ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

A COMPREHENSIVE ASSESSMENT OF AMERICA'S INFRASTRUCTURE

2021 REPORT CARD FOR AMERICA'S INFRASTRUCTURE

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ABOUT ASCE

The American Society of Civil Engineers, founded in 1852, is the country's oldest national civil engineering organization. It represents more than 150,000 civil engineers in private practice, government, industry, and academia who are dedicated to advancing the science and the profession of civil engineering, and protecting public health, safety, and welfare.

2021 REPORT CARD FOR AMERICA'S INFRASTRUCTURE

Introduction

Infrastructure supports nearly every aspect of life. Our pipes deliver drinking water to homes and hospitals. Airports, railroads, and inland waterways transport goods from farms and manufacturing plants to store shelves. The roads that crisscross the country allow us to get to work and school safely, and the network of transmission and distribution lines keeps the lights on and our electronics charged. Dams enable consistent water supply in arid climates, and levees hold back floodwaters to protect rain-soaked communities.

Since ASCE began issuing the Report Card in 1998, the grades have struggled to get out of the D's. However, more recently, decision-makers at all levels of government have recognized the critical role our infrastructure plays in supporting our quality of life and economy. Voters and lawmakers alike have championed smart infrastructure policy and increased investment in our multimodal freight system, drinking water networks, and more. This down payment on our infrastructure bill has contributed to modest but meaningful improvements.

KEY FINDINGS

The *2021 Report Card for America's Infrastructure* reveals we've made some incremental progress toward restoring our nation's infrastructure. For the first time in 20 years, our infrastructure is out of the D range.

The 2021 grades range from a B in rail to a D- in transit. Five category grades — aviation, drinking water, energy, inland waterways, and ports — went up, while just one category — bridges — went down. And stormwater infrastructure received its first grade: a disappointing D. Overall, eleven category grades were stuck in the D range, a clear signal that our overdue bill on infrastructure is a long way from being paid off.

While we grade 17 categories individually, our infrastructure is a system of systems and more connected than ever before. As we look at the low grades and analyze the data behind them, there are three trends worth noting:

1. **Maintenance backlogs continue to be an issue, but asset management helps prioritize limited funding.** Sectors like transit and wastewater have staggering maintenance deficits, but developing a clear picture of where the available funding is most needed improves overall system performance and public safety. The drinking water sector, for example, has embraced asset management and new technology to pinpoint leaks and target repairs.

2. **State and local governments have made progress. Increased federal investment or reform has also positively impacted certain categories.** Thirty-seven states have raised their gas tax to fund critical transportation investments since 2010. Ninety-eight percent of local infrastructure ballot initiatives passed in November 2020. At least 25 major cities and states now have chief resilience officers. These improvements were made by elected officials from both sides of the aisle and with strong voter support. Meanwhile, categories like ports, drinking water, and inland waterways have been the beneficiaries of increased federal funding.

GRADING SCALE

A — EXCEPTIONAL, FIT FOR THE FUTURE

The infrastructure in the system or network is generally in excellent condition, typically new or recently rehabilitated, and meets capacity needs for the future. A few elements show signs of general deterioration that require attention. Facilities meet modern standards for functionality and are resilient to withstand most disasters and severe weather events.

B — GOOD, ADEQUATE FOR NOW

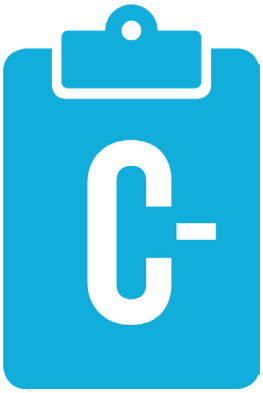
The infrastructure in the system or network is in good to excellent condition; some elements show signs of general deterioration that require attention. A few elements exhibit significant deficiencies. Assets are generally safe and reliable, with minimal capacity issues and minimal risk.

3. **There are still infrastructure sectors where data is scarce or unreliable.** Sectors like school facilities, levees, and stormwater still suffer from a lack of robust condition information or inventory of assets. To target investments and allocate funding, routine, reliable data should be the standard.

