

# Delivering for America

**The macroeconomic impacts of reinvesting  
in America's infrastructure systems**

2021 Update

Business Roundtable partnered with Inforum, also known as the Interindustry Forecasting Project at the University of Maryland, to model the effects of infrastructure investment on the U.S. economy. Inforum pioneered the construction and use of dynamic, general-equilibrium models that portray the economy in a unique “bottom-up” fashion and specializes in developing and using structural economic models to improve general understanding of the economy.



Business Roundtable (BRT) is an association of chief executive officers of leading U.S. companies working to promote sound public policy and a thriving U.S. economy.

Business Roundtable's CEOs lead companies with \$8.8 trillion in annual revenues and 18.8 million employees around the world. The combined market capitalization of BRT member companies is equivalent to over 42 percent of the value of all publicly traded U.S. firms and BRT members invest more than \$225 billion annually in research and development – equal to over 50 percent of total U.S. private R&D spending. Our companies pay \$360 billion in dividends to shareholders and make more than \$8 billion a year in charitable contributions.

# Delivering for America

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2021 Update

This report is an update and continuation of Business Roundtable's 2019 **Delivering For America** study. BRT has updated the original study to reflect the current economic environment, consider the new political landscape, and further underscore how a substantial reinvestment in American infrastructure is more important and impactful than ever.

The reports and data sources used to estimate incremental spending needs have been updated to more recent versions where available, and macroeconomic modeling assumptions have been refreshed to reflect current economic conditions, including the economic effects of the COVID-19 pandemic and outlook for future growth. In addition, the updated study reflects the need to make considerable investments in rural broadband infrastructure, intended to address disparities that have been highlighted and exacerbated by the pandemic.

# Contents

Executive Summary.....	1
Policy Context and Spending Scenarios.....	2
Results .....	5
Methodology and Approach.....	15
Technical Appendices.....	20
Endnotes.....	27

# Executive Summary

**Investment adds  
\$8.2 trillion in GDP  
over 20 years**



Every additional  
\$1 invested creates  
\$3.82 in economic  
growth over 20 years



Investment adds \$1.47  
to hourly worker wages  
by 2040, as labor  
productivity rises



It boosts job growth,  
creating 1.2 million  
additional new jobs  
by 2030

**There is an urgent need for widespread reinvestment in American infrastructure.** A modern infrastructure system is key to unleashing the full productive potential of the U.S. economy. In recent years, however, public-sector investment in infrastructure has dwindled, leaving many critical systems in disrepair and hampering U.S. competitiveness and productivity. And as we continue to focus on building a broad-based economic recovery and creating more American jobs, public spending on infrastructure is urgently needed to spur economic activity, unlock private investment, and reinvigorate the labor force. This study is designed to quantify and advocate for the benefits of substantial investment in American infrastructure by using an industry-based macroeconomic model to estimate the economic impacts of a fiscally responsible investment of \$979 billion over ten years in surface transportation, water and wastewater, aviation, water resources and transportation, and broadband. This study also takes the crucial step of establishing a “new normal” level of public-sector commitment to maintaining American infrastructure.

**Infrastructure investment delivers tangible benefits for the average American family.** This study finds that the investment scenario adds an average of nearly \$1,800 in disposable income for the average U.S. household every year for 20 years, or \$35,900 by 2040. At the same time, average wages are \$1.47 per hour higher after 20 years. In addition to these direct benefits, workers and families benefit indirectly from infrastructure investment via time savings, reduced costs, and a more dynamic economic and employment environment.

**Modernized, improved, and expanded infrastructure can shift U.S. business into a higher gear.** Infrastructure investment boosts productivity across all sectors of the economy, allowing businesses to do more with less as they see fewer delays, eliminate unnecessary costs, and overcome drags on efficiency that harm U.S. competitiveness. Over 20 years, average annual labor productivity is 0.55 percent higher than baseline, and the gap widens over time.

**Infrastructure investment is good for America.** An investment of this scale adds \$8.2 trillion to GDP over 20 years as a result of the average annual real GDP growth rate increasing by 0.12 percentage points over that time period. It also catalyzes private investment, with U.S. businesses investing an additional \$2.4 trillion over 20 years.

**The unique benefit of infrastructure investment is its ability to drive productivity growth, and with it the long-run potential productive capacity of the economy.** While positive labor market outcomes and accelerated growth are observed in the short term, the true benefits of infrastructure are observed over a much longer time frame, and at a much larger scale. Over 20 years, every additional \$1 invested in infrastructure drives roughly \$3.82 in additional economic growth. This isn't just about delivering for U.S. businesses and workers now. This is about creating a new foundation for our economy to be more competitive for the foreseeable future.

The results of this study clearly demonstrate that investing in renewing America's infrastructure represents a vital opportunity to advance the interests of American families, workers, businesses, and the economy as a whole. **The daily costs of inaction are observable to all, but a full understanding of the benefits of taking action is equally, if not more, important for leading the way toward the modern, dynamic, and prosperous economy of the future.**

# Policy Context & Spending Scenarios

## The Role of Infrastructure in the U.S. Economy

*A modern infrastructure system is key to unleashing the full productive potential of the U.S. economy.*

This report examines the state of U.S. infrastructure, where we need to go, and the economic effects of taking action.

- **Infrastructure Undergirds a Modern, Competitive U.S. Economy.** The collection of roads and bridges, airports, water systems, dams and levees, ports, and urban transit systems facilitates and helps drive innovation, competitiveness, job growth, and productivity.
- **America's Infrastructure Is Falling Behind.** The scale and ambition of American infrastructure projects long defined the global gold standard. Over time, however, this commitment and our nation's critical infrastructure systems have begun to erode. Public financing has not kept pace with population and economic growth. The growing gap between our needs and our investment threatens not only the quality and reliability of our national infrastructure, but also America's economic foundation.
- **Impacts of a COVID Economy:** Infrastructure investments can serve as a critical input to reviving the U.S. economy following the COVID-19 pandemic and recession. Growing infrastructure needs and current economic conditions such as elevated unemployment, depressed private investment, and continued widespread uncertainty amplify the near-term value of a significant infrastructure spending package. Such an investment would create jobs, boost confidence and spur private investment, and increase productivity over the long-term.
- **Timing with New Administration.** A new administration also creates a window of opportunity for implementing bold policy solutions. The Biden-Harris administration has signaled its plans for a substantial reinvestment in American infrastructure, making it critical that Congress capitalize on this renewed momentum and pass a much needed, fiscally-responsible infrastructure spending package.
- **It's Time to Reinvest in America's Infrastructure.** Investing in American infrastructure is a prerequisite for delivering job creation, growth, and a high quality of life for Americans. It is also a catalyst for the connections and creativity that will power the innovation and economy of the future. This urgent problem requires strong leadership that is focused on restoring America's gold standard of infrastructure excellence.

# Current Trends in U.S. Infrastructure Investment

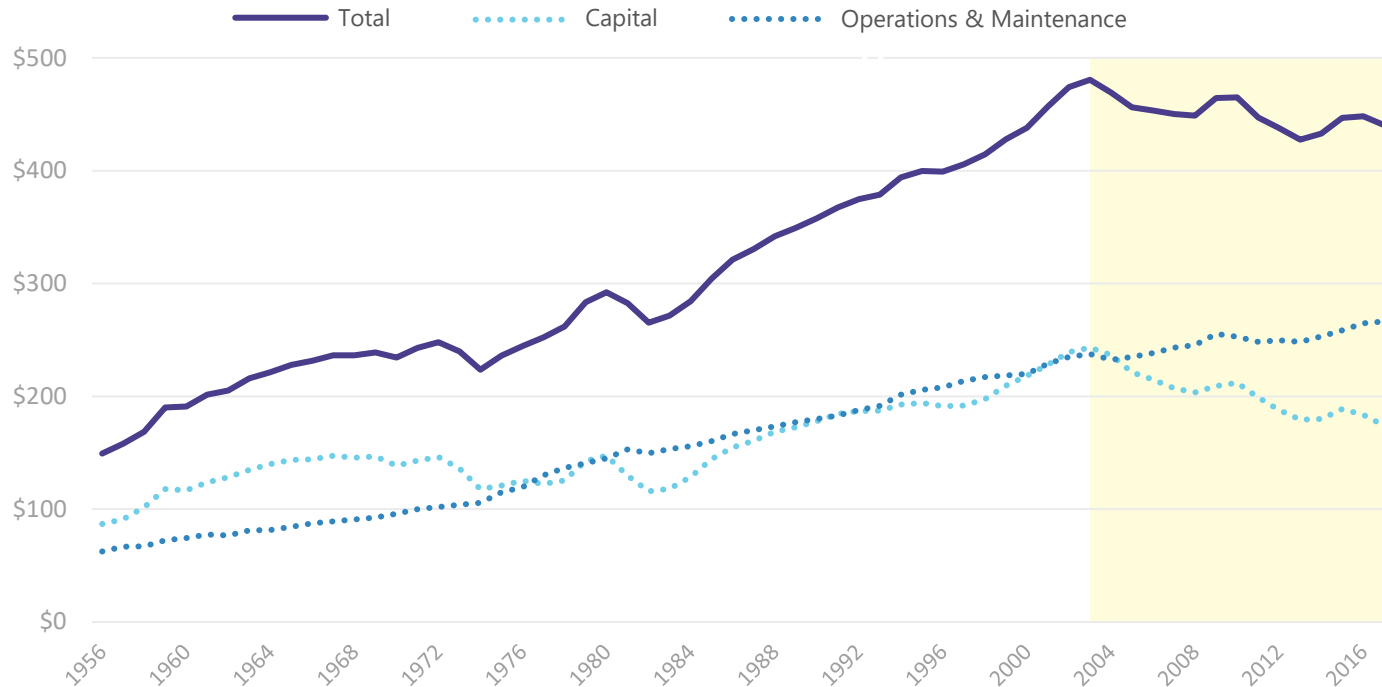
*Public spending on infrastructure fell by 8 percent from 2003 to 2017.*

