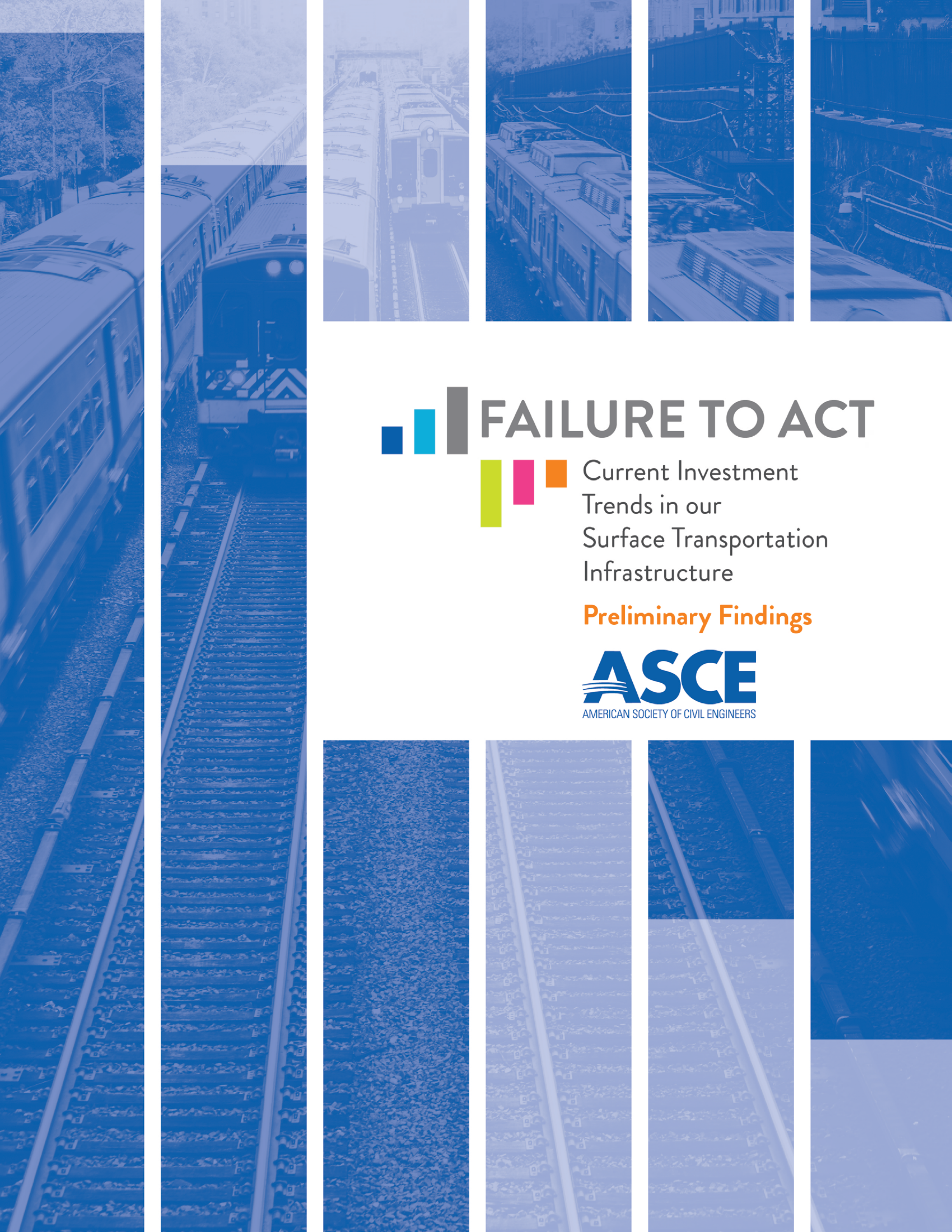

FAILURE TO ACT

Current Investment Trends in our Surface Transportation Infrastructure

Preliminary Findings

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Failure to Act: Current Investment Trends in our Surface Transportation Infrastructure