The elected officials and members of the public who have improved infrastructure policy and supported additional funding are applauded. We're seeing the benefits of this action in drinking water, inland waterways, and airports. The private sector has invested in the electric grid, freight rail, and more.

However, significant challenges lie ahead. Importantly, the COVID-19 pandemic's impacts on infrastructure revenue streams threaten to derail the modest progress we've made over the past four years. In addition, many sectors and infrastructure owners are learning what it will take to make our communities climate resilient as we grapple with more severe weather. Meanwhile, many of our legacy transportation and water resource systems are still in the D range. These infrastructure networks suffer from chronic underinvestment and are in poor condition.

We're headed in the right direction, but a lot of work remains.



For the first time in 20 years, our infrastructure GPA is a C-, up from a D+ in 2017. This is good news and an indication we're headed in the right direction, but a lot of work remains.

C MEDIOCRE, REQUIRES ATTENTION

The infrastructure in the system or network is in fair to good condition; it shows general signs of deterioration and requires attention. Some elements exhibit significant deficiencies in conditions and functionality, increasing vulnerability to risk.

D POOR, AT RISK

The infrastructure is in fair to poor condition and mostly below standard, with many elements approaching the end of their service life. A large portion of the system exhibits significant deterioration. Condition and capacity are of serious concern with strong risk of failure.

F FAILING/CRITICAL, UNFIT FOR PURPOSE

The infrastructure in the system is in unacceptable condition with widespread, advanced signs of deterioration. Many of the components of the system exhibit signs of imminent failure.

ABOUT THE REPORT CARD FOR AMERICA'S INFRASTRUCTURE

Every four years, America's civil engineers provide a comprehensive assessment of the nation's 17 major infrastructure categories in ASCE's *Report Card for America's Infrastructure*. Using a simple A to F school report card format, the Report Card examines current infrastructure conditions and needs, assigning grades and making recommendations to raise them.

The ASCE Committee on America's Infrastructure, made up of 31 dedicated civil engineers from across the country with decades of expertise in all categories, volunteers their time to work with ASCE Infrastructure Initiatives staff to prepare the Report Card. The Committee assesses all relevant data and reports, consults with technical and industry experts, and assigns grades using the following criteria:

METHODOLOGY

CAPACITY
Does the infrastructure's capacity meet current and future demands?

CONDITION
What is the infrastructure's existing and near-future physical condition?

FUNDING
What is the current level of funding from all levels of government for the infrastructure category as compared to the estimated funding need?

FUTURE NEED
What is the cost to improve the infrastructure? Will future funding prospects address the need?

OPERATION AND MAINTENANCE
What is the owners' ability to operate and maintain the infrastructure properly? Is the infrastructure in compliance with government regulations?

PUBLIC SAFETY
To what extent is the public's safety jeopardized by the condition of the infrastructure and what could be the consequences of failure?

RESILIENCE
What is the infrastructure system's capability to prevent or protect against significant multi-hazard threats and incidents? How able is it to quickly recover and reconstitute critical services with minimum consequences for public safety and health, the economy, and national security?

INNOVATION
What new and innovative techniques, materials, technologies, and delivery methods are being implemented to improve the infrastructure?

In addition to this national Report Card, ASCE's sections and branches also prepare state reports on a rolling basis. Visit InfrastructureReportCard.org to learn about your state's infrastructure.

2021 REPORT CARD FOR AMERICA'S INFRASTRUCTURE

G.P.A.