U.S. public infrastructure spending fell by 8 percent from 2003 to 2017, when adjusted for inflation and the cost of infrastructure inputs.<sup>1</sup> As a share of GDP, public infrastructure spending fell by nearly 11 percent over this period.<sup>2</sup>

This decline was driven by a sharp drop in capital investment: -28 percent from 2003 to 2017. While spending on capital and operations and maintenance were roughly equal from the 1970's until 2002, increases in input costs coupled with only marginal increases in nominal spending have created a widening gulf between forward-looking capital investment and maintenance of existing infrastructure.<sup>3</sup>

## Public Spending on Infrastructure

Spending by Category, Billions 2017\$, Adjusted for Inflation Using Infrastructure-Specific Price Indexes as Specified by the CBO)



Source: Congressional Budget Office, "Public Spending on Transportation and Water Infrastructure, 1956-2017", October 2018, p. 6.



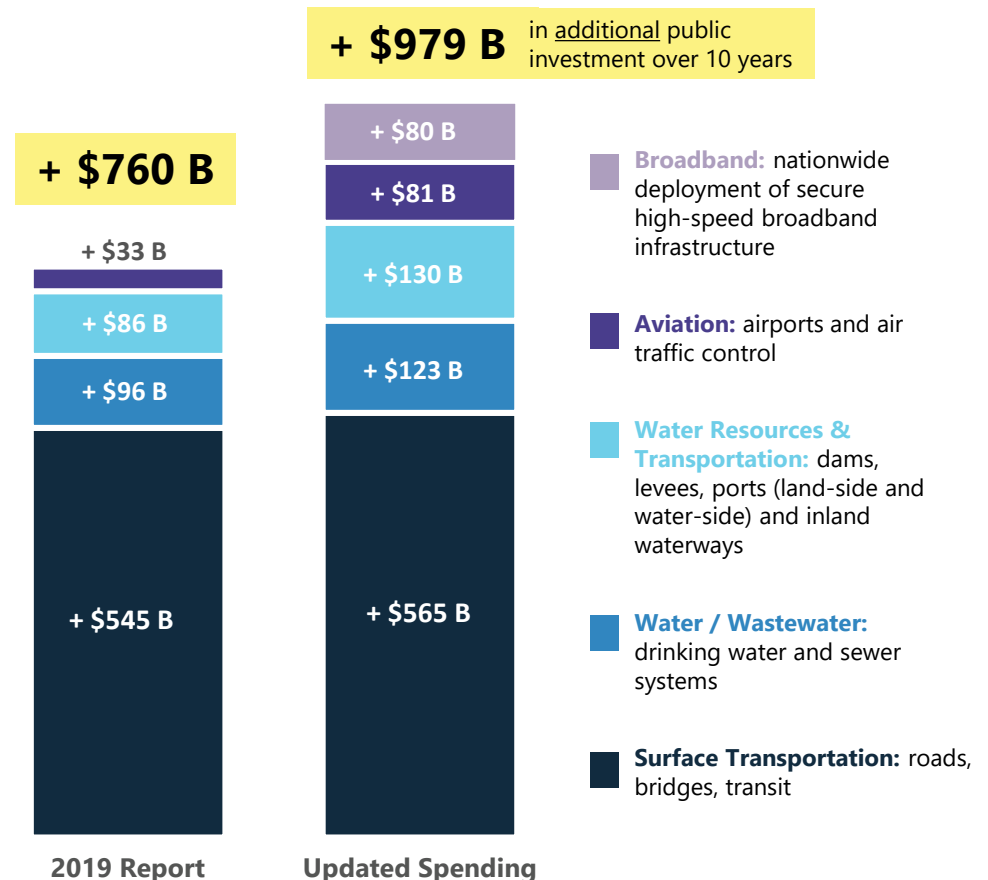
# Spending Scenarios: Incremental Investments by System

*Infrastructure investment needs are heavily concentrated in surface transportation systems.*

- The modeled policy scenario reflects a fiscally responsible approach to an infrastructure investment package with \$979 billion invested over 10 years in roads, bridges and transit; water and sewer; aviation; dams, levees, ports and inland waterways; and broadband buildout. *(Note: All inputs and outputs to the model – spending figures and results – are reported in 2020 dollars. Conversions have been made based on a 2020 GDP deflator of 113.626, or 1.2% inflation for the year.)*
- In addition to the \$979 billion capital investment package over 10 years (i.e., the “policy period”), the scenario also establishes a new normal for infrastructure spending in the “out years” (i.e., after the 10-year \$979 billion spending package) by holding public capital investment in infrastructure steady at a fixed share of GDP, in the range of 1.2 percent. This new rate of investment corrects the declining trend in public infrastructure investment and reflects a right-sized commitment to maintaining, expanding, and improving the nation’s vital infrastructure systems.
- This scenario represents an investment amount intended to (1) return these systems to a state of good repair, (2) expand capacity to meet future demand, and (3) fund innovative approaches to future infrastructure challenges. *(See p 17 for detailed scenario tables; See Appendix C for a sources and assumptions overview; See Appendix D for a detailed list of sources.)*

## Policy Scenario: Updated Incremental Investment by System

Capital Investment Above Baseline, Billions (2020\$)



# Results

## Summary of Key Results

*Infrastructure investment unlocks meaningful productivity growth and boosts U.S. household income.*

This updated report further emphasizes the **significant long-term benefits of investing in infrastructure**, as investments considerably boost labor productivity, wage growth, household income, and private investment over the next 20 years. In addition, the **substantial growth potential in the current economic environment** results in larger short-term benefits from infrastructure spending relative to those estimated in the 2019 report.

- **Investing in infrastructure pays for itself several times over.** Every additional \$1 invested in infrastructure delivers roughly \$3.82 in additional economic growth over 20 years.
- It adds \$8.2 trillion to **real GDP** over 20 years as a result of a 0.12 percentage point increase in the average annual real GDP growth rate over that period.
- It increases **labor productivity**, the benefits of which reach all corners of the economy. Over 20 years, average annual labor productivity is 0.55 percent higher than baseline, and the gap widens with time.
- It contributes to higher **job growth**, creating 1.2 million additional jobs by year 10 of the policy scenario (2030).
- It raises **worker wages**, adding \$1.47 to average real hourly wages by 2040, compared to the baseline scenario.
- It adds to bank accounts, boosting **household real disposable income** by an average of nearly \$1,800 every year, or \$35,900 over 20 years.
- It catalyzes **private investment**, adding an additional \$2.4 trillion in investment over 20 years.