The nation's surface transportation infrastructure includes the critical highways, bridges, and transit systems that enable access to markets, employment, community services, and the economic engines that drive American GDP. For many years, the nation's surface transportation infrastructure has been underfunded and continues to experience deterioration, in both its condition and its capacity to perform. Moreover, even where conditions are now stable, backlogs are growing, potentially signaling future decline. Because this deterioration and accumulating backlog have been diffused throughout the nation and has occurred gradually over time, its true costs and economic impacts are not always immediately apparent. In practice, the transportation funding that is appropriated is spent on a mixture of preservation projects and select system expansions. **While these allocations have often been sufficient to avoid imminent failure of key facilities, the continued deterioration leaves a significant and mounting burden on the U.S. economy.**

This analysis is about the effect that transportation deficiencies have, and will continue to have, on U.S. economic performance. Specifically, this report looks at:

1) What we are currently spending on roads and transit systems; and
2) What we need to be spending to return the systems to a state of good repair.

Subsequently, the report extends these trends out to 2039 to explore how underinvestment stands to impact everything from household income to our overall economic competitiveness.

The methods and models employed in assessing the economic impacts of current investment levels for our nation's bridges and public transportation systems focuses on state of good repair, and in particular on addressing the current and growing backlog of capital assets that are in poor condition, obsolete, and/or past their useful service lives. Our analysis of highways addresses mounting urban congestion well as identifies rehabilitation needs where pavement conditions can transition from good to fair and poor as one moves off the Interstate system.

TRANSIT INVESTMENT TRENDS AND NEEDS

To estimate the public transportation investment gap, our analysis relied heavily on the Federal Transit Administration's (FTA) National Transit Database and the Transit Economic Requirements Model (TERM). In keeping with the FHWA Conditions and Performance Report, we define "state of good repair" as transit capital assets within their useful service life.

The baseline investment scenario is a continuation of current (2019) funding levels for the transit sector through 2039. The alternative investment scenario is one in which capital assets are replaced once they have exceeded their useful lives. Thus, in any given year, the analysis uses backlogs as a catalogue of asset replacement costs for assets that are past their useful lives. Additionally, system expansion which adds capacity to the transit network was also incorporated into the analysis, as a share of transit capital investment is allocated to new capacity. For example, from 2000 to the end of 2017, 52 new systems and 124 extensions (both rail and busway) opened, resulting in a total of 1,393 additional segment miles.

Assuming that capital investment for the large and growing state of good repair needs does not increase above current funding levels, the transit sector will face two major consequences: growth in passenger delay resulting from increasing service interruptions (e.g., mechanical failures and secondary service delays on rail systems due to fixed guideway breakdowns), and a significant increase in maintenance and vehicle procurement costs as service vehicles become more expensive to maintain and larger fleets are required to compensate for unreliable or faulty vehicles (i.e., to maintain higher spare ratios). As shown in Table 1, these cumulative costs total $24.8 billion.