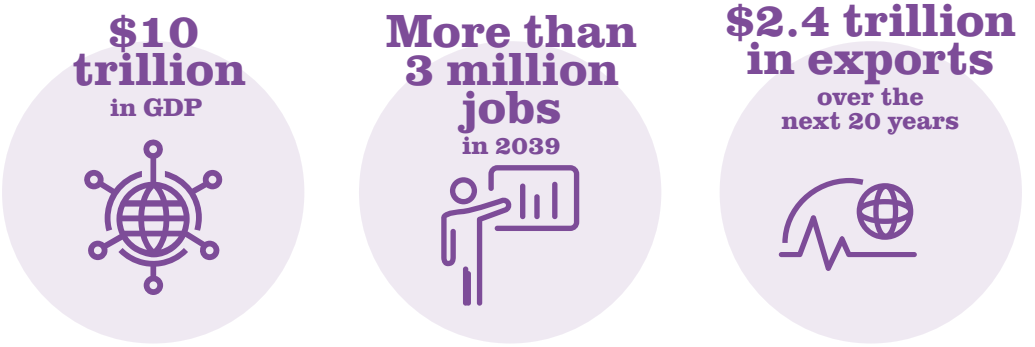
C-

AVIATION **D+**	PUBLIC PARKS **D+**
BRIDGES **C**	RAIL **B**
DAMS **D**	ROADS **D**
DRINKING WATER **C-**	SCHOOLS **D+**
ENERGY **C-**	SOLID WASTE **C+**
HAZARDOUS WASTE **D+**	STORMWATER **D**
INLAND WATERWAYS **D+**	TRANSIT **D-**
LEVEES **D**	WASTEWATER **D+**
PORTS **B-**	

INVESTMENT PAYS

Every four years, ASCE estimates the investment needed in each infrastructure category to maintain a state of good repair and earn a grade of B. The most recent analysis reveals that while we've made incremental immediate gains in some of the infrastructure categories, our long-term investment gap continues to grow. We're still just paying about half of our infrastructure bill – and the total investment gap has gone from $2.1 trillion over 10 years to nearly $2.59 trillion over 10 years.

As ASCE discovered in its 2021 study, *Failure to Act: Economic Impacts of Status Quo Investment Across Infrastructure Systems*, failing to close this infrastructure investment gap brings serious economic consequences. By 2039, a continued underinvestment in our infrastructure at current rates will cost:



When we fail to invest in our infrastructure, we pay the price. Poor roads and airports mean travel times increase. An aging electric grid and inadequate water distribution make utilities unreliable. Problems like these translate into higher costs for businesses to manufacture and distribute goods and provide services. These higher costs, in turn, get passed along to workers and families. By 2039, America's overdue infrastructure bill will cost the average American household $3,300 a year, or $63 a week. When we fail to invest in our infrastructure, we pay the price.

The good news is that closing America's infrastructure gap is possible with big, bold action from Congress, continued financial support from states and localities, and smart investments and management by infrastructure owners.

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CUMULATIVE INVESTMENT NEEDS BY SYSTEM BASED ON CURRENT TRENDS, 2020 TO 2029

ALL VALUES IN BILLIONS

Infrastructure System	Total Needs	Funded	Funding Gap
Surface Transportation[1]	$2,834	$1,619	$1,215
Drinking Water / Wastewater / Stormwater[2]	$1,045	$611	$434
Electricity[2]	$637	$440	$197
Airports[2]	$237	$126	$111
Inland Waterways & Marine Ports[2]	$42	$17	$25
Dams[3]	$93.6	$12.5	$81
Hazardous & Solid Waste[4]	$21	$14.4	$7
Levees[5]	$80	$10.1	$70
Public Parks & Recreation[6]	$77.5	$9.5	$68
Schools[7]	$870	$490	$380
Totals	**$5,937**	**$3,350**	**$2,588**

1 Data taken from ASCE Failure to Act 2021 study + rail funding gap from ASLRRA

2 Data taken from ASCE Failure to Act 2021 study. www.asce.org/failuretoact

3 Includes estimates from ASDSO, USACE, U.S. Bureau of Reclamation, and FEMA

4 Data based on conversations with ASTSWAMO: RCRA Part C; Brownfield analysis; the Superfund funding information does not include DOE's Environmental Management program

5 Total needs numbers is based on discussions with the National Committee on Levee Safety

6 Estimates from National Parks Service; National Association of State Park Directors; City Parks, and National Association of State Park Directors

7 Data from State of our Schools: America's K-12 Facilities (2016). 21st Century School Fund, Inc., U.S. Green Building Council, Inc.