# Macroeconomic Effects

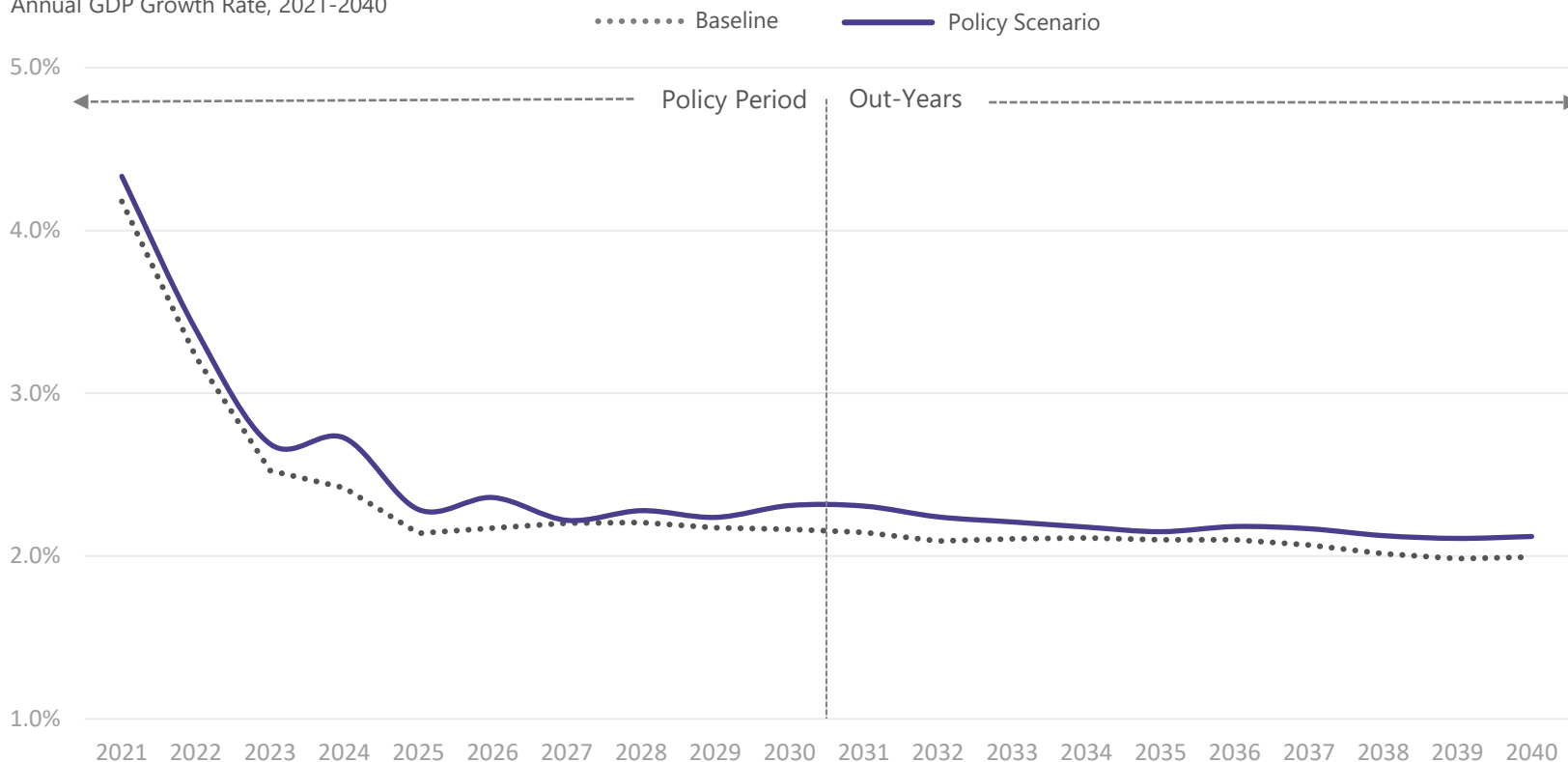
## Gross Domestic Product

*Investing in American infrastructure adds \$8.2 trillion to real GDP over 20 years.*

The infrastructure investment scenario adds an average of **0.12 percentage point to annual real GDP growth** over a 20-year period. This acceleration in the economic growth rate reflects a sustained increase in long-run potential U.S. economic output that extends well beyond the ten-year policy period. An impact of this magnitude is the equivalent of adding approximately **\$8.2 trillion to real GDP** over 20 years.

### Impact of Additional Infrastructure Investment on Real GDP

Annual GDP Growth Rate, 2021-2040



# Macroeconomic Effects

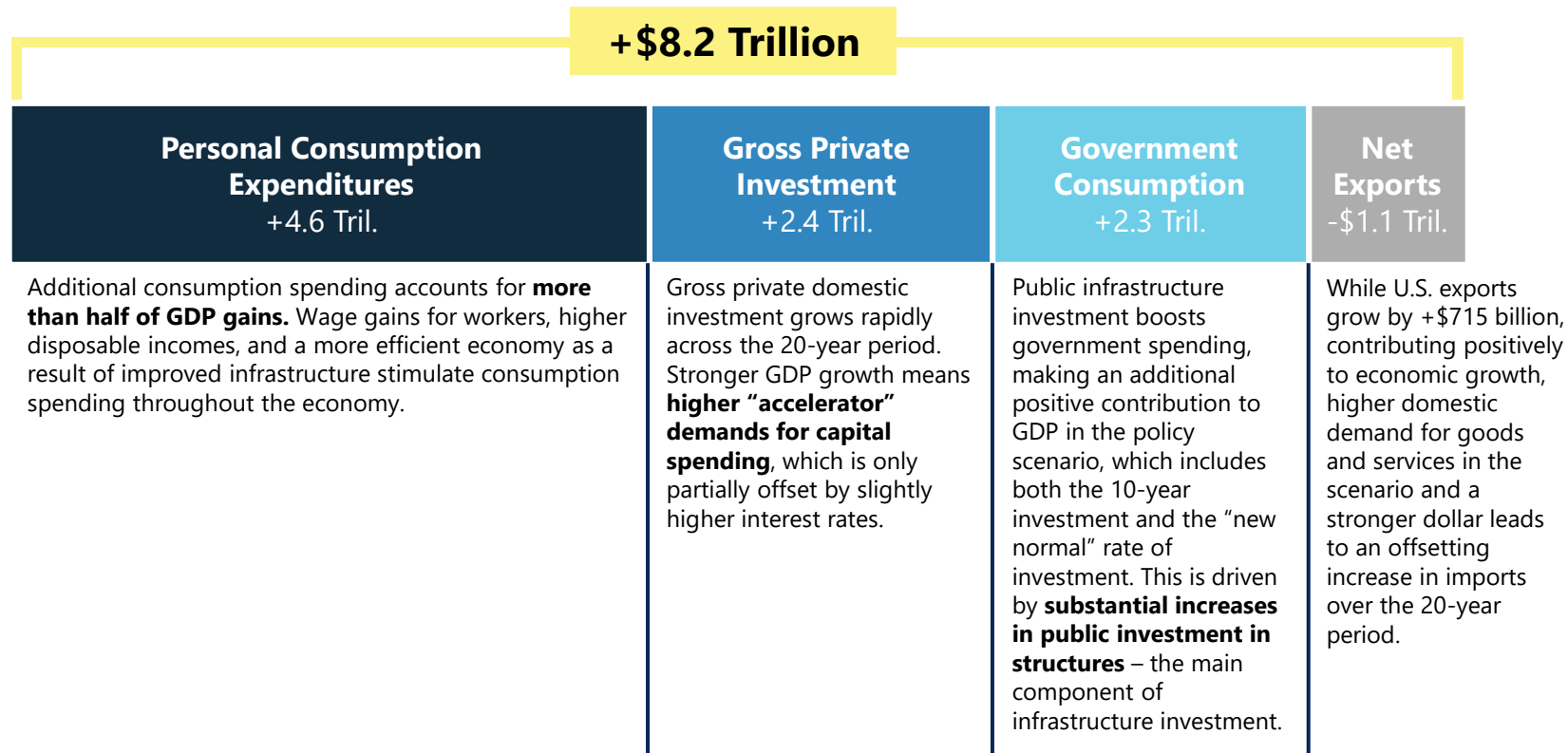
## Gross Domestic Product (cont.)

*Investing in American infrastructure adds \$8.2 trillion to real GDP over 20 years.*

Faster real GDP growth compounds over time, leading to a substantial increase in long-term potential output. The \$8.2 trillion increase in GDP in the scenario is comprised of strong growth in consumption expenditures, meaningful contributions from private investment and government consumption, and a small offsetting negative contribution from net exports.