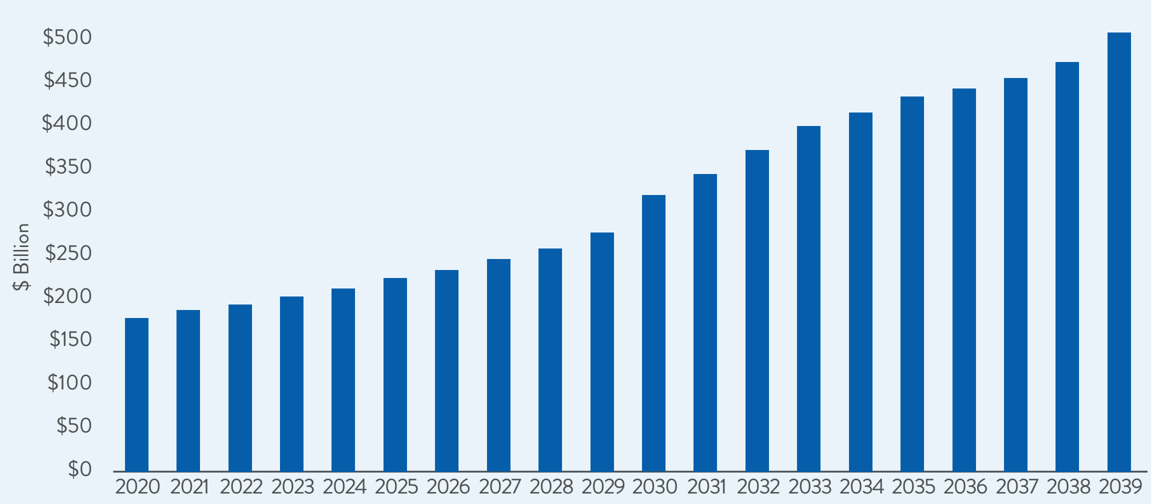
TABLE 1. Transit Cost Trends Extended Funding Scenario, Costs by Type, Period, and Region

Region	2020-2029	2030-2039	Cumulative Total
	Passenger Delay Costs ($M)		
National	$1,183.8	$1,871.0	$3,054.8
Far West	*$326.0*	*$420.1*	*$746.1*
Great Lakes	*$184.2*	*$233.8*	*$418.1*
Mideast	*$293.3*	*$707.1*	*$1,000.5*
New England	*$54.3*	*$77.4*	*$131.7*
Plains	*$45.5*	*$63.6*	*$109.1*
Rocky Mountain	*$18.8*	*$30.8*	*$49.6*
Southeast	*$180.2*	*$223.5*	*$403.6*
Southwest	*$79.2*	*$110.7*	*$189.9*
Territories	*$2.2*	*$4.0*	*$6.2*
	Additional Spare Vehicle Costs ($M)		
National	$770.6	$2,375.9	$3,146.5
Far West	*$73.5*	*$219.9*	*$293.3*
Great Lakes	*$318.7*	*$373.9*	*$692.6*
Mideast	*$245.3*	*$1,128.4*	*$1,373.7*
New England	*$22.0*	*$213.3*	*$235.4*
Plains	*$23.7*	*$76.1*	*$99.8*
Rocky Mountain	*$7.7*	*$33.7*	*$41.4*
Southeast	*$57.6*	*$146.6*	*$204.2*
Southwest	*$19.2*	*$162.5*	*$181.8*
Territories	*$2.8*	*$21.5*	*$24.3*
	Additional Vehicle Maintenance Costs		
National	$7,292.9	$11,342.5	$18,635.3
Far West	*$1,467.9*	*$2,014.6*	*$3,482.5*
Great Lakes	*$1,360.6*	*$1,653.9*	*$3,014.5*
Mideast	*$3,180.8*	*$5,592.0*	*$8,772.8*
New England	*$442.9*	*$676.8*	*$1,119.7*
Plains	*$105.3*	*$235.8*	*$341.1*
Rocky Mountain	*$58.5*	*$88.8*	*$147.3*
Southeast	*$509.0*	*$646.3*	*$1,155.2*
Southwest	*$131.5*	*$311.0*	*$442.5*
Territories	*$36.4*	*$123.3*	*$159.6*

Sources: National Transit Database 2018 Data Products (Urbanized Area Asset Summary Tool, National Transit Profile Summary, Breakdowns, TS1.1 - Total Funding Time-Series, Annual Operating Expenses Database, Annual Capital Use Database), APTA 2019 Public Transportation Vehicle Database, APTA 2019 Public Transportation Factbook Figure 11. Calculations by EBP.

Our analysis estimates a current backlog of **$176.1 billion for transit investments**, considering the vehicles, facilities, and track that are already past their useful lives.[1] If transit capital investment is maintained at the current real level of funding, that backlog value is expected to grow to **$498.9 billion through 2039** as existing assets continue to age, as shown in Figure 1. Our findings show that the current estimated state of good repair backlog is over 10 times greater than the average amount spent on capital investment annually in recent years (i.e., 2012-2018) for all urban transit systems in the U.S. (for both state of good repair and new capacity combined).