Recommendations to Raise the Grade

To improve our quality of life and strengthen our international competitiveness, we need a strategic and holistic plan to renew, modernize, and invest in our infrastructure. This plan should make basic maintenance a centerpiece as we improve our legacy systems. Importantly, policymakers must understand we are only as strong as our weakest link — if our roadways become too rough to travel, if our bridges close to heavier traffic like ambulances, or if our levees protect one community at the expense of the one next door, the economy grinds to a halt. We all pay the price.

ASCE urges bold leadership and action, sustained investment, and a focus on resilience to raise the national infrastructure grade over the next four years, so that every American family, community, and business can thrive.

1) Leadership and action

Smart investment will only be possible **with strong leadership, decisive action, and a clear vision for our nation's infrastructure.** Leaders from all levels of government, business, labor, and nonprofit organizations must come together to:

a. Incentivize asset management and encourage the creation and utilization of infrastructure data sets across classes.

b. Streamline the project permitting process across infrastructure sectors, while ensuring appropriate safeguards and protections are in place.

c. Ensure all investments are spent wisely, prioritizing projects with critical benefits to the economy, public safety, environment, and quality of life (e.g., sustainability).

d. Leverage proven and emerging tech to make use of limited available resources.

e. Consider life cycle costs when making project decisions. Life cycle cost analysis determines the cost of building, operating, and maintaining the infrastructure for its entire life span.

f. Support research and development of innovative materials, technologies, and processes to modernize and extend the life of infrastructure, expedite repairs or replacements, and promote cost savings. Innovation should include a component of integration and utilization of big data, as well as the "internet of things."

g. Promote sustainability, or the "triple bottom line" in infrastructure decisions, by considering the long-term economic, social, and environmental benefits of a project.

2) Investment

If the United States is serious about achieving an infrastructure system fit for the future, some specific steps must be taken, beginning with **increased, long-term, consistent investment.** To close the nearly $2.59 trillion 10-year investment gap, meet future need, and restore our global competitive advantage, we must **increase investment from all levels of government and the private sector from 2.5% to 3.5% of U.S. Gross Domestic Product (GDP) by 2025.** This investment must be consistently and wisely allocated, and must begin with the following steps:

a. Congress should fully fund authorized infrastructure programs.

b. Infrastructure owners and operators must charge, and Americans must be willing to pay, rates reflecting the true cost of using, maintaining, and improving infrastructure.

c. The surface transportation investment gap is the largest deficit in the categories of infrastructure that ASCE evaluates. Continuing to defer maintenance and modernization is impacting our ability to compete in a global marketplace and maintain a high quality of living domestically. Congress must fix the Highway Trust Fund.

d. All parties should strive to close the rural/urban and underserved community resource divide by ensuring adequate investment in these areas through programmatic set-asides.

e. All parties should make use of public-private partnerships, where appropriate.

3) Resilience

We must **utilize new approaches, materials, and technologies to ensure our infrastructure** can withstand or quickly recover from natural or man-made hazards. Advancements in resilience across all infrastructure sectors can be made by:

a. Enabling communities, regardless of size, to develop and institute their own resilience pathway for all their infrastructure portfolios by streamlining asset management, implementing life cycle cost analysis into routine planning processes, and integrating climate change projections into long-term goal-setting and capital improvement plans.

b. Incentivizing and enforcing the use of codes and standards, which can mitigate risks of major climate or manmade events such as hurricanes, fires, sea level rise, and more.

c. Understanding that our infrastructure is a system of systems and encourage a dynamic, "big picture" perspective that weighs tradeoffs across infrastructure sectors while keeping resilience as the chief goal.