### Contributions to Change in Real GDP from Baseline

Cumulative Additional GDP (2020\$), 2021-2040



# Macroeconomic Effects

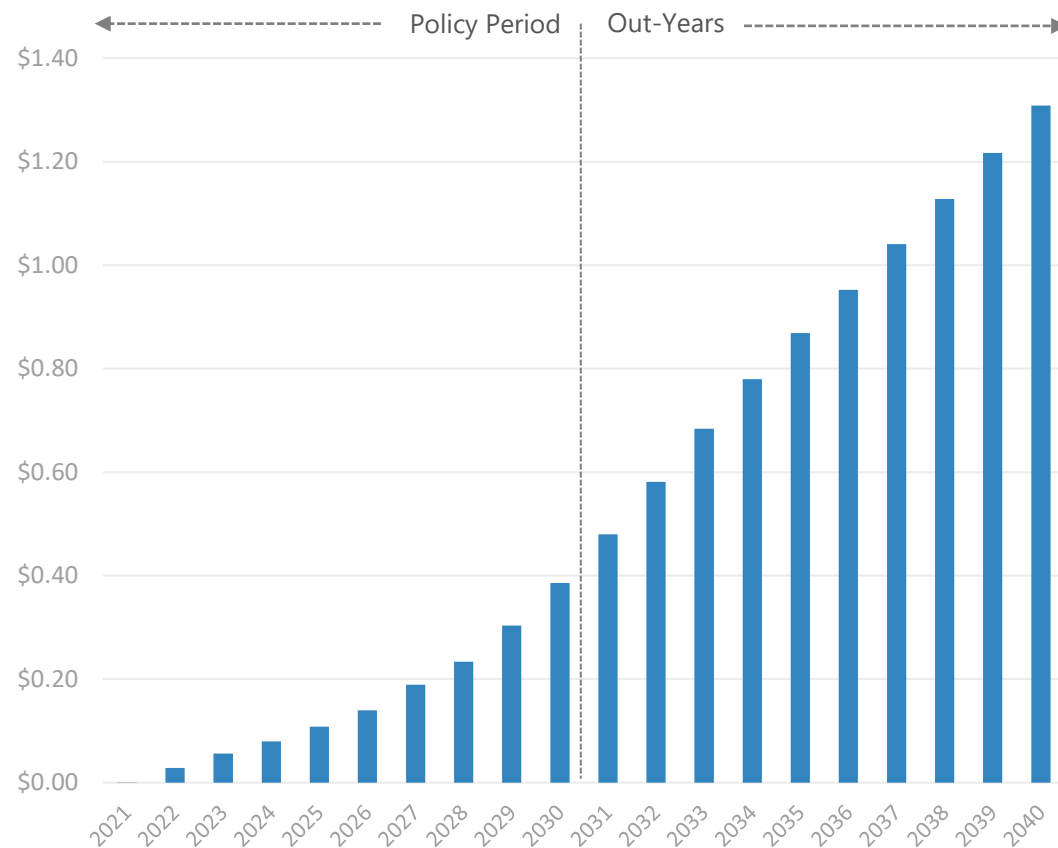
## Productivity

*Labor productivity drives long-term economic growth.*

- Improved infrastructure reduces economic friction and accelerates productivity by shortening transit times, reducing input costs, lowering inflation, and stimulating aggregate demand.
- Increased infrastructure investment would **add an average of 0.06 percentage points to the annual labor productivity growth rate** each year through 2040.
- The gap between the labor productivity growth rate in the baseline and policy scenarios widens over time, illustrating sustained and growing benefits.
- Impacts on labor productivity accelerate over time. In year ten of the policy scenario (2030), average labor productivity was 0.4 percent above baseline, compared to **1.2 percent above baseline in 2040.**

### Improvement to Labor Productivity

Incremental Labor Productivity Relative to Baseline (2020\$/hr), 2021-2040



# Macroeconomic Effects

## Employment

*The stimulative effects of increased investment will drive short-term job growth and draw more workers into the labor force.*

As the U.S. economy continues to face higher unemployment than pre-pandemic levels in early 2021 (with a current unemployment rate around 6 percent), there is much to be gained by the strong employment effects of increased infrastructure spending.

Results indicate a substantial positive labor market response to increased infrastructure investment. Most of these impacts are concentrated during the 10-year policy period: by the 10th year of the scenario (i.e., 2030), the economy has nearly 1.2 million more jobs than under the baseline scenario. These gains are maintained over the following decade.

As should be expected, many of these additional jobs are in the construction sector – 347,000 at the end of the 10-year policy period – though other sectors, including retail trade (+110k) and wholesale trade (+18k); finance, insurance, and real estate (+69k); and durables manufacturing (+58k), also make notable contributions.

The impact of increased infrastructure spending in terms of higher aggregate demand, in the presence of elevated unemployment, means that more Americans are pulled into the labor force as wages increase. This effect translates into 949,000 more people in the labor force by 2040 than there would be under a baseline scenario – leading to an increase in the labor force participation rate.

# Household Effects

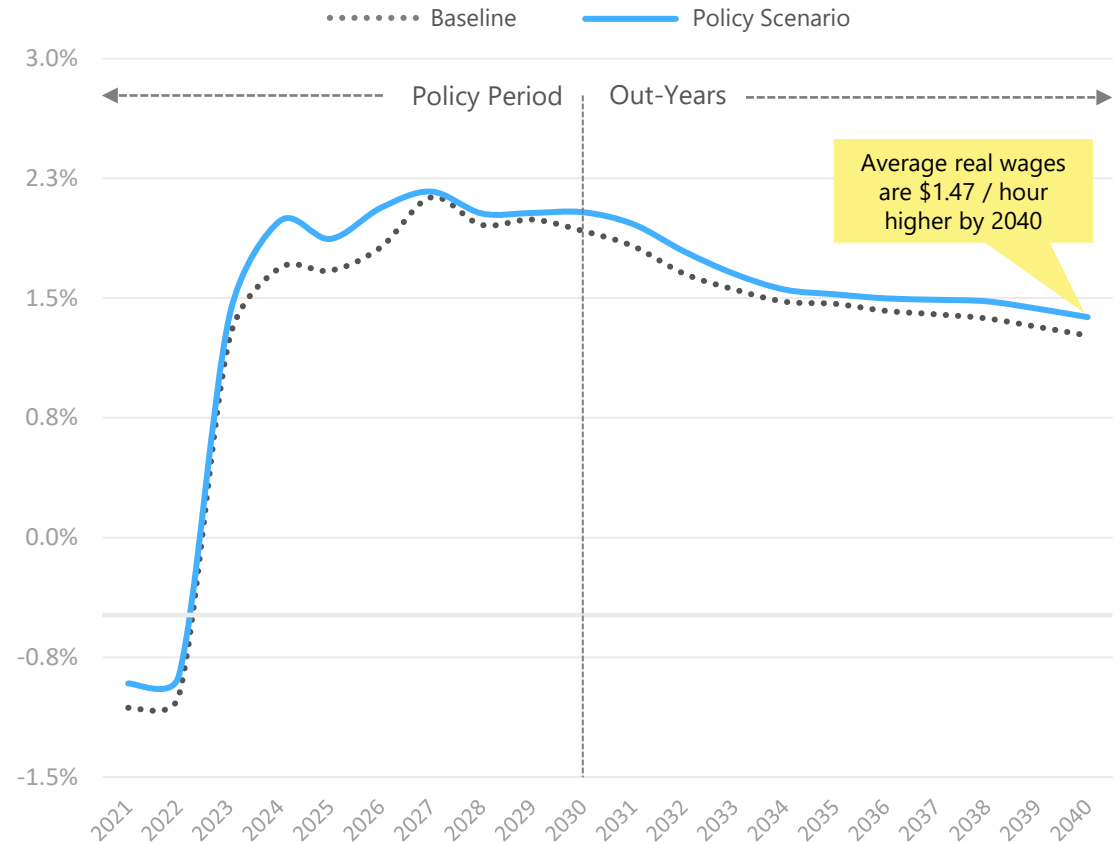
## Wages

*Infrastructure investment adds \$1.47 per hour to real average real wages by 2040.*

- Infrastructure investment – and the related gains in labor productivity – boosts **average annual real wage growth by 0.12 percentage points** over 20 years.
- By 2040, faster wage growth results in average hourly real wages that are **\$1.47 per hour higher** than in the baseline scenario – an increase of 2.4 percent.
- Wage growth responds strongly to the short-term effects of increased investment during the policy period.
- In the out-years, the productivity effects of additional investment sustain high rates of wage growth over the long term.

### Average Real Wage Growth

Average Annual Real Hourly Wage Growth, 2021-2040



# Household Effects

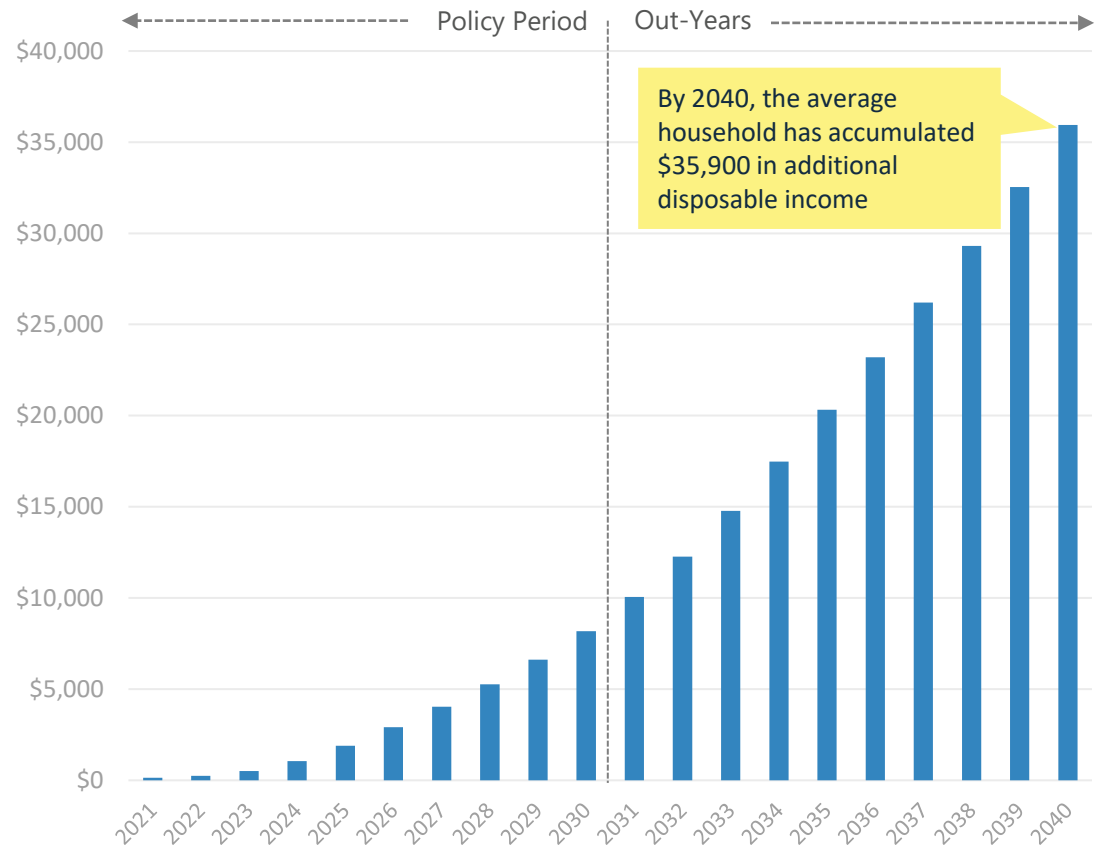
## Household Disposable Income

*Infrastructure investment adds \$35,900 to average real disposable household income over 20 years.*

- The average U.S. household's cumulative real disposable income is **\$35,900 above baseline** after 20 years.
- This equates to just under **\$1,800 per year** per household in additional disposable income as a consequence of infrastructure investment.
- Higher wages – a product of gains in labor productivity – are a key driver of increased household income.

### Growth in Real Average Household Disposable Income

Cumulative Difference in Average Real Disposable Household Income (2020\$), 2021-2040





# Industry Effects

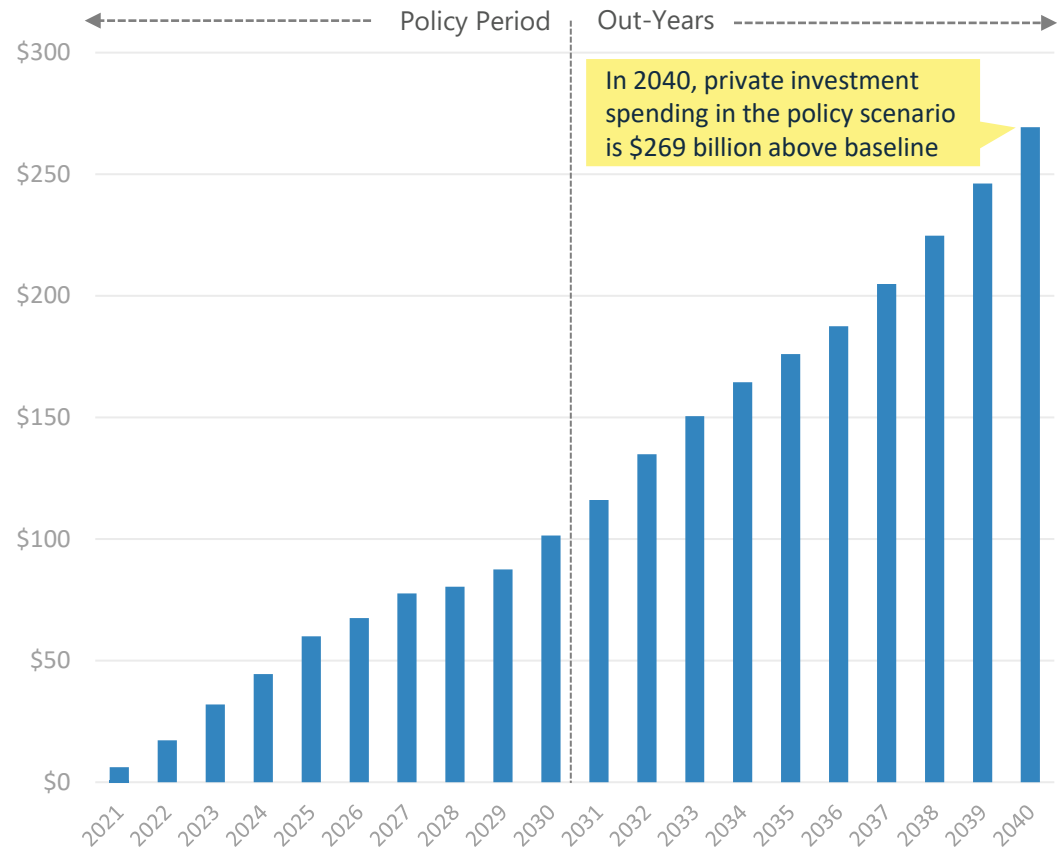
## Private Investment

*Infrastructure investment spurs additional private investment in both the short and long terms.*

- Over 20 years, infrastructure investment spurs an additional **\$2.4 trillion in gross private investment**, relative to baseline.
- Infrastructure investment boosts the annual average growth rate of gross domestic private investment by **0.18 percentage points** over baseline during the 20-year period.
- Private investment is highly responsive to improved infrastructure and constitutes a **larger share of GDP** in the policy scenario than under baseline conditions.
- The vast majority (77 percent) of the increase in private investment spending is due to an **increase in business investment spending**.

### Annual Incremental Gross Domestic Private Investment

Additional Private Investment Relative to Baseline, Billions (2020\$), 2021-2040



# Industry Effects

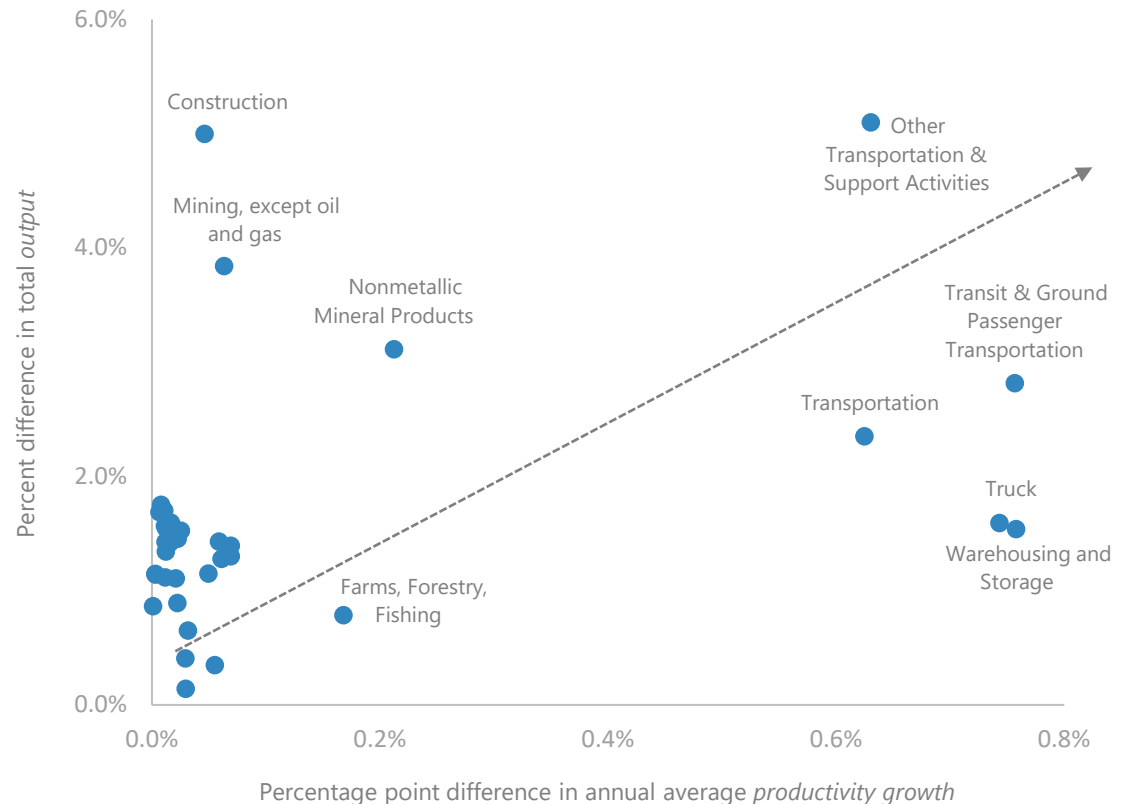
## Productivity and Output Change by Sector

*Higher productivity boosts output in virtually every sector of the economy, with particularly strong gains in the transportation sector.*

- Higher productivity drives an **additional \$857 billion in real gross output in the transportation industry** over 20 years, relative to baseline.
- Improved infrastructure drives productivity gains that let industry **do more with less**, which leads to substantial increases in real output.
- Improved transportation sector productivity translates into higher efficiencies in other sectors as well, leading to broad-based growth in real gross output.

## Sector Output & Productivity Growth

Increase in Total Output by Increase in Productivity Growth, 2021-2040



## Discussion of Key Results

*The benefits of infrastructure investment are driven and sustained by a long-term boost to productivity.*

Infrastructure investment has two broad categories of economic benefits: **short-term stimulus** and **long-term productivity gains**. While these are distinct policy goals, the findings presented in this study support both.

**In the short term**, the direct effects of infrastructure spending are evident. Elevated unemployment, depressed private investment, and low interest rates have created an economic environment where public spending on infrastructure has high short-term stimulative potential at a relatively low long-term cost. The injection of investment spending creates jobs, pulls additional workers into the labor market, stimulates demand, and prompts a temporary acceleration in consumption spending and business investment that will hasten economic recovery from the COVID-19 pandemic.

**Over the longer term**, it is not the additional dollars spent on infrastructure that generate meaningful and sustained economic benefits, but the productivity-enhancing effects of the infrastructure itself. Chief among these benefits is a steady, accelerating increase in labor productivity. An increase in productivity is like tightening the gears of the economy – a frame shift that allows you to do more for less, boosting efficiency and generating positive ripple effects throughout the entire economy. Increases in labor productivity are most concentrated in the sectors that are more directly linked with infrastructure: particularly passenger transportation, trucking, and warehousing and storage. However, the ripple effects are virtually universal, reaching diverse industries from farming to manufacturing to wholesale and retail trade – driving widespread efficiencies and cost savings.

The impacts of productivity growth are reflected most clearly in the increase in potential U.S. GDP, driven by increased consumption and investment, which accelerates economic growth for the foreseeable future. Households also see tangible benefits from increased productivity – in higher wages, increased disposable income, lower prices, and lower spending on key goods and services like transportation. Meanwhile, American industry supports a sustained increase in private investment and output, strengthening their competitive edge and continuing to propel economic growth.

# Methodology & Approach

## About This Study

*The goal of this study is not to provide a prescriptive policy roadmap for increasing infrastructure investment, but to make a clear and compelling case for the economic benefits of taking action.*

### **PURPOSE**

The purpose of this modeling study is to quantify the significant, long-term economic benefits of increasing investment in the nation's public infrastructure systems. The costs of doing nothing have been well-documented. This study endeavors to advance the national conversation by articulating the benefits of doing something.

The study is not intended to advocate for a specific spending amount or particular policy mechanisms for increasing investment. What is clear – and what is reflected in the policy scenario – is that it will take hundreds of billions in additional investment to bring America's infrastructure systems back into a state of good repair and capacity capable of supporting continued economic growth and international competitiveness. What is also clear is that the federal government must take a leadership role in right-sizing the investment in the nation's infrastructure systems, and that this investment can and must be made in a fiscally responsible manner.

### **SCOPE**

The study is focused narrowly on a core set of infrastructure systems that are primarily publicly funded, particularly those that receive significant federal funding. Investment in privately funded infrastructure systems – freight rail, energy pipelines, etc. – is robust and barriers to accelerating investment in these systems are generally related to regulatory and permitting roadblocks, not a lack of funding. Funding for broadband buildout is a new component of the proposed spending package in this updated report. The COVID-19 pandemic has underscored the disparities around this issue and highlighted the need for increased public investment in rural broadband infrastructure.

### **TECHNICAL APPROACH**

Business Roundtable partnered with the University of Maryland Inforum modeling group to conduct a macroeconomic modeling study of the impact of increasing infrastructure investment on the U.S. economy. The model is not an engineering model that estimates the specific community-level impacts of repairing a bridge versus widening a road versus expanding a port. Rather, it is a fully dynamic, general-equilibrium model of the U.S. economy that captures the impacts and feedback loops of increased infrastructure investment across all sectors of the economy. Inputs to the model include (a) a policy scenario that specified spending amount by infrastructure system and funding source and (b) estimates of sector-specific productivity effects associated with improved infrastructure.

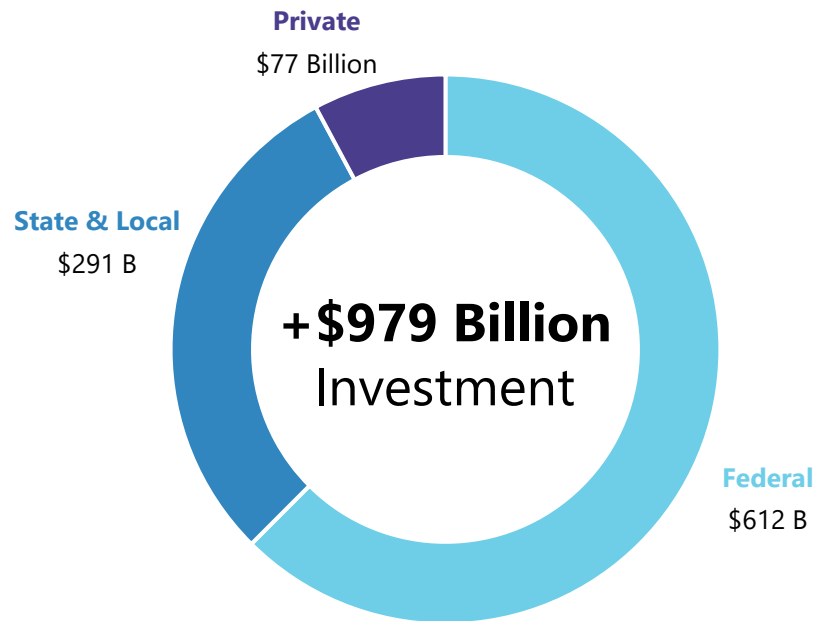
## About the Policy Scenario

*The policy scenario reflects a strong federal role and a fiscally responsible approach.*

- Federal funding accounts for more than 60 percent of the investment package, illustrating the needed leadership from the federal government in addressing infrastructure deficiencies.
- The breakdown between federal and state/local spending generally reflects cost-sharing requirements of existing federal grant and loan programs. The exception is the water/wastewater system, where the vast majority of funding is state/local. (See Appendix D for a detailed list of sources)
- The private sector's share of the infrastructure investment is based on modest assumptions of growth in the private share of spending on infrastructure systems where considerable private spending already occurs (i.e. surface transportation and aviation).
- The study models a fiscally responsible approach to funding \$979 billion of additional infrastructure investment:
  - Federal spending: Two-thirds of federal spending is funded by taxes and user fees and one-third is deficit-financed.
  - State/Local spending: All state & local spending is funded by debt that is retired via taxes and fees over 15 years.

### Policy Scenario: Sources of Funding / Financing\*

Additional Spending by Source, Billions (2020\$)



*\*Note: The source of funding or financing is not necessarily the same entity that directly spends the funds. For example, the majority of federal dollars invested in roads and bridges is distributed to state governments for direct spending on projects.*

## About the Policy Scenario (cont.)

*The policy scenario reflects a bottom-up assessment of infrastructure investment need.*

System	Additional Investment (Billions 2020\$)	Spending Source	Spending Share	Spending Amount (Bil 2020\$)
<b>SURFACE TRANSPORTATION</b> Roads, Bridges, and Transit	\$ 565.0	Fed	70%	\$397.8
		S/L	20%	\$110.6
		Private	10%	\$56.6
<b>AVIATION</b>	\$ 81.1	Fed	81%	\$65.3
		S/L	14%	\$11.7
		Private	5%	\$4.1
<b>WATER RESOURCES &amp; TRANSPORTATION</b> Ports, Inland Waterways, Dams & Levees	\$ 130.3	Fed	60%	\$78.2
		S/L	40%	\$52.1
		Private	0%	\$0.00
<b>WATER / WASTEWATER</b>	\$ 122.6	Fed	5%	\$6.4
		S/L	95%	\$116.2
		Private	0%	\$0.00
<b>BROADBAND</b>	\$ 80.0	Fed	80%	\$64.0
		S/L	0%	\$0.00
		Private	20%	\$16.0
<b>TOTAL</b>	<b>\$ 979.0</b>	<b>Fed</b>	<b>62%</b>	<b>\$611.7</b>
		<b>S/L</b>	<b>30%</b>	<b>\$290.7</b>
		<b>Private</b>	<b>8%</b>	<b>\$76.6</b>

*Note: Numbers may not sum or share out exactly due to rounding.*

# Modeling Assumptions and Qualifications

## **INVESTMENT TIMING**

The \$979 billion in additional infrastructure capital investment is distributed over the course of the 10-year policy period. To reflect a realistic spending trajectory, and the fact that most projects do not have the capability to “turn on” immediately, the spending level ramps up gradually and peaks in the 6<sup>th</sup> year of the 10-year period. It gradually declined in the subsequent years, settling in year 11 (i.e., 2031) at a “new normal” steady state tied to GDP growth.

This “new normal” is intended to reflect a future state where, instead of reverting to the historical sub-optimal level of investment after the policy period, capital investment settles at a share of GDP below the “surge” level in the policy period, but above baseline, and thus grows in tandem with the rest of the economy.

## **CAPITAL VERSUS OPERATIONS & MAINTANANCE SPENDING**

Capital spending on infrastructure includes new structures (e.g., bridges and ports), new equipment (e.g., buses and air traffic control systems), and the improvement and major rehabilitation of existing infrastructure (e.g., widening a road or re-paving a runway). Operations and maintenance includes services (e.g., lock and dam operation), minor repairs, and other related activities. The \$979 billion policy scenario reflects capital spending only, with no consideration given to the increased O&M requirements associated with a larger future stock of infrastructure assets. For this reason, the economic impacts of increased public infrastructure investment presented in this study should be considered conservative. *(Note: The difficulty of accurately estimate the additional O&M spending associated with major infrastructure investment is a typical constraint of macroeconomic modeling studies of infrastructure investment.)*

## **OFFSETTING EFFECTS OF INFRASTRUCTURE INVESTMENT**

The modeling approach incorporated a slight offsetting effect of expanded infrastructure investment on state & local non-infrastructure spending. In this case, the study assumes that state & local non-infrastructure investment shrinks by an amount equal to 10 percent of the additional state and local spending on infrastructure specified in the policy scenario. This reflects the likelihood that states and localities will face budgetary pressures that cause them to temporarily decrease their focus on other types of spending during the policy period.

## **ALLOCATION OF INVESTMENT SPENDING**

The majority (75 percent) of the spending package was allocated to investment in structures. This is the core category of infrastructure capital investment, covering products like dams, roads, and buildings. Meanwhile, the remaining investment categories of equipment, intellectual property, and real estate & acquisition were allocated 13%, 7%, and 5%, respectively of the investment spending totals.

## Modeling Assumptions and Qualifications (cont.)

### **THE LIFT MODEL**

The study utilizes the University of Maryland Inforum's Long-term Interindustry Forecasting Tool (LIFT) model – a 121-sector dynamic, general equilibrium model of U.S. economy. It takes a "bottom up" approach to macroeconomic forecasting, building up to macroeconomic totals by modeling industry-level effects (*See Appendix B for a detailed description of the model*). The policy scenario is imposed upon the model, resulting in increases in both aggregate demand and labor productivity, which are observed both for individual sectors and in the overall macroeconomy.

### **INDUSTRY-LEVEL PRODUCTIVITY RESPONSES**

The model incorporates expectations for industry-level labor productivity gains in response to infrastructure improvements. Each industry experiences different changes to input costs and efficiency due to improved infrastructure, and the model internalizes this variation as an input to forecasts of employment, output, wages, and other key indicators. For example, labor productivity in the trucking sector – an industry undeniably dependent on public infrastructure – responds strongly to improved infrastructure, as drivers are able to move goods more quickly and efficiently. The estimated magnitudes of these effects are the product of detailed studies and research conducted by Inforum in collaboration with engineering and industry experts.

### **THE BASE CASE**

The baseline assumptions in the model represent a steady-state forecast of the macroeconomy over the specified time period (i.e., 2021-2040). The model extrapolates current macroeconomic and demographic trends and trends in infrastructure spending from recent history to set the baseline. As a result, the baseline reflects the unique economic environment of the present day, which is characterized by relatively high unemployment, relatively low borrowing costs, and moderate GDP growth. The \$979 billion policy scenario is imposed on top of this baseline.



# Appendix A

## Detailed Results: Macroeconomic Results

Indicator	Units	Scenario	Policy Period 2021-2030	Out Years 2031- 2040	20-Year Period: 2021-2040
<b>Real Gross Domestic Product</b>	Level (Billions 2020\$)	Baseline	244,060	302,025	546,085
		Policy Scenario	246,222	308,068	554,290
	Average Annual Growth Rate	Baseline	2.54%	2.07%	2.31%
		Policy Scenario	2.68%	2.18%	2.43%
<b>Real Personal Consumption Expenditures</b>	Level (Billions 2020\$)	Baseline	169,374	208,124	377,498
		Policy Scenario	170,367	211,702	382,069
	Average Annual Growth Rate	Baseline	2.56%	2.01%	2.28%
		Policy Scenario	2.68%	2.09%	2.39%
<b>Real Gross Domestic Private Investment</b>	Level (Billions 2020\$)	Baseline	47,251	65,478	112,729
		Policy Scenario	47,824	67,353	115,177
	Average Annual Growth Rate	Baseline	3.92%	3.31%	3.61%
		Policy Scenario	4.11%	3.48%	3.80%
Non-Residential Fixed Investment	Level (Billions 2020\$)	Baseline	38,079	53,528	91,607
		Policy Scenario	38,509	54,982	93,491
	Average Annual Growth Rate	Baseline	3.86%	3.42%	3.64%
		Policy Scenario	4.04%	3.58%	3.81%
Residential Fixed Investment	Level (Billions 2020\$)	Baseline	8,663	11,488	20,151
		Policy Scenario	8,786	11,869	20,656
	Average Annual Growth Rate	Baseline	2.95%	2.95%	2.95%
		Policy Scenario	3.17%	3.16%	3.17%
<b>Real Government Consumption &amp; Investment</b>	Level (Billions 2020\$)	Baseline	39,357	43,447	82,804
		Policy Scenario	40,369	44,695	85,064
	Average Annual Growth Rate	Baseline	0.77%	1.08%	0.93%
		Policy Scenario	1.02%	1.14%	1.08%
<b>Real Net Exports</b>	Level (Billions 2020\$)	Baseline	(12,107)	(14,251)	(26,358)
		Policy Scenario	(12,588)	(14,905)	(27,493)
	Average Annual Growth Rate	Baseline	1.56%	2.91%	2.24%
		Policy Scenario	2.17%	2.69%	2.43%
Real Exports	Level (Billions 2020\$)	Baseline	33,517	45,425	78,942
		Policy Scenario	33,496	46,162	79,658
Real Imports	Level (Billions 2020\$)	Baseline	45,625	59,676	105,301
		Policy Scenario	46,084	61,067	107,151

## Detailed Results: Macroeconomic Results (cont.)

Indicator	Units	Scenario	Policy Period 2021-2030	Out Years 2031- 2040	20-Year Period: 2021-2040
<b>Total Jobs</b>	Average Annual Level (Millions)	Baseline	166.306	172.444	169.375
		Policy Scenario	167.083	173.684	170.383
<b>Total Civilian Labor Force</b>	Average Annual Level (Millions)	Baseline	166.925	172.283	169.604
		Policy Scenario	167.423	173.211	170.317
<b>Total Labor Productivity</b>	Average Annual Level (2020\$/Hour)	Baseline	88.01	105.21	96.61
		Policy Scenario	88.16	106.11	97.14
	Average Annual Growth Rate	Baseline	1.43%	1.66%	1.55%
		Policy Scenario	1.47%	1.74%	1.61%
<b>Real Average Disposable Household Income</b>	Average Annual Level (2020\$/Hour)	Baseline	145,317	166,436	155,877
		Policy Scenario	146,136	169,212	157,674
<b>Average Real Wage</b>	Average Annual Level (2020\$/Hour)	Baseline	48.43	57.16	52.79
		Policy Scenario	48.86	58.29	53.58
	Average Annual Growth Rate	Baseline	1.24%	1.48%	1.36%
		Policy Scenario	1.38%	1.58%	1.48%
<b>Personal Savings Rate</b>	Average Annual Level	Baseline	8.78%	7.96%	8.37%
		Policy Scenario	8.76%	7.90%	8.33%
<b>Interest Rate: 10-Year Treasury Bond Yields</b>	Average Annual Level	Baseline	2.31%	3.81%	3.06%
		Policy Scenario	2.37%	3.87%	3.12%
<b>Interest Rate: 3-Month Treasury Bill Yields</b>	Average Annual Level	Baseline	1.18%	2.55%	1.86%
		Policy Scenario	1.27%	2.61%	1.94%
<b>GDP Deflator (2012 = 100)</b>	Average Annual Level	Baseline	127.20	156.19	141.69
		Policy Scenario	127.59	156.78	142.18

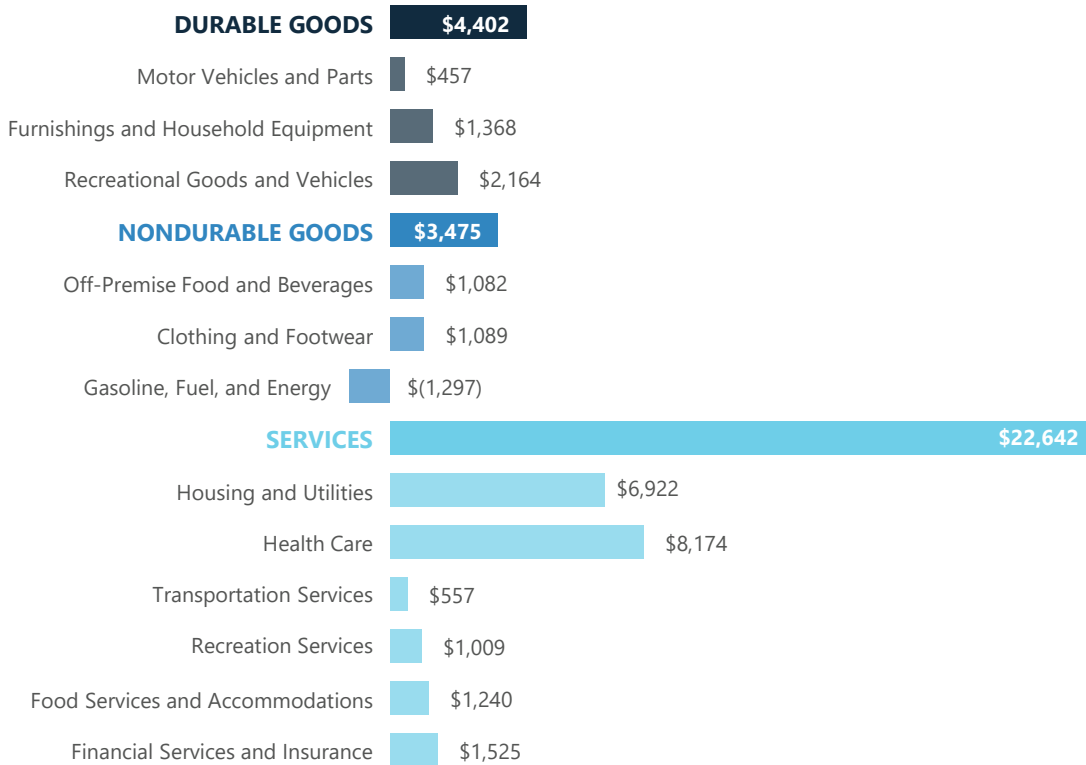
## Detailed Results: Results by Sector

Industry	Percent Difference in Employment Level by 2040	Percent Difference from Baseline 20-Year Cumulative Industry Output	Percentage Point Difference from Baseline Annual Average Labor Productivity Growth Rate
<b>Total</b>	<b>0.73%</b>	<b>1.43%</b>	<b>0.06 pp</b>
<b>Farms, Forestry, Fishing</b>	-0.42%	0.78%	0.17 pp
<b>Mining</b>	2.01%	1.42%	0.02 pp
Mining, except oil and gas	4.82%	3.84%	0.06 pp
<b>Utilities</b>	1.81%	1.14%	0.00 pp
<b>Construction</b>	4.28%	5.00%	0.05 pp
<b>Nondurables Manufacturing</b>	0.95%	0.89%	0.02 pp
Food, Beverage, Tobacco	0.61%	0.65%	0.03 pp
Textiles and Apparel	1.73%	1.14%	0.00 pp
Wood & Paper Products	1.59%	1.52%	0.03 pp
Printing and Support Activities	1.20%	1.10%	0.02 pp
Petroleum and Coal Products	0.34%	0.41%	0.03 pp
Chemical, Plastics, & Rubber Products	1.14%	0.86%	0.00 pp
Nonmetallic Mineral Products	0.20%	3.11%	0.21 pp
<b>Durables Manufacturing</b>	1.56%	1.59%	0.02 pp
Metals	1.78%	1.75%	0.01 pp
Machinery	1.38%	1.54%	0.01 pp
Computer & Electronic Products	0.39%	1.30%	0.07 pp
Electrical Equipment & Appliances	1.75%	1.57%	0.01 pp
<b>Transportation Equipment</b>	1.93%	1.70%	0.01 pp
Miscellaneous	1.48%	1.34%	0.01 pp
<b>Trade</b>	0.50%	1.28%	0.06 pp
Wholesale Trade	0.24%	1.39%	0.07 pp
Retail Trade	0.59%	1.15%	0.05 pp
<b>Transportation</b>	-7.45%	2.35%	0.62 pp
Air	2.24%	1.69%	0.01 pp
Rail	1.69%	1.43%	0.01 pp
Water	1.27%	1.11%	0.01 pp
Truck	-11.64%	1.59%	0.74 pp
Transit & Ground Passenger Transportation	-9.20%	2.81%	0.76 pp
Pipeline	-0.18%	0.14%	0.03 pp
Other Transportation & Support Activities	-4.43%	5.10%	0.63 pp
Warehousing and Storage	-8.45%	1.54%	0.76 pp
<b>Finance, Insurance, and Real Estate</b>	1.37%	1.45%	0.02 pp
<b>Other Services</b>	1.23%	1.45%	0.01 pp
<b>Civilian Government</b>	0.07%	0.35%	0.05 pp

# Detailed Results: Consumer Spending

## Additional Consumption Spending per Household

Cumulative Additions to Personal Consumption, Select Categories (2020\$), 2021-2040



Savings from improved infrastructure flow directly to households in the form of decreased spending on fuel and energy. On average, each household saves a cumulative \$1,297 on gas, fuel, and energy over 20 years. These savings, as well as higher wages and household incomes, allow households to increase their consumption of a wide variety of other goods and services, including recreation, entertainment, healthcare, insurance, etc.

# Appendix B

## Description of Model

*LIFT is a dynamic interindustry macroeconomic model.*

This analysis was performed using the University of Maryland’s Inforum LIFT model — a widely used econometric model of the U.S. economy. The LIFT (Longterm Interindustry Forecasting Tool) model is unique among large-scale models of the U.S. economy; combining an interindustry (input-output) formulation with extensive use of regression analysis, the LIFT model utilizes a dynamic general equilibrium structure that portrays the economy in a “bottom-up” fashion and allows effects to be captured at the detailed industry and product level.



LIFT models the behavior of 71 industries producing 121 commodities, allowing interrelated demand and price relationships to cascade through the economy from the ground up. The model works like the actual economy, building the macroeconomic totals from details of industry activity rather than distributing predetermined macroeconomic quantities among industries. The detailed industry foundation enables industry-specific calculations of the benefits of infrastructure investment, including direct and indirect impacts. It also traces the flow of additional consumer spending arising from employment shifts and productivity boosts across industries.

Despite its industry basis, LIFT is a full macroeconomic model with more than 800 macroeconomic variables determined consistently with the underlying industry detail. This macroeconomic “superstructure” contains functions for key indicators that reflect the macroeconomic impacts of infrastructure investment. The model also has a detailed federal government fiscal accounting, which allows it to describe revenue collection and spending for a specific investment scenario.

# Appendix C

## Detailed Policy Scenario by System

*The magnitude of the spending scenario was arrived at based on bottom-up, system-level research comparing current capital spending with consensus estimates of the “need” by system. These “need” estimates represent the capital investment required to return each system to a state of good repair and expand and improve the system to meet future demand, as determined by current asset conditions and performance and reported by system-level experts.*

System	Additional Investment (Billions 2020\$)	Sources & Assumptions Overview
<b>Surface Transportation</b> Roads, Bridges, and Transit	\$ 565.0	Compared “business as usual” spending to needed investment to “expand and enhance” the system from the DOT 2020 Conditions and Performance Report, including addressing a capital backlog. State and local shares of spending are based on Highway Trust Fund cost-sharing guidelines and leverage ratios of existing federal grant and credit programs that fund road & bridge projects (e.g., TIFIA, BUILD). Assumes that private share of spending increases to 5% of the total for roads and bridges, in turn decreasing the state and local share. Also incorporates a non-specified 5% “plus up” to account for new and innovative infrastructure investments not included in DOT need estimates.
<b>Aviation</b>	\$ 81.1	Compared “business as usual” spending from the CBO 2017 Infrastructure Spending Tables for public sector spending on aviation and FAA estimates of baseline upgrades required by NextGen to the capital need estimates from ACI-NA and FAA estimates of capital needs for NextGen. State and local shares of spending are based on FAA AIP cost-sharing requirements and leverage ratios. Assumes that the private share of spending increases to 5% of the total, in turn decreasing the state and local share.
<b>Water Resources &amp; Transportation</b> Ports, Inland Waterways, Dams & Levees	\$ 130.3	Compared “business as usual” spending from the CBO 2017 Infrastructure Spending Tables for public sector spending on water resources and AAPA estimates for private sector spending to need estimates from AAPA for ports, need estimates from the IMTS Capital Investment Strategy Team for inland waterways, and need estimates from ASCE for levees and dams. State and local shares of spending are based on cost-sharing guidelines of various applicable programs (e.g., WIIN, IWTF, WIFIA) and their leverage ratios. Assumes no significant additional private share of spending.
<b>Water / Wastewater</b>	\$ 122.6	Compared “business as usual” spending from the CBO 2017 Infrastructure Spending Tables for public sector spending on water and wastewater systems to need estimates from EPA’s 2012 needs assessment, which accounts for expanded future demand and necessary capital replacements. Assumes no significant additional private share of spending.
<b>Broadband</b>	\$ 80.0	Used incremental broadband spending needs estimate from 2017 FCC white paper estimating total upfront capex required to deploy fixed broadband to the 14% of locations nationwide currently lacking access. This \$80B number was echoed in the House E&C Democrat’s LIFT America Act introduced in March 2021.

# Appendix D

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# Endnotes

1. Congressional Budget Office. (2018, October). *Public Spending on Transportation and Water Infrastructure, 1956-2017*, 3.
2. *Ibid*, 4.
3. *Ibid*, 6.