FIGURE 1. Estimated Growth in Transit State of Good Repair Backlog, 2020-2039, Extended



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ROADS INVESTMENT TRENDS AND NEEDS

The analysis finds that to date, the federal-aid highway system is reasonably maintained, as measured by pavement conditions which have been stable and experienced moderate improvements at recent levels of investment. Looking forward, however, a gap will exist for all federal aid highways – including rural and urban arterials and collectors – between what is estimated to be spent and what is actually required to rehabilitate pavement and other operational conditions. It's important to note that pavement conditions vary considerably by a roadway's functional class. While the urban and rural interstate systems are well-funded and pavement conditions are generally good or very good, urban and rural collectors and non-interstate highways require considerably more funding to improve conditions to a consistently acceptable level of performance.

Based on the 2019 FHWA Condition & Performance Report, over the next 20 years the funding that will be required to rehabilitate pavement and other operational conditions will average approximately $53 billion annually, or almost $1.1 trillion across 20 years (adjusted to 2019 dollars). Meanwhile, projected spending is estimated at only $41 billion annually. The resulting funding gap is approximately $12 billion annually, or $238 billion over 20 years. In other words, spending must increase 29 percent over current spending levels to address the current backlog and

1 For perspective on this backlog cost, FHWA's most recent Conditions and Performance Report (2019) estimated that the replacement value of all the nation's transit assets was $894.8 billion as of 2014, 43 percent of which was guideway elements. As of 2014, FHWA estimated a national transit backlog of $98.0 billion, a figure that has grown in just six years.

anticipated future backlogs, after adjusting to 2019 dollars.[2]

While not all of the additional spending would be applied to improve pavement conditions (it also includes some operational improvements, such as safety improvements and highway geometry), it represents a reasonable approximation of the spending needed to maintain the highway system in a state of good repair and serve households and industry at a consistently acceptable level. The FHWA Conditions & Performance data indicates that the state of good repair gap is primarily with non-interstate collectors and arterial systems, and that interstate highways are mostly in good repair.

Meanwhile, congestion on the nation's highway network is an increasingly significant problem, particularly in metropolitan areas with severe bottlenecks. The cost of congestion was monetized for highway users and found to be almost $180 billion in 2017.[3] The average yearly congestion delay per auto commuter grew by 15% between 2012 and 2017. Over the same five-year period, congestion costs have grown more steeply, increasing 19% for all vehicles, while truck congestion delay costs increased by 35%.

The costs of deficient road networks, even with a significant gain in connected and autonomous vehicle (CAV) technology, could reach **$4.2 trillion** cumulatively over 20 years, according to this analysis. The $4.2 trillion includes the travel delay costs for auto users, excess petroleum-based fuel burned by autos and trucks (including the electricity cost of CAV, in equivalent terms of gasoline), the direct time costs of truck delay (including operator and other vehicle maintenance expenses), and an additional loss – the logistics costs of delay for the freight carried on trucks, a measure of the opportunity cost of late and unreliable delivery of goods to markets or intermediate destinations. With just-in-time inventory systems an increasingly important element of supply chains, these costs will become more critical in maintaining cost-effective productivity across the U.S. economy and competitiveness in global markets.