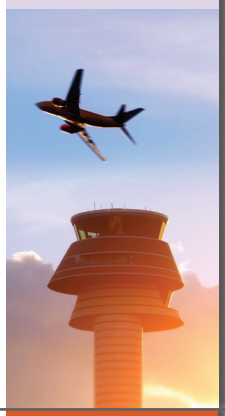
d. Prioritizing projects that improve the safety and security of systems and communities, to ensure continued reliability and enhanced resilience.

e. Improving land use planning across all levels of decision-making to strike a balance between the built and natural environments while meeting community needs, now and into the future.

f. Enhancing the resilience of various infrastructure sectors by including or enhancing natural or "green" infrastructure.

Aviation

D+



Prior to the onset of the COVID-19 pandemic, the nation's airports were facing growing capacity challenges. Over a two-year period, passenger travel steadily increased from 964.7 million to 1.2 billion per year, yet flight service only increased from 9.7 to 10.2 million flights per year — contributing in part to a total of nearly 96 million delay minutes for airline passengers in 2019. Terminal, gate, and ramp availability was not meeting the needs of a growing passenger base. Under pre-COVID-19 projections, our aviation system was set to have a 10-year, $111 billion funding shortfall, and that gap has likely grown significantly as passenger volumes dropped in March 2020 and have yet to recover. However, funding from Congress has risen from $11 billion annually to approximately $15 billion from 2017 to 2020. These additional investments are driving some early results as measured by improved economic performance.

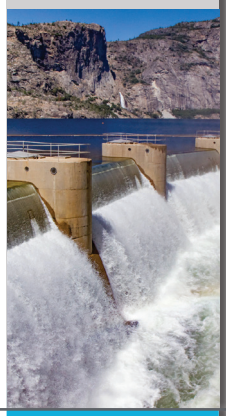
Bridges

C

There are more than 617,000 bridges across the United States. Currently, 42% of all bridges are at least 50 years old, and 46,154, or 7.5% of the nation's bridges, are considered structurally deficient, meaning they are in "poor" condition. Unfortunately, 178 million trips are taken across these structurally deficient bridges every day. In recent years, though, as the average age of America's bridges increases to 44 years, the number of structurally deficient bridges has continued to decline; however, the rate of improvements has slowed. A recent estimate for the nation's backlog of bridge repair needs is $125 billion. Estimates show that we need to increase spending on bridge rehabilitation from $14.4 billion annually to $22.7 billion annually, or by 58%, if we are to improve the condition. At the current rate of investment, it will take until 2071 to make all of the repairs that are currently necessary, and the additional deterioration over the next 50 years will become overwhelming. The nation needs a systematic program for bridge preservation like that embraced by many states, whereby existing deterioration is prioritized and the focus is on preventive maintenance.

Dams

D



There are over 91,000 dams across the country that serve many purposes. Dams are classified by hazard potential. A high-hazard-potential rating does not imply that a dam has an increased risk for failure; it simply means that if failure were to occur, the resulting consequences would likely be a direct loss of human life and extensive property damage. Over the last 20 years, the number of high-hazard-potential dams has more than doubled as development steadily encroaches on once rural dams and reservoirs. Although the number of high-hazard-potential dams has increased, the overall percentage of these dams protected by an Emergency Action Plan has increased as well. As of 2018, 81% of such dams had a plan on file, up 5% from 2015. Unfortunately, due to the lack of investment, the Association of State Dam Safety Officials estimates the number of deficient high-hazard-potential dams now exceeds 2,300. Meanwhile, approximately 3% of dams supply households and businesses with hydroelectric power, and many of these dams are privately owned by utilities and follow a rigorous operations and maintenance schedule.

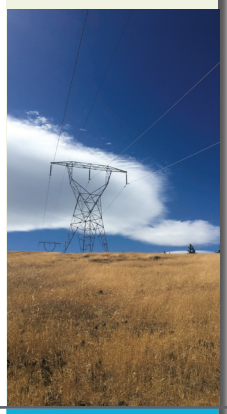
Drinking Water

C-

Our nation's drinking water infrastructure system is made up of 2.2 million miles of underground pipes that deliver safe, reliable water to millions of people. Unfortunately, the system is aging and underfunded. There is a water main break every two minutes and an estimated 6 billion gallons of treated water lost each day in the U.S., enough to fill over 9,000 swimming pools. However, there are signs of progress as federal financing programs expand and water utilities raise rates to reinvest in their networks. It is estimated that more than 12,000 miles of water pipes were planned to be replaced by drinking water utilities across the country in 2020 alone. In 2019, about a third of all utilities had a robust asset management program in place to help prioritize their capital and operations/maintenance investments with limited dollars. Finally, water utilities are improving their resilience by developing and updating risk assessments and emergency response plans, as well as deploying innovative water technologies like sensors and smart water quality monitoring.

Energy

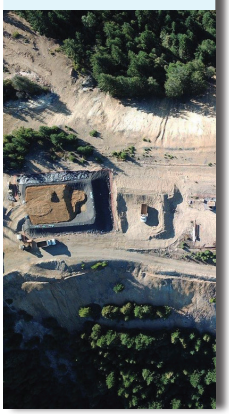
C-



In a digital, connected world, Americans increasingly rely on readily available and uninterrupted electricity. Over the last four years, transmission and distribution and reliability-focused pipeline investments have increased, and outages have declined slightly. Annual spending on high voltage transmission lines grew from $15.6 billion in 2012 to $21.9 billion in 2017, while annual spending on distribution systems — the "last mile" of the electricity network — grew 54% over the past two decades. Utilities are taking proactive steps to strengthen the electric grid through resilience measures. However, weather remains an increasing threat. Among 638 transmission outage events reported from 2014 to 2018, severe weather was cited as the predominant cause. Additionally, distribution infrastructure struggles with reliability, with 92% of all outages occurring along these segments. In the coming years, additional transmission and distribution infrastructure, smart planning, and improved reliability are needed to accommodate the changing energy landscape, as delivery becomes distributed and renewables grow.

Hazardous Waste

D+



There are an estimated 35 million tons of hazardous materials managed annually in the United States. In general, there is adequate capacity for the treatment and disposal of these materials through the year 2044. However, progress toward mitigating legacy sites where hazardous waste was produced and improperly disposed of has stalled. There are approximately 1,300 Superfund sites where cleanup activities are either incomplete or not yet begun, roughly the same number as four years ago. Meanwhile, the Superfund budget has remained essentially flat at around $1.1 billion over the last 10 years. The two other hazardous waste programs — one for brownfields and one for hazardous waste regulated under the Resource Conservation and Recovery Act — are also in a steady state. In general, grant funding for the Brownfields Program has increased, but the program is still oversubscribed, with just 30% of applicants receiving funding. Meanwhile, resilience is a growing concern at many hazardous waste sites. Around 60% of all nonfederal Superfund sites are located in areas that may be impacted by flooding, storm surge, wildfires, or sea level rise related to climate change effects.

Inland Waterways

D+

The Mississippi River and its tributaries, as well as the Columbia, Sacramento, and San Joaquin Rivers on the West Coast make up nearly 12,000 miles of navigable waterways — the U.S. freight network's "water highway." Inland waterway infrastructure includes locks and dams as well as navigation channels. Investing in this infrastructure helps move agricultural exports and relieves strain on other transportation modes. One barge can move as many tons as 70 tractor trailers. Recent boosts in federal investment and an increase in user fees have begun to reverse decades of declining lock and dam conditions, with unscheduled lock closures reaching a 20-year low in 2017. While this is encouraging, the system still reports a $6.8 billion backlog in construction projects and ongoing lock closures — totaling 5,000 hours between 2015 and 2019 — harming the industries that rely on the waterways to get their goods to market. The U.S. Department of Agriculture estimates delays cost up to $739 per hour for an average tow, or $44 million per year.

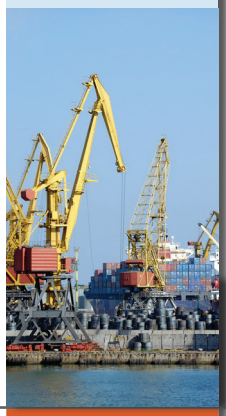
Levees

D

Seventeen million people across the nation live or work behind a levee. Levees protect critical infrastructure systems, $2.3 trillion of property, 4,500 schools that collectively enroll over 2 million students, and a range of industries. The National Levee Database contains nearly 30,000 miles of levees across the U.S., and current estimates identify up to 10,000 additional miles of levees outside of the U.S. Army Corps of Engineers (USACE) portfolio whose location and condition are unknown due to complex and varying local ownership. The USACE estimates that $21 billion is needed to improve and maintain the moderate to high-risk levees in its portfolio, which represents only about 15% of the known levees in the U.S. As more extreme weather events result in increased flooding, such as the $20 billion in damages caused by flooding in the Midwest during the spring of 2019, it is now more important than ever to have a complete inventory of the nation's levees and to equip communities with resources to mitigate flood risk and make necessary repairs.

Ports

B-



The nation's more than 300 coastal and inland ports are significant drivers of the U.S. economy, supporting 30.8 million jobs in 2018 and 26% of the total GDP. Ports and port tenants plan to spend $163 billion between 2021 and 2025, up by over $8 billion the last four years. Investments are focused on capacity and efficiency enhancements as maximum vessel size has doubled over the last 15 years, and tonnage at the top 25 ports grew by 4.4% from 2015 to 2019. Federal funding has increased through multimodal competitive grant programs. However, there is a funding gap of $15.5 billion for waterside infrastructure such as dredging over the next 10 years, with additional billions needed for landside infrastructure. Smaller and inland ports are especially challenged to maintain their infrastructure and have difficulty competing for federal grants. Meanwhile, a port's success is reliant on the infrastructure outside of its gates, which is often congested or in poor condition. For example, just 9% of intermodal connector pavement — the portions of roadway that connect a port to other modes — are in good or very good condition.

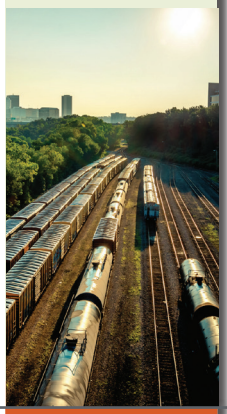
Public Parks

D+

Americans spend a lot of time in their parks, visiting local parks and recreational facilities more than twice a month on average. In 2017, people spent $887 billion on outdoor recreation, directly supporting 7.6 million jobs. There are about 10 acres of public park land per 1,000 residents. Despite their increased popularity, investment in parks is lagging, resulting in deteriorating bridges, trails, parking areas, drinking water systems, and more. State parks and local parks face a $5.6 billion and $60 billion deferred maintenance backlog, respectively. While the National Park Service's deferred maintenance backlog grew over 9% in the last decade, with more than half of their assets in need of repair, federal funding for parks is set to increase with passage of the Great American Outdoors Act of 2020. Meanwhile, limited space in urban areas is causing local governments, utilities, and nonprofits to be more creative by building parks projects that provide mutually beneficial functions, such as public access spaces that also serve as flood control.

Rail

B



Our nation's rail network is divided into two categories: freight rail and passenger rail. Approximately 140,000 rail miles are operated by freight's Class I, II, and III railroads. Amtrak operates over a 21,400-mile network, 70% of which is owned by other railroads, also known as host track. Despite freight and passenger rail being part of an integrated system, there remain stark differences in the challenges faced by the two rail categories. While freight maintains a strong network largely through direct shipper fees — investing on average over $260,000 per mile — passenger rail requires government investment and has been plagued by a lack of federal support, leading to a current state of good repair backlog at $45.2 billion. Along our nation's busiest passenger rail corridor, the Northeast Corridor (NEC), infrastructure-related issues caused 328,000 train-delay minutes, or the equivalent of roughly 700 Northeast Regional train trips from Boston, Massachusetts, to Washington, D.C.

Roads

D

America's roads are critical for moving an ever-increasing number of people and goods. However, these vital lifelines are frequently underfunded, and over 40% of the system is now in poor or mediocre condition. As the backlog of rehabilitation needs grows, motorists are forced to pay over $1,000 every year in wasted time and fuel. Additionally, while traffic fatalities have been on the decline, over 36,000 people are still dying on the nation's roads every year, and the number of pedestrian fatalities is on the rise. Federal, state, and local governments will need to prioritize strategic investments dedicated to improving and preserving roadway conditions that increase public safety on the system we have in place, as well as plan for the roadways of the future, which will need to account for connected and autonomous vehicles.

Schools

D+

School facilities represent the second largest sector of public infrastructure spending, after highways, and yet there is no comprehensive national data source on K-12 public school infrastructure. What data is available indicates that 53% of public school districts report the need to update or replace multiple building systems, including HVAC systems. More than one-third of public schools have portable buildings due to capacity constraints, with 45% of these portable buildings in poor or fair condition. Meanwhile, as a share of the economy, state capital funding for schools was down 31% in fiscal year 2017 compared to 2008. That is the equivalent of a $20 billion cut. The best estimates indicate a minimum of $38 billion annual funding gap for public school facilities across the country. Meanwhile, public schools increasingly serve a secondary function as emergency shelters and community resource facilities during man-made or natural disasters, and facility upgrades are needed to effectively fulfill this important community purpose.

Solid Waste

C+

The U.S. produced approximately 268 million tons of municipal solid waste (MSW) in 2017, or 4.51 pounds per person per day. This is a modest increase from the 4.4 pounds of MSW generated per person per day in 2014. Overall, 53% of waste is deposited in landfills, 25% is recycled, 10% is composted, and 13% is combusted for energy. The transport and disposal of MSW remains largely funded and managed by the private sector. However, the U.S. MSW management system faces a growing number of challenges such as plateauing recycling rates, emerging contaminants found in legacy landfills, and significantly changing global markets. Funding mechanisms are needed to invest in a nationwide solid waste infrastructure system that recognizes MSW as a resource to be utilized more so than waste to be disposed.

Stormwater

D

Stormwater systems range from large concrete storm sewers, roadside ditches, and flood control reservoirs, to rain gardens and natural riverine systems. While stormwater utilities are on the rise, with more than 40 states having at least one, the impervious surfaces in cities and suburbs are also expanding, exacerbating urban flooding, which results in $9 billion in damages annually. Stormwater also affects water quality as polluted runoff from pavement enters water bodies. Nearly 600,000 miles of rivers and streams and more than 13 million acres of lakes, reservoirs, and ponds are considered impaired. Federal funding, though up in recent years, averages about $250 million annually, which leaves a growing annual funding gap of $8 billion just to comply with current regulations. With few dedicated funding sources, complicated governance and ownership structures, expansive networks of aging assets, increasingly stringent water quality regulations, and concerning climate change projections, the expected performance of stormwater systems is declining. Many of the country's legacy stormwater systems, are struggling with the high cost of retrofits needed to address urban flooding and climate change. Upgrading large networks of aging systems underneath densely populated areas carries significant costs and engineering challenges.

Transit

D-

Public transit is essential to everyday living in communities across the country, providing access to jobs, schools, shopping, healthcare, and other services, while enabling equitable access and sustainable mobility options. Unfortunately, 45% of Americans have no access to transit. Meanwhile, much of the existing system is aging, and transit agencies often lack sufficient funds to keep their existing systems in good working order. Over a 10-year period across the country, 19% of transit vehicles, and 6% of fixed guideway elements like tracks and tunnels were rated in "poor" condition. Currently, there is a $176 billion transit backlog, a deficit that is expected to grow to more than $270 billion through 2029. Meanwhile, transit ridership is declining, a trend compounded by the COVID-19 pandemic. Failure to address the transit revenue shortfall will only exacerbate ridership declines as service cuts mean that trip delays and reliability issues become more frequent. This stands to increase congestion, hamper the economy, and