and waste networks more resilient and sustainable.

Long-term innovations that make our infrastructure safer, more resilient and reliable, less polluting, and better performing must be a priority, for both the public and private sectors.

Forthcoming federal support for infrastructure should include funding for "Transformative Infrastructure Projects" that are bold, ambitious, and innovative. These projects would not merely represent a modest, incremental change to business as usual, but a significant step in advancing how infrastructure is designed, delivered, constructed, operated, or maintained. Such support would accelerate R&D, development, and funding for ambitious, groundbreaking infrastructure projects that raise our quality of life.

I. An unmet need, amplified by crisis

COVID-19 is having a devastating impact on U.S. mobility infrastructure.

The COVID-19 pandemic is creating unprecedented stress for U.S. mobility infrastructure. Road traffic may not fully recover until the first quarter of 2024.¹ Airports are still emptied out, with passenger volumes down by around 60%.² Transit agencies have severely curtailed or suspended services in light of 60-100% declines in ridership.³ The pandemic has disrupted worldwide supply chains and U.S. freight transportation networks.

While government acted to stem near-term losses, COVID-19 will have a lasting impact.

The CARES Act was a bold and quick response, providing badly needed funding for airports, transit agencies, and related industries. Unfortunately, the longer-term effects of the pandemic's disruption are only beginning to be felt.

For the public sector, this means assets that usually contribute to general funds (such as municipally owned airports) may need relief precisely when municipal operating budgets are strained by the combination of severe declines in farebox and sales tax revenues, plus additional COVID-19 related costs. While access to municipal lending markets is expected to ensure ongoing solvency, the depletion of general funds may compromise transit agencies' ability to maintain service levels and capital budget plans. The federal government plays an important role in infrastructure through funding, financing, economic, safety, and environmental regulation, and the tax code, and it has a unique opportunity to support a transformative response, though solutions need to be carefully tailored rather than one-size fits all.

For the private sector, the pandemic has put stress on capital structures that are incompatible with the "new normal," while traditional capital markets are shut. Depressed revenues (combined with elevated leverage levels pre-crisis) are prompting transportation companies to take emergency cost-containment measures, such as reducing headcount, cutting maintenance, and deferring growth to conserve liquidity. Ratings downgrades will push more companies into non-investment grade territory, where capital markets are currently shut, and borrowers generally face higher-cost and riskier financing. Even as vaccines potentially become available, economic uncertainty, coupled with potentially long-lasting shifts in behavior, will require further investment to right-size capital structures.

¹ [Global Toll Roads May Not Recover Until 1Q24](#), Fitch Ratings, September 22, 2020.

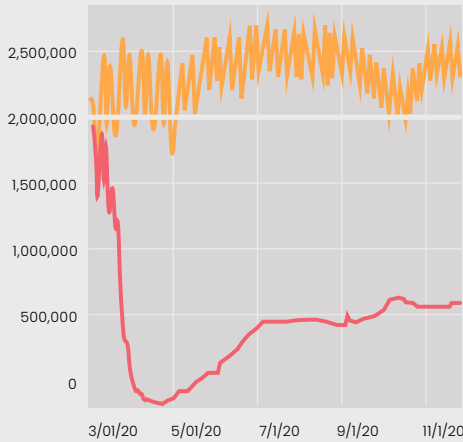
² [TSA checkpoint travel numbers for 2020 and 2019](#), Transportation Security Administration, accessed on November 16, 2020.

³ [COVID-19 trends impacting the future of transportation planning](#), Transportation Research Board, September 8, 2020.

Distress spurs declines in transportation industries

Weekly U.S. Air Travel Throughput
Passengers

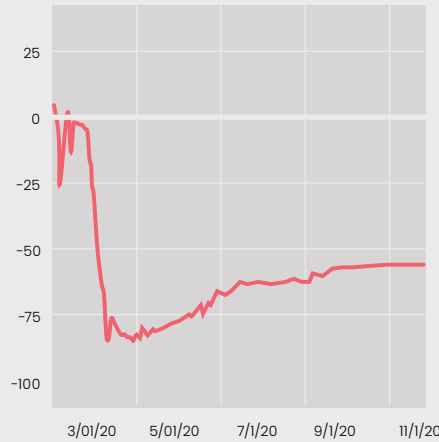
63% decline versus same period
2019 2020



Transportation Security Administration, [ISA checkpoint travel numbers for 2020 and 2019](#), accessed on November 16, 2020.

Transit Travel
New York County

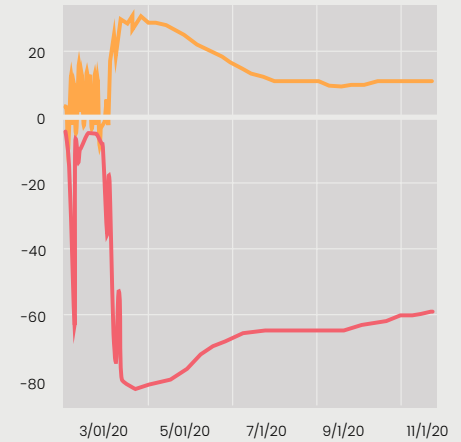
52% compared to baseline
Transit Station Visits



Google, [COVID-19 Community Mobility Reports - New York](#), November 16, 2020.

Visits to Home and Work
New York County

+20% compared to baseline
-55% compared to baseline
Residential Workplace



Google, [COVID-19 Community Mobility Reports - New York](#), November 16, 2020.

COVID-19 is highlighting the strategic importance of digital infrastructure.

The massive shift to remote work and school almost instantaneously altered the location, timing, and flow of broadband demand, straining wireline and wireless networks built around different usage assumptions. Evening peaks have shifted to mid-day; voice traffic has risen significantly; wifi and data demand are surging; and video game play is up 75%.⁴ Usage will decline once the near-term crisis ends, but not to pre-pandemic levels. The “new normal” envisions more working, learning, and shopping from home – and much more bandwidth consumption.

Basic access to broadband must now be seen as an essential utility, much like electricity, and perhaps even a public good. Notably, public education, a core tenet of our democracy and civic society, cannot be delivered equitably without equitable broadband access. Yet even today, millions of American students are falling behind their peers as schoolwork becomes increasingly digitized; a trend that COVID-19 has dramatically accelerated and highlighted. The digital divide is metastasizing into a public education failure that could permanently set back an entire generation of low-income students. Residents simply cannot engage economically, civically, or socially without widespread, affordable, and consistent broadband access. Schools, libraries, municipal agencies, and businesses likewise suffer with inadequate connectivity.

⁴ [Verizon delivers network reliability during COVID-19 while accelerating 5G deployments](#), Verizon, June 2020.

The digital divide is too often narrowly framed as a rural dilemma, when in fact cities large and small suffer from chronic network access problems. Of the 18.4 million American households who have neither in-home nor wireless broadband subscriptions, more than 75% are in urban or metropolitan areas.

A historically weak energy market risks imperiling our transition to sustainable energy sources and forms of mobility.

Energy consumption has dropped significantly with the decline in commercial and industrial activity, reducing electricity prices across the U.S. And in response to geopolitical events and the massive drop in air and vehicle travel, oil prices have witnessed significant volatility and fallen significantly. Low power prices risk decelerating investment in renewable and distributed energy and efficiency measures – including the transition to electric vehicles – needed to decarbonize the U.S. and mitigate greenhouse gas emissions. Notwithstanding these developments in the global energy market, we must continue demonstrating climate leadership in the U.S. by aggressively investing in cleaner and more resilient forms of energy and transportation.

COVID-19 is impacting infrastructure systems that were already under invested.

Even before the pandemic, U.S. infrastructure was already under significant pressure, with climate change resulting in more frequent flooding and fires, increased density causing congestion and pollution, and badly needed maintenance chronically deferred. The global pandemic has added to the strain of decades of under-funding. The need for capital intervention is now more acute as owners and operators of infrastructure assets face mounting financial pressure.

II. The need for innovation

As Congress and a new administration consider a major infrastructure investment, they must ensure that we do not pour capital into maintaining assets that are fast-becoming obsolete, and must avoid perpetuating the status quo of burdensome, lengthy processes required to implement outdated infrastructure assets. Instead, we have a unique opportunity to “future-proof” this generational investment in infrastructure by encouraging and rewarding transformative infrastructure projects and applying technologies that will drive growth, resiliency, efficiency, and sustainability.

An opportunity to prioritize transformative infrastructure.

Infrastructure is a priority for both political parties and of significant importance to constituencies of all types throughout America. The current moment in time presents Congress and the new administration with a unique opportunity to promote a new wave of transformative infrastructure to unlock long-term growth and achieve better outcomes. Congress should prioritize the next generation of technology-enabled infrastructure by providing critical funding and regulatory support.

Infratech Innovations

RESILIENCY
SUSTAINABILITY
SAFETY
AFFORDABILITY
CONVENIENCE
ACCESSIBILITY

	INNOVATIONS	OVERVIEW	MEETING KEY OBJECTIVES	RESILIENCY	SUSTAINABILITY	SAFETY	AFFORDABILITY	CONVENIENCE	ACCESSIBILITY
CROSS-SECTOR	ADVANCED ANALYTICS	Digital twin Complete virtual representation of a physical asset.	Enables reduced project cost and timelines, optimized operations in real-time including maintenance, and improved flexibility / resilience for future scenarios.	High	High	High	High	High	High
		Security for IoT and edge devices AI-based cybersecurity solutions to detect and respond to threats more rapidly and effectively than conventional systems.	Improves safety and resiliency of infrastructure assets against cyber attacks, which could cause costly disruptions.	High	High	High	High	High	High
TRANSPORTATION AND MOBILITY	TRANSIT	Fixed bus route replacement Fixed, static bus routes replaced with app-based, dynamically routed, smaller vehicles aggregating passengers.	Improves service quality, accessibility, rider experience, and overall operating costs versus traditional bus transit, particularly in low density areas.	High	High	High	High	High	High
		Mobility-as-a-service solutions and supporting infra Platform of multi-modal infrastructure that integrates customer experience across multiple transportation modes seamlessly.	Improves passenger experience, transit time, and potentially costs, and enables policy goals on safety, accessibility, etc. to be tracked.	High	High	High	High	High	High
	ROADWAYS & HIGHWAYS	Dedicated lanes for CAVs Dedicated lanes for connected & autonomous vehicles (CAVs) incorporating physical and digital infrastructure needed for safe and efficient operations at scale.	Improves road safety, congestion, and emissions, and provides a potentially lower capex alternative to light rail transit systems.	High	High	High	High	High	High
		Intelligent traffic management Hardware and software that controls flow of traffic, adapting in real-time to achieve specific policies.	Enables management of mobility grid easily and efficiently to optimize and track policy objectives.	High	High	High	High	High	High
		Dynamic pricing and advanced toll payments Dynamic usage- and congestion-based pricing enabled by state-of-the-art payment systems.	Advances EV infrastructure including new revenue models to replace the gas tax shortfall for road infrastructure due to electric vehicle (EV) proliferation.	High	High	High	High	High	High
	PARKING	CAV depots Upgraded parking assets to include infrastructure required for CAV operations depots, ghost kitchens, emergency medical centers, or edge computing resources.	Provides necessary infrastructure to enable technology-enabled reuse of parking to improve the resiliency and sustainability of a given asset.	High	High	High	High	High	High
FREIGHT & LOGISTICS	Autonomous trucking Self-driving EVs optimized for movement of goods and the associated infrastructure required for scaled deployment.	Helps to significantly increase road safety, decrease congestion, and improve energy efficiency / emissions.	High	High	High	High	High	High	
CONNECTIVITY & COMMUNICATION	WIRED	Fiber Despite not being a recent innovation, fiber broadband is not an option for most Americans today and there is a large "digital divide."	Provides fast and reliable internet access, is the digital backbone for many infrastructure innovations, and is an important national strategic asset.	High	High	High	High	High	High
	NETWORKING SOFTWARE	Next generation networking and connectivity Digital connectivity and computing as a digital utility. Software and cell nodes / hardware for 5G cellular wireless inc. small cell makes wide area networks.	Provides ubiquitous connectivity and edge compute with lower connectivity costs, optimized use of resources, and improved network resiliency with no single points of failure.	High	High	High	High	High	High
SUSTAINABLE ENERGY	ELECTRIC GENERATION	Small, modular nuclear reactors Fission reactors significantly smaller than conventional reactors.	Allows for less on-site construction, increased containment efficiency, heightened nuclear materials security, and lower capex.	High	High	High	High	High	High
	DISTRIBUTED ENERGY	Advanced storage and flow batteries Innovations including duration of discharge, useful life, energy density, charging speed, and use of non-flammable materials.	Reduces grid costs, improves reliability and resiliency of the grid, enables integration of renewable energy sources, and reduces overall energy emissions.	High	High	High	High	High	High
		Distributed energy resource management and load automation Software and hardware to integrate distributed energy resources with intermittent and unpredictable generation profiles.	Enables scaling distributed energy resources (for energy, capacity, and ancillary services) while improving grid operations, increasing sustainability, safety, reliability and resiliency of the grid.	High	High	High	High	High	High
	ELECTRIC VEHICLES	EV smart charging Charging infrastructure to support proliferation of EVs, including use of EVs as grid assets for frequency regulation, balancing, and more.	Mitigates range anxiety associated with EVs and helps to advance sustainability goals associated with vehicle electrification. Brings reliable capacity for grid performance, sustainability, and reliability.	High	High	High	High	High	High

■ HIGH IMPACT
■ MEDIUM IMPACT
■ LOW IMPACT
■ NOT APPLICABLE

Innovation means approaching established challenges with novel ideas and technologies to achieve positive outcomes.

Revitalizing existing infrastructure assets is vital to U.S. economic well-being. But only focusing on what already exists fails to meaningfully improve quality of life. “Business as usual” approaches, having scored a “C-” on the 2021 American Society of Civil Engineers Infrastructure Report Card,⁵ do not address paradigm shifts driven by rapid technological advancements and are a Band-Aid solution. Commuters are spending hours a day in traffic congestion. Sustainable energy efforts are lagging and are further threatened by volatility in energy markets. Health services and broader social infrastructure are stretched. And the performance, safety, and resiliency of digital infrastructure are facing stress under the current “work from home” paradigm, which will likely have lasting effects beyond the present crisis.

Innovation is often confused for creativity. Innovation does not mean simply imagining novel, flashy ideas; it requires connecting new ideas and approaches to real-world execution. For infrastructure to be innovative, it must provide essential services — energy, water, sanitation, connectivity, and mobility outcomes — and technology means we no longer have to accept that there are tradeoffs between improved sustainability, affordability, access, safety, and convenience. Innovation also means making those essential systems more reliable and resilient to future systemic shocks, such as climate-, cyber-, or health-related events.

Finally, innovation means changing the way we act: how we develop, build, finance, operate, and maintain infrastructure. We must break down silos within sponsoring agencies, plan for the entire lifecycle of an asset, and use new payment structures that reward actual performance, not assumed performance. As challenges rise, so does the opportunity to address them using emerging capabilities.

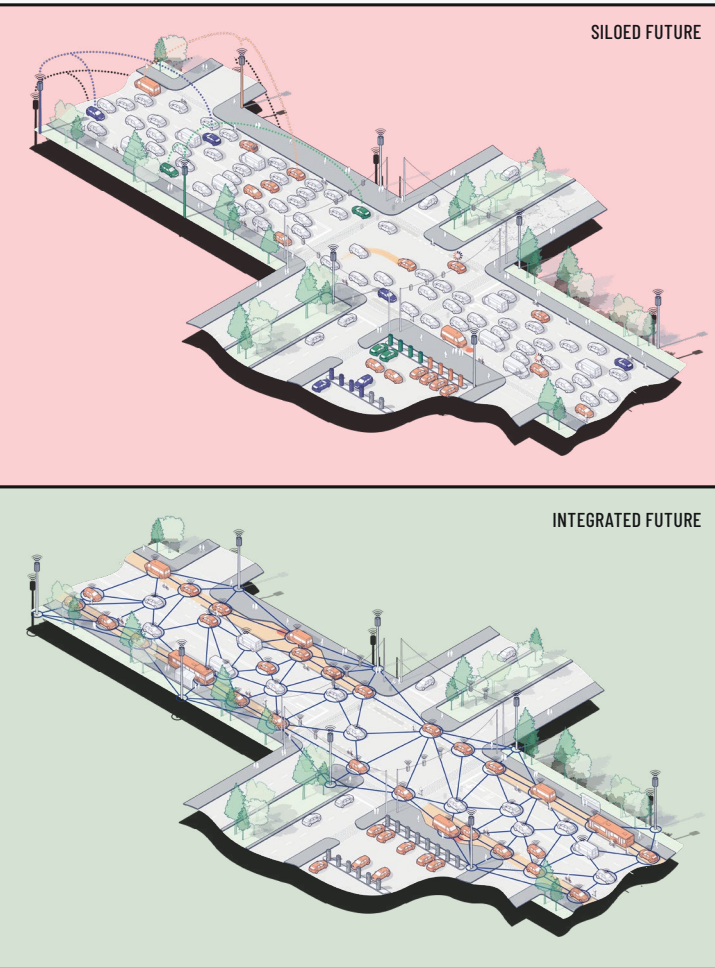
The need for innovation is most urgent in mobility, energy, communications, and digital infrastructure, which are most stressed by the crisis.

Congress and the new administration have an opportunity to proactively tackle the most critical challenges we face at a transformational scale. The COVID-19 crisis has demonstrated the pressing need to revitalize infrastructure in three areas: (i) revitalized and improved mobility; (ii) sustainable and resilient energy systems; and (iii) national broadband connectivity.

Revitalizing and improving transportation infrastructure provides a clear set of addressable assets.

Longer-term mobility investments that improve safety, congestion, accessibility, affordability, and sustainability can be achieved only with a dedicated focus on innovation. For example, instead of ignoring the long-term structural decline of traditional transportation revenue sources, deficits in the Highway Trust Fund, driven by divergence in vehicle-miles-traveled and gas taxes, could be solved using technology to implement usage-based pricing that treats electric and gas engine vehicles equally. Furthermore, to address declining bus ridership, fixed low-ridership routes could be replaced with smaller-form-factor, dynamically routed vehicles that aggregate passengers with similar origins and destinations. Dedicated lanes for connected and autonomous vehicles, incorporating transit options, state-of-the-art tolling, and key communications technologies, would reduce

⁵ [2021 Infrastructure Report Card](#), American Society of Civil Engineers, March 2021.



traffic congestion while improving road safety and rider experience.⁶ We have an opportunity to take the lead in connected and autonomous vehicles, the promise of which can save tens of thousands of lives each year, reduce congestion, and improve transportation access for millions. Emerging mobility and shipping options, including micromobility and unrelia**m**anned airborne vehicles (i.e., drones), should be explored. Finally, advanced sensing could enable traffic signals to adapt in real time to accidents or school drop-off schedules, or prioritize high-rider public transit vehicles.⁷ Some of these innovations are already being deployed – but not at a scale that is truly transformative, and not in a welcoming regulatory environment.

Sustainable and innovative energy systems can incorporate additional solar and wind energy to reduce emissions, while maintaining or lowering costs.

Innovation will drive long-term sustainability of traditional utility systems – such as our energy, waste, and water infrastructure. In particular, while many cities and states have committed to sustainable energy targets, delivering climate-positive electric and thermal grids to residential and commercial end users is extremely challenging. Deploying distributed energy resources, such as batteries, innovative demand response, and renewables gener-

ation, can help address these goals but requires technology and business model innovation to become viable at scale. For example, we must develop electric vehicle smart charging to manage the peak demands that electric vehicles might place on the electric grid. Those same electric vehicles can be transformed into distributed energy resources by deploying bi-directional charging infrastructure and associated control software, thus improving grid reliability and reducing greenhouse gas emissions. And, with distributed grid assets and intermittent renewable energy resources, scaled deployment of distributed energy resource management systems (DERMS) would ensure that the grid is well-balanced at all times.

Connectivity is essential and requires additional build-out.

Upgrading our digital infrastructure should be a top long-term strategic goal. And improving connectivity addresses the digital divide, a key equity issue in underserved and low-income areas. The spread of connectivity, in particular 5G, enables Internet of Things (IoT) devices that increase efficiency and reduce operating costs for infrastructure assets. Additional elements – fiber backhaul for 5G and rural deployments, as well as edge computing infrastructure – improve capacity, accessibility, and resiliency. Edge computing makes possible 5G’s bandwidth and latency promises, while also reducing backhaul traffic, improving network reliability, and providing resiliency against distributed denial of service (DDoS) attacks and other cyber threats.

6 Impact of dedicated lanes for connected and autonomous vehicles on traffic flow throughput, NHTSA, Automated Vehicles for Safety; Lanhang Yea, Toshiyuki Yamamoto, December 2018.
 7 The technology that could end traffic jams, FHWA, Adaptive Signal Control Technologies; BBC, December 2018.

In addition to much-needed proposals for a significant federal investment in nationwide broadband, cities have the opportunity made available by their public asset portfolios to work with technology and implementation partners to develop shared, neutral host broadband infrastructure. By rationalizing the disparate deployment models on a single resource-efficient infrastructure, cities can deliver broadband to previously underserved areas by transforming the economics for the service providers and thereby create an open platform on which incumbents and new market entrants can competitively deliver services.

Cross-sector innovation will deliver lower costs, enable preventive maintenance, and advance sustainability, resiliency, and affordability.

Some transformative technologies cut across the sectors of mobility, energy, and digital infrastructure. For example, digital representations of assets can unlock the true value of connected and technology-enabled infrastructure. “Digital twins” enable a complete understanding of infrastructure systems in real time, making it possible to optimize resource use and operations; predict, prevent, and respond to changes; and design and build assets faster and more economically. Similarly, predictive maintenance technologies, which use advanced sensors and algorithms to predict and prevent costly disruptions in infrastructure operations, can improve safety and reliability of critical systems, while also reducing downtime costs.

These examples and those in the table “Infratech Innovations” (Pg. 5) represent a fraction of proposed innovations to transform transportation and mobility, energy, and connectivity. Investment in transformative projects should engage the broadest range of ideas; the most promising should be piloted and scaled. While many will be first-of-their-kind infrastructure projects, and some will not fully scale, by sharing risk with the private sector, governments can significantly reduce exposure. Ultimately, successful projects will serve as blueprints for national scaling. To jump start this process, Congress and the new administration should acknowledge that existing structures are not conducive to creating transformative infrastructure projects, and that we have a remarkable opportunity to change that.

III. Shared goals inform policy responses

Innovation in infrastructure has the potential to transform how we travel every day, power our workplaces and homes, connect to each other, and provide the basic services that enhance quality of life. But unlocking this potential requires a fundamental change in how we deliver, finance, and operate infrastructure, beginning with reforms to existing programs to encourage innovation, and over the longer-term, developing durable structures and programs.

The U.S. should consider an **Innovative Infrastructure Initiative “I³” Plan** that will accelerate **“Transformative Infrastructure Projects.”** Under this proposal, innovative, ambitious, and groundbreaking projects applying novel technologies to achieve valuable policy objectives will constitute Transformative Infrastructure Projects and thus qualify for treatment pursuant to an **I³ Plan**. These projects should

receive priority funding and financing, faster approvals, and flexibility to experiment (as described in Section IV below).

At a moment of historically narrow majorities in Congress, this proposal draws on the best ideas from a range of infrastructure proposals, from nonpartisan experts to major plans put forward by both parties, and all of these plans have a common theme: it isn't simply about spending more, it is about targeting funds to unlock the most impactful innovations. There are versions of the core proposal – supporting transformative projects – in the infrastructure plans put forward by both the current administration and President Biden. Former President Trump's ["Legislative Outline for Rebuilding Infrastructure in America,"](#)⁸ and President Biden's ["Investments in Our Infrastructure to Plan to Invest in Middle Class Competitiveness"](#)⁹ respectively call for \$20 billion and \$40 billion in public funds for transformative projects. Both the President's plan and House Democrats' 2020 ["Moving Forward Framework"](#)¹⁰ support expanding innovative infrastructure financing proposals, such as the Transportation Infrastructure Finance and Innovation Act (TIFIA) program.

The nonpartisan [Brookings Metropolitan Policy Program](#) calls for "major infrastructure reforms to address transformative economic, social, and environmental changes," including "build[ing] a new foundation for how the entire public sector, but especially the federal government, approaches infrastructure policy... and fostering innovation around technology, procurement, and permitting."¹¹ [Mayor Michael Bloomberg](#) calls for forthcoming relief legislation to include modernizing America's infrastructure to "reduce traffic congestion, cut pollution and carbon emissions, improve resiliency, and spur new economic opportunity, including by extending broadband to communities that don't have it." The [World Economic Forum](#) argues that "infrastructure is the only way to fight a COVID-19 recession in the US" and calls for a data-driven approach to close America's 30-year gap in infrastructure investment with the rest of the world.

Additional precedents are drawn from proposals by the [American Enterprise Institute](#), the [Center for American Progress](#), and the [Roosevelt Institute](#), as well as campaign proposals by the new [Secretary of Transportation Pete Buttigieg](#), [Senator Elizabeth Warren](#), and [Senator Bernie Sanders](#).

The proposal for the I³ Plan for Transformative Infrastructure Projects will achieve critical goals.

This proposal aims to ensure that we develop future-proofed, nonpartisan proposals that have the potential to establish a decades-defining investment in infrastructure. This proposal is intended to:

1. Achieve national goals in safety, sustainability, and resiliency, and improve quality of life:

Beyond the present crisis, infrastructure is central to achieving key national goals. Innovations such as connected and electric vehicles, distributed energy, and ubiquitous connectivity can drastically reduce accidents, make the built world more sustainable and resilient in the face of climate change, and improve convenience, accessibility, and quality of life.

2. Develop an actionable pipeline of impactful projects that create well-paying jobs as we

recover: Infrastructure projects take time to develop. While no one can put a date certain on the length of this recovery, we expect that our lives and livelihoods may still be recovering years into the future. By investing in early-stage research related to Transformative Infrastructure Projects, catalyzing initial planning and development, and speeding procurement and approvals, this proposal seeks to create a pipeline of actionable, impactful projects that will create well-paying jobs when we need them most.

8 [Legislative Outline for Rebuilding Infrastructure in America](#), The White House, February 2018.

9 [The Biden Plan to Invest in Middle Class Competitiveness](#), Biden for President, accessed in November 2020.

10 [Moving Forward Framework](#), House Democrats, January 2019.

11 [To fix our infrastructure, Washington should start from scratch](#), Adie Tomer, Joseph Kane, and Lara Fishbane, Brookings Institution, December 2019.

- 3. Accelerate projects throughout their lifecycle:** Barriers to innovation exist at every stage of an infrastructure project's development and delivery. There is limited appetite for funding basic R&D. Procurement processes often limit the scope of proposed innovations. Projects can take years to move through the permitting and approval process. And existing grant and financing programs are limited in their mandate or approach to underwriting risk. This proposal will accelerate Transformative Infrastructure Projects throughout their lifecycle, from research through planning and development to execution.
- 4. Surface the best ideas to future-proof infrastructure and set replicable precedents with a data-driven approach:** The systems and structures we adopt today will last decades. Accordingly, it is critical to build flexible infrastructure that can incorporate technologies we have not yet implemented, as well as those we have not even imagined. The I³ Plan for Transformative Infrastructure Projects will catalyze the future-proofing of investments for expected improvements in technological capabilities and provide nationally replicable precedents demonstrating the power of innovation to improve infrastructure. We should use a data-driven approach, drawing on real-time data like traffic congestion and wind speeds, to prioritize and accelerate the most impactful projects.
- 5. Unlock additional private sector funding to share risks:** Emerging technologies inherently involve greater risk and uncertainty than traditional ways of building and operating infrastructure. Taxpayers and the public should not bear the brunt of that risk. By scaling programs that encourage Transformative Infrastructure Projects to leverage private capital, this proposal expands the scope of funding sources for a range of infrastructure projects. We should commit to extensive transparency in data on performance, achievement of outcomes and goals, and rigorous reporting of results.

IV. Policy proposals addressing our unmet need for infrastructure innovation

In the near-term, our proposal would prioritize and accelerate funding and procurement from existing federal infrastructure programs to rapidly catalyze actionable and groundbreaking projects and build a pipeline of projects that will help our economy recover. In the longer-term, our proposal would establish a consistent, repeatable, government-wide framework for building innovation and future-proofing into a wide range of infrastructure projects.

Transformative Infrastructure Projects must be bold, ambitious, and innovative.

An infrastructure project would qualify as a Transformative Infrastructure Project, and thus be treated as described below, if it meets the following criteria:

THE I³ PLAN: INNOVATIVE INFRASTRUCTURE INITIATIVE

- 1. Bold, ambitious, and innovative:** Transformative Infrastructure Projects must go beyond modest, incremental changes to business as usual and meaningfully advance infrastructure's fundamental design, delivery, construction, operation, or maintenance. A Transformative Infrastructure Project should not only reflect today's needs and technological capabilities, but also anticipate future growth and advancements.

Priority will be given to truly novel projects — ones that deploy cutting-edge technologies in new ways; utilize innovative partnership or financing models; employ commercial innovation, such as performance-based offtake agreements; or synergistically integrate multiple systems. Eligible Transformative Infrastructure Projects should apply state-of-the-art technologies to improve infrastructure, such as computer vision; robotics and automation; cloud and data analytics; IoT and sensors; machine learning and artificial intelligence; and autonomous and electric vehicles.

- 2. Infrastructure in eligible sub-sectors:** Eligible sub-sectors for Transformative Infrastructure Projects will include:
 - **Mobility, transit, and supply-chain logistics:** including roads, bridges, airports, ports, tunnels, advanced logistics systems, and shared mobility and public transportation systems.
 - **Energy:** including renewables and storage, microgrids, thermal, and electric vehicle charging.
 - **Circular economy:** including wastewater treatment, water reuse and recycling, stormwater systems, clean drinking water advancements, and advanced materials recovery facilities or other recycling systems.
 - **Digital:** including IoT-enabled systems, fiber, advanced broadband, ubiquitous connectivity and software-defined networks, edge computing, and data centers.
- 3. Unlocking private sector capital and risk sharing:** To qualify for federal funds or risk sharing, Transformative Infrastructure Projects will need to demonstrate viability by securing financial commitments from private capital or other new revenue sources as evidence of their actionability, ability to generate economic returns, and apolitical nature. Leveraging private capital will make available new sources of funding for additional projects and protect taxpayers by ensuring the private sector shares in risks.
- 4. Improvements in outcomes:** Transformative Infrastructure Projects must marshal innovation to improve outcomes — such as better and more efficient performance and greater resiliency and reliability (e.g., longer asset life, lower maintenance costs, improved productivity, or shorter downtime); enhanced sustainability; increased security; improved equity, access, availability, or affordability; increased public health and safety; and improved quality of life (e.g., reduced congestion or shorter commutes).

Transformative Infrastructure Projects will qualify for the I³ Plan, providing expanded, improved, and accelerated federal support.

Under the **I³ Plan**, the federal programs and initiatives listed below could be expanded and accelerated, with additional funds and support prioritized for Transformative Infrastructure Projects.

ACCELERATED, PRIORITIZED PERMITTING, WAIVERS, AND EXPERIMENTATION

- **Outcomes-based permitting:** Transformative Infrastructure Projects would be eligible to use performance measures instead of full environmental or other review processes to assess an infrastructure project's impacts. The project sponsor would agree to design the project to meet performance standards and permitting parameters established by the lead federal agency.
- **Accelerated procurement:** Transformative Infrastructure Projects would be eligible for single-agency or "one-stop-shop" decision making; a two-year window for approval and procurement decisions; and a consistent, standard template for fast-tracked reviews across infrastructure programs. Flexible procurement and project delivery methods might include "A+B bidding," a procurement method that considers both cost and schedule in contract bids, driving more scheduled competition among bidders and sole-source procurements.¹² Accelerating permitting should leverage the work already underway by the Federal Permitting Improvement Steering Council, established in a bipartisan plan by Senator Portman (R-OH) and former Senator McCaskill (D-MO).
- **Waivers and experimentation:** Transformative Infrastructure Projects would be eligible for waivers and able to experiment with a suite of regulatory flexibilities with respect to permitting and procurement rules and requirements to ensure faster decisions and a performance orientation. For example, in mobility, Transformative Infrastructure Projects could be prioritized for existing pilots or new avenues to enable innovative revenue measures on interstate highways, like vehicle-mile-traveled and dynamic pricing.

GENERAL

- **Preferential access to expanded PAB program:** Private activity bonds (PABs) provide tax-advantaged financing for privately developed and funded infrastructure projects, including roads and highways, rail, waste, power, heating and cooling, and water facilities.¹³ PAB issuance is currently capped at \$15 billion, with specific state-based volume caps. We propose that Congress raise the cap to allow additional PABs to be issued and prioritize Transformative Infrastructure Projects by excluding them from caps. Eligibility for PABs, and other creative federal financing programs, such as TIFIA and WIFIA, should be expanded to cover a broad range of infrastructure projects rather than being limited to specific verticals such as transportation or water.

MOBILITY

- **Preferential access to expanded BUILD grant program:** The Better Utilizing Investments to Leverage Development (BUILD) Transportation Discretionary grant program allows the federal Department of Transportation to invest in road, rail, transit, and port projects that promise to achieve national objectives. As part of the I³ Plan, Congress would authorize expanded BUILD grant funding, with priority given to Transformative Infrastructure Projects.
- **Preferential access to expanded INFRA grant program:** The Infrastructure for Rebuilding America (INFRA) grant program promotes projects with national and regional economic vitality goals while leveraging non-federal funding to increase the total investment by state, local, and private partners. Under the I³ Plan, Congress would expand INFRA funding and prioritize Transformative Infrastructure Projects, including by making INFRA grants available for pilots and demonstrations of Transformative Infrastructure Projects.

¹² [A quick, bipartisan fix for America's slow infrastructure permitting](#), Philip Wallach and Nick Zaiac, Brookings, June 2018.

¹³ [Private Activity Bonds: An Introduction](#), Congressional Research Service, July 2018.

Creating a Pipeline of Transformative Infrastructure Projects with Support Throughout the Project Lifecycle

Transformative Infrastructure Projects need support at every stage of the lifecycle of an asset – from R&D through planning and development, piloting, and financing and implementation – in order to accelerate a pipeline of actionable, transformative projects that not only respond to the current economic crisis but also provide precedent-setting innovations that can future-proof this generational investment in infrastructure:

Research and development:

Technologies and innovations relevant to Transformative Infrastructure Projects would receive pre-commercial funding at the R&D stage, for example, as described below through the ARPA-E program for innovative clean energy projects, or a new APRA-I program for other forms of innovative infrastructure.

Planning and development:

Transformative Infrastructure Projects would be eligible for accelerated federal permitting and procurement, in order to speed planning and development.

Piloting and demonstration:

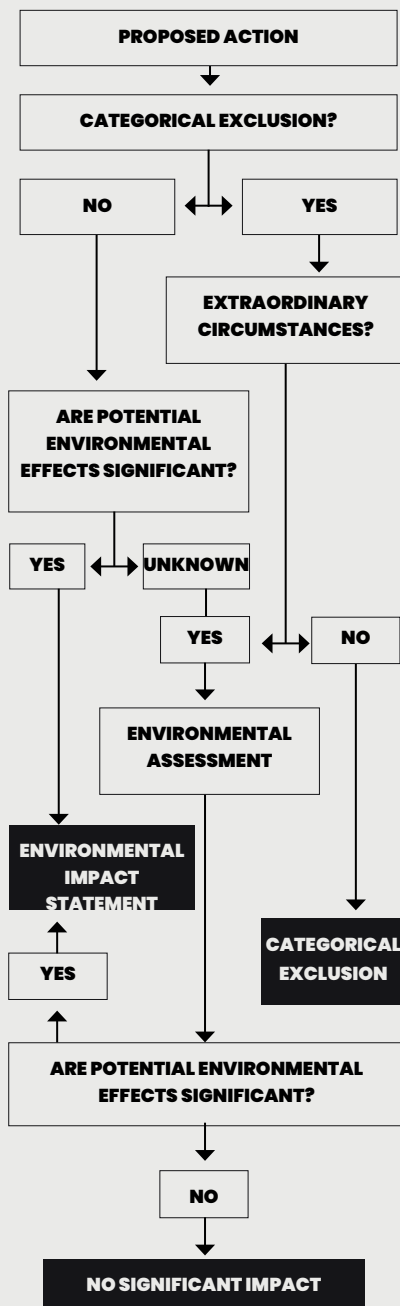
Existing grant programs for infrastructure – such as the BUILD and INFRA grant programs – would be expanded to support early-stage pilots and demonstrations of key components of Transformative Infrastructure Projects.

Financing and implementation:

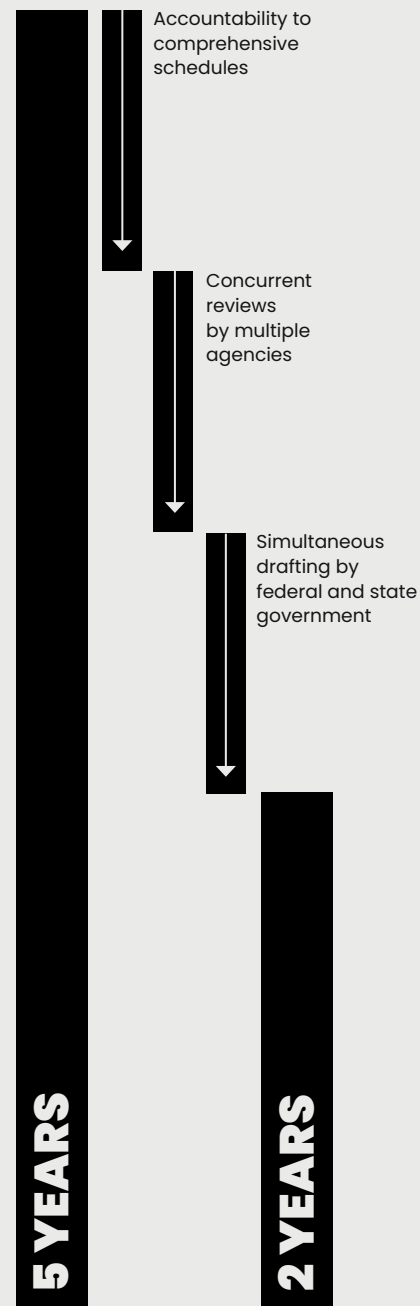
Existing infrastructure grant and financing programs would be expanded and prioritized for Transformative Infrastructure Projects, to unlock financing and accelerate implementation.

By supporting transformative projects not only at the financing and construction stage, but also throughout the project lifecycle beginning with R&D and development, the I³ Plan will catalyze an entire pipeline of advanced projects that can be responsive and actionable

Complex process for infrastructure approvals:



Reforms can accelerate permitting:



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- **Expansion of FTA CIG program:** The discretionary Capital Investment Grants (CIG) program allocates federal funds to new and expanded rapid rail, commuter rail, light rail, streetcars, bus rapid transit, and ferries, as well as corridor-based bus rapid transit. As part of the **I³ Plan**, the FTA-led program would offer grant support for a new category of Transformative Infrastructure Projects, in addition to the existing four categories (New Starts, Small Starts, Core Capacity, and Programs of Interrelated Projects).
- **Preferential access to expanded TIFIA loan program:** The Transportation Infrastructure Finance and Innovation Act (TIFIA) program provides credit assistance to qualified projects of regional and national significance. Many large-scale surface transportation projects qualify. Under the **I³ Plan**, Congress would expand eligibility, increase the size of TIFIA's participation in the credit, and increase credit support for TIFIA projects. Transformative Infrastructure Projects would receive priority for loans backed by the expanded program. As described above, Congress could both speed and expand project eligibility for creative infrastructure financing programs, such as TIFIA and WIFIA, beyond verticals such as transportation and water.

ENERGY

- **Targeted support for early-stage research from ARPA-E:** The Advanced Research Projects-Energy (ARPA-E) program provides early-stage funding for high-impact energy technologies. The **I³ Plan** would expand funding for ARPA-E overall and dedicate a portion of additional funds to technologies applicable to Transformative Infrastructure Projects. This would encourage building a pipeline of pilot programs and innovations that could be scaled up from the R&D stage to broader, project-level applications.
- **Expansion of Department of Energy Innovative Energy Loan Guarantee Program:** The Title XVII loan program's mandate and credit subsidy would be expanded as part of the **I³ Plan** to support Transformative Infrastructure Projects related to distributed energy and resilient grid solutions.
- **Renewal, expansion, and adoption of better targeted incentives for innovative clean energy:** Key renewable energy tax incentives — the Production Tax Credit and Investment Tax Credit — are scheduled to phase out or phase down by 2022, and electric vehicle tax credits face being capped, despite an urgent need for energy innovation in a range of emerging sectors, such as clean energy and fleet electrification. The **I³ Plan** would renew, expand, and better target these incentives for clean energy by focusing on the most innovative technologies, aligning with support for early-stage R&D, and removing the requirement to raise tax equity.^{14,15} Transformative Infrastructure Projects in energy would qualify for the renewed and expanded incentives.

CIRCULAR ECONOMY

- **Preferential access to expanded WIFIA loan program:** The Water Infrastructure Finance and Innovation Act (WIFIA) loan program provides credit assistance to water infrastructure projects, including those that build and upgrade drinking water and treat wastewater and stormwater.¹⁶ As part of the **I³ Plan**, Congress would expand WIFIA funding to allow additional lending and

14 [The Next Generation of Federal Clean Electricity Tax Credits](#), Varun Sivaram and Noah Kaufman, Columbia University SIPA Center on Global Energy Policy, June 2019.

15 As part of Section 1603 of the American Recovery and Reinvestment Tax Act of 2009, the Department of the Treasury made payments in lieu of investment tax credits.

16 [Water Infrastructure Financing: The Water Infrastructure Finance and Innovation Act \(WIFIA\) Program](#), Congressional Research Service, May 2019.

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credit, and prioritize Transformative Infrastructure Projects, such as IoT solutions to detect the state of water assets and digital twins to improve efficiency.

- **Prioritization through other EPA and USDA programs supporting the circular economy:** As part of the I³ Plan, Transformative Infrastructure Projects would be given priority treatment under existing EPA and USDA programs, including the Clean Water State Revolving Fund and the Water and Waste Disposal Loan & Grant Program.

BROADBAND AND CONNECTIVITY INFRASTRUCTURE

- **Funding and financing for resilient broadband and connectivity infrastructure:** Under the I³ Plan, Congress would authorize significant additional funding for Transformative Infrastructure Projects for broadband and connectivity infrastructure and would establish low-interest financing for build-outs necessary to make the U.S. a leader in 5G technology. Transformative Infrastructure Projects designed to accelerate and scale ubiquitous, resilient connectivity would be prioritized.
- **Encouraging innovative, municipal-first broadband partnerships.** Under the Innovative Infrastructure Initiative, Congress would seek to remove barriers to broadband expansion and empower municipalities to expand innovative networks in a way that bridges digital divides and puts residents first, such as neutral-host networks. Municipalities should be able to leverage emerging innovations, such as software-defined networks, to provide broadband that meets their community's needs. The proposal would encourage public-private partnerships to scale broadband in partnership with cities, and enhance municipalities' ability to organize and establish next-generation broadband.

V. Reimagining how government supports infrastructure investment by private sector

The I³ Plan will be administered by an empowered multi-agency committee of Chief Innovation Officers.

The Secretaries of Transportation and Energy, as well as the heads of other relevant departments, would establish a multi-agency infrastructure innovation working group, consisting of empowered representatives of each agency (and any appropriate related or sub-agencies). This group should consist of Chief Innovation Officers (CIOs), or other officials leading innovative procurement programs, who would be delegated authority – with deadlines and accountability to outcomes – to make determinations on each member agency’s behalf for matters within the mandate of the **I³ Plan**, including deciding whether a project qualifies, making allocation determinations, and adjudicating approval requests.

The above proposals, which expand and update existing federal programs, are only half of the equation. To meet this moment and prepare for the challenges awaiting us in the decades ahead, we must create new, enduring structures and programs that encourage innovation. And, to achieve that, the public and private sectors must work in tandem.

THE PUBLIC SECTOR

The federal government should create lasting institutions that build innovation into the lifecycle of infrastructure projects, including R&D, planning, development, procurement, financing, building, and implementation. Specifically, Congress should **create a new ARPA-I program**, modeled off of DARPA and ARPA-E, with a mandate to invest in R&D through grants to universities, research institutions, and early-stage companies developing infrastructure innovations. To build resources and capacity and break down silos at the state and local level, a **“race to the top” for infrastructure innovation and acceleration** could provide competitive grants for state and local governments to reform and speed infrastructure procurement and innovation and deploy best-in-class practices, leveraging funds to incentivize broad-based reforms beyond just the winning jurisdictions. Over time, Congress should consider longer-term reforms, including coordinating into a working group or even re-organizing Cabinet departments to break down barriers between agencies, and combining disparate loan, credit, and other support programs in a single place, with input from different executive agencies.

THE PRIVATE SECTOR

Government sets the rules and can provide critical funding and financing for transformative infrastructure projects. But the public sector’s impact is greatest when the private sector steps up to

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identify the most promising technologies and demonstrates its conviction by sharing the risk of early-stage technology and ultimately serving as a long-term partner.

To catalyze additional financing, legislation could **create a new Infrastructure Innovation Public-Private Investment Partnerships Program (I-PPIP)** to mobilize private capital. In the 2008-09 financial crisis, the predecessor PPIP matched public funds with private capital to catalyze a market for legacy mortgage-backed securities.¹⁷ Applied to Transformative Infrastructure Projects, this structure would involve raising private pools of capital, deployed by experienced technologists and infrastructure investors, and apply a multiplier through government leverage and matching equity capital to investment partnerships. The private sector would identify promising projects and technologies, and the government would multiply the impact, as only the government can. **Billions of dollars could be catalyzed by the private sector to respond to this effort.**

Beyond new approaches to public-private partnerships, we believe that the private sector and other non-governmental actors — including technology innovators and entrepreneurs, developers, investors, academics, and philanthropic funders focused on responding to big challenges — **should establish an infrastructure innovation challenge prize** that provides grants to state and local governments to plan, develop, and implement the most innovative proposals for Transformative Infrastructure Projects, and commit to backing viable proposals with their resources and capital.

We must seize this opportunity to transcend the silos that too often separate technologists, policymakers, municipal governments, and investors. Only through true collaboration can we build the transformative infrastructure our country needs — now and in the decades ahead. The I³ Plan is the vehicle to achieve that generation-defining innovation.

[Learn more about I³](#)

¹⁷ Secretary Timothy F. Geithner's Written Testimony Before the Congressional Oversight Panel, Department of the Treasury, December 16, 2010.

APPENDIX

About

The Innovative Infrastructure Initiative (I³) is a consortium of technologists, investors, policymakers, academics, and other leading thinkers joining together to champion and accelerate transformative infrastructure projects that utilize innovative solutions to address pressing infrastructure needs and achieve better outcomes.

Right now is a critical moment for the future of infrastructure. Existing infrastructure systems are aging and under increasing pressure, and government is increasingly recognizing the urgency of addressing current challenges to deliver infrastructure systems that better meet the needs of its constituencies. With new infrastructure policy and invigorated spending on the horizon as the economy begins to emerge from COVID-19, it is imperative that we develop and invest in next-generation infrastructure systems rather than simply pouring money into band-aid solutions that replicate last century's outdated and crumbling systems.

The I³ was established to help achieve that goal and ensure that we make the most of this once-in-a-generation opportunity. By bringing together the unique experiences, expertise, and perspectives of its diverse set of members, I³ seeks to reimagine how technology can be applied to transform and improve infrastructure for a more resilient, sustainable, and equitable future.