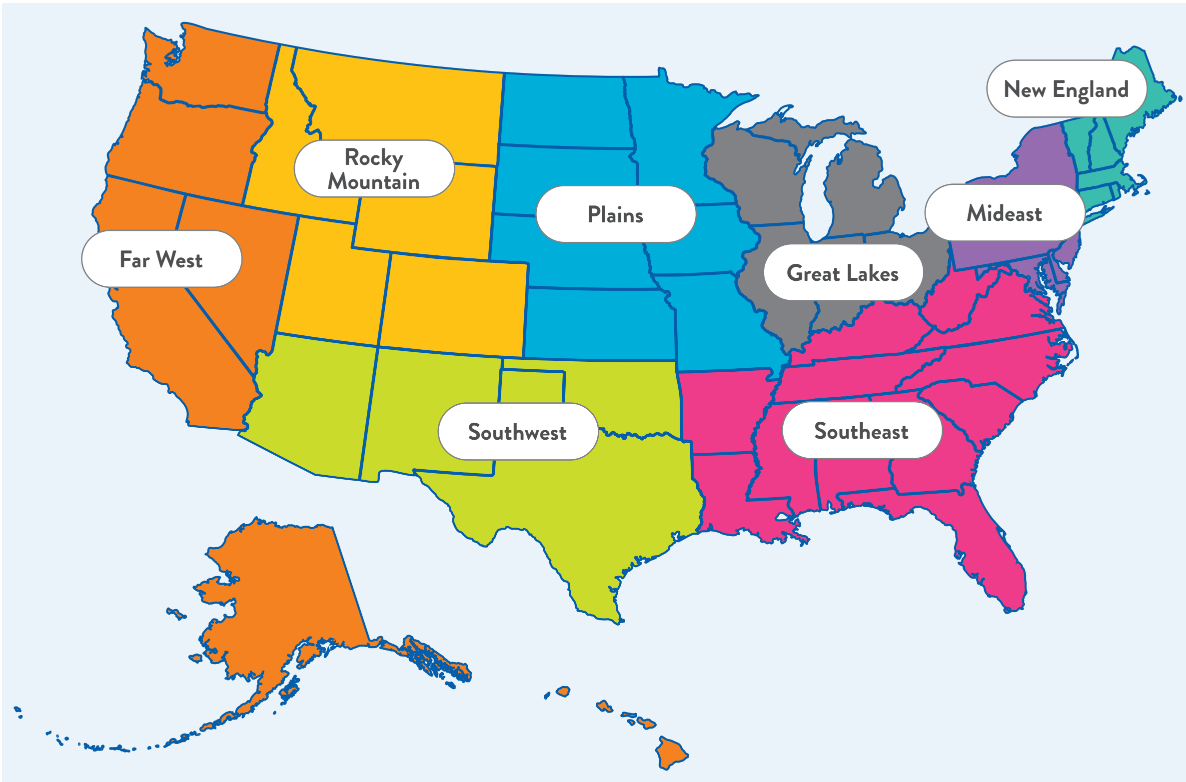
The eight multi-state regions defined by the U.S. Bureau of Economic Analysis (BEA) are used to look at projected sub-national variations, illustrated by Figure 1. Table 2 includes the total cumulative costs of congestion by region. On average across the U.S., a 60-minute trip in free flow traffic will be expected to take 106 minutes in 2039. In the Far West, the same 60-minute trip on average will take 129 minutes, and in the Plains – the region with the lowest level of congestion per trip would require 83 minutes on average.

The cumulative investment gap between current spending and needed expenditures to decrease congestion and maintain our assets in a state of good repair is approximately $1.5 trillion in 2019 dollars.

2 FHWA C&P Report, 2019. Exhibit 7-7: Improve Conditions and Performance Scenario for Federal-aid Highways: Distribution of Average Annual Investment for 2015 Through 2034 Compared with Actual 2014 Spending by Functional Class and Improvement Type.

3 This cost considers user travel delay and excess fuel, exclusive of any subsequent impacts of congestion such as lost productivity or increased business costs.

FIGURE 1. Estimated Growth in Transit State of Good Repair Backlog, 2020-2039, Extended



Source: U.S. Department of Commerce, Bureau of Economic Analysis

TABLE 2. 20-Year Cumulative Costs by Region

Region	Congestion Costs 2020-2039 ($2019 Billions)
New England	$170.8
Mideast (Mid-Atlantic Region)	$620.8
Great Lakes	$335.7
Plains	$120.3
Southeast	$684.8
Southwest	$800.7
Rocky Mountains	$135.3
Far West	$1,327.6
Total Congestion Cost	$4,196.2

Source: EBP calculations based on the Urban Mobility Report of the Texas Transportation Institute, 2017

TOTAL INVESTMENT GAP FOR SURFACE TRANSPORTATION SYSTEMS

In total, about $4.1 trillion will be needed from 2020 through 2039 to sustain the multiple components of surface transportation across the U.S. (Table 3). During this timeframe, spending of slightly more than $2 trillion is projected, or about 50 cents on the dollar, which leaves an overall investment gap of more almost $2.1 trillion.

TABLE 3. Projected Surface Transportation Infrastructure Gap, 2020-2039 ($2019 Billions)

Surface Transportation Component	Projected Needs	Projected Investment	Estimated Investment Gap
Highways & Bridges	$3,256	$1,720	$1,536
Transit & Intercity Rail	$842	$308	$535
Totals	$4,098	$2,028	$2,071

Note: Columns and Rows may not add due to rounding.

OVERALL ECONOMIC IMPACTS OF UNDERINVESTMENT

Chronic underinvestment in our surface transportation infrastructure bears severe economic consequences. Subpar roadway conditions and transit that does not meet a state of good repair produces direct costs to businesses and households, as well as to the national economy.

Should investment in our nation's highways, bridges, and public transportation systems continue at current trend levels of capital spending, households and businesses will incur nearly $2 trillion dollars in extra costs cumulatively over the 20-year timeframe of this study. These costs do not include all of the travel delay incurred by private auto users under congested conditions although it does include "on-the-clock" travel. **As shown in Table 4, costs break down to almost $1.8 trillion to industries and more than $217 billion directly to households.** The direct costs to households equate to more than $1,500 per household over 20 years. Moreover, if industry costs are passed onto consumers, the cumulative cost per household could be as high as $12,500 over 20 years, or $625 annually. The effects will compound greatly over time; losses to households and industries will amount to $677 billion over the 2020 -2029 period and $1.5 trillion during the 2030-2039 decade.

TABLE 4. Direct economic costs, $2019 billions

	2020-2029	2030-2039	2020-2039
Industries	$594	$1,158	$1,752
Households	$83	$134	$217
Totals	$677	$1,292	$1,969

The U.S. stands to lose jobs in several key industries because of inefficiencies in the surface transportation network. Collectively, professional services, manufacturing and health care sectors are expected to lose more than 540,000 jobs by 2040. These areas, some of which drive the nation's leading research and development sectors, support innovation and technologically-related advancements. Unfortunately, these sectors will fall behind international competitors as transportation costs borne by U.S. industries drive prices higher.

TABLE 5. Cost to Industry in 2039 from Deficient Surface Transportation Infrastructure

Industry Sector	Projected Direct Cost Impacts in 2039	Percent of Impacts
Truck transportation	$40.0	26%
Wholesale trade	$19.3	12%
Retail	$13.9	9%
Manufacturing	$12.4	8%
Construction	$8.2	5%
State and local general government	$5.5	4%
Health Care Services	$5.3	3%
Administrative and support services	$4.7	3%
Miscellaneous professional, scientific, and technical services	$4.3	3%
Warehousing and storage	$3.5	2%
Other transportation and support activities	$3.4	2%
Other services, except government	$3.4	2%
Food services and drinking places	$3.3	2%
Waste management and remediation services	$3.1	2%
Agriculture	$2.2	1%
Other	$22.9	15%

Costs to industries and households are the starting point for economic impacts that will be felt across the nation. As conditions continue to deteriorate over time, they will increasingly detract from the ability of American households and businesses to be productive and prosperous at work and at home, inflicting cascading effects on the national economy. For example, the costs imposed by congestion and poor infrastructure will increase prices and decrease profits of goods and services provided by U.S. businesses, leading to reductions in wages and disposable income of households. Moreover, households will have to divert more dollars to offset transportation costs and away from other purchases, just as overall income is decreasing. The result is that cumulatively from 2020 through 2039, $6.2 trillion in national gross output will be lost, GDP will be $2.8 trillion lower, and disposable household income will drop by $1.8 trillion. In addition, the 2039 economy is expected to support 726,000 fewer jobs due to poor surface transportation infrastructure.

Table 4 and 5 above show the direct costs to industries and households as a consequence of inadequate surface transportation infrastructure and Table 6 below presents the expected impacts of these losses on the national economy.

TABLE 6. Losses on Total U.S. Economy due to Failing Transportation Infrastructure, 2020-2039 ($2019 billions)

Year	Business Sales[4] (Output)	GDP	Disposable Income	Jobs
Losses in the Year 2029	$216	$97	$71	378,000
Losses in the Year 2039	$824	$371	$227	726,000
Cumulative Losses 2020-2029	$1,035	$472	$334	N/A
Cumulative Losses 2030-2039	$5,186	$2,341	$1,504	N/A
Cumulative Losses 2020-2039	$6,221	$2,813	$1,838	N/A

Columns may not add due to rounding.
Note: Losses and increases reflect impacts in a given year against national baseline projections. These measures do not indicate declines from 2019 levels.
Sources: EBP and LIFT model, University of Maryland, INFORUM Group, 2020.

4 Output represents gross production of U.S. industries. According the U.S. Bureau of Economic Analysis, gross output consists of both the value of what is produced and then used by others in their production processes and the value of what is produced and sold to final users—that is, final product. Industry "value added" is defined as the value of the industry's sales to other industries and to final users minus the value of its purchases from other industries. Value added is a nonduplicative measure of production that when aggregated across all industries equals gross domestic product (GDP) for the economy.

Conclusion

The most recent data available shows that current surface transportation system investment trends are unsustainable. Furthermore, the report's findings are likely seriously understated, especially given the COVID-19 pandemic is exacerbating existing shortfalls. Serious economic consequences will be inflicted without a combination of changes in investments. The cost of continuing to inadequately fund America's surface transportation system will, at current levels, produce a mounting burden that takes the form of higher costs of doing business, fewer opportunities for firms to invest, a sluggish research and development sector, and less disposable income for households. The burden also compromises America's competitive position in the world's economy and leads to lower overall profitability for business sectors.

About this report

The report utilizes the University of Maryland's LIFT national macroeconomic model of the U.S. economy to arrive at the long-term economic impacts of underinvestment scenarios for our transportation infrastructure.[5] The analysis relies on baseline data that predates the COVID-19 pandemic.[6] Data sets and economic models generally lag one to three years behind the present, to allow for data collection, validation, and publication. As a result, economic modeling does not yet account for COVID-19 impacts. Also unknown is the extent and permanence of pandemic-related changes to commuting trends and travel behavior, goods movement, and the long-term impacts to user-based transportation revenue streams.

Failure to Act is structured around five reports that assess implications for the productivity of industries, national competitiveness, and effects on households given the present trends of infrastructure investment. Together these reports review nine of the 17 categories addressed by the ASCE Report Card.

This report covers Surface Transportation, encompassing highways, bridges, and transit. Other Failure to Act reports address: Water, Wastewater & Stormwater Delivery, Collection, and Treatment; Energy Transmission; Airports and Marine Ports/Inland Waterways.

5 The LIFT model derives key measures of economic wellbeing for households and industries, including employment, income, gross domestic product (GDP) and other key macroeconomic measures. Direct impacts on transportation system users and transportation agencies across all three modes (highways, bridges, and transit) have been aggregated and a combined macroeconomic impact is reported.

6 Data includes the FHWA Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance Report published in 2019, as well as the National Bridge Inventory, Texas A&M University Transportation Institute's Urban Mobility Report, and other sources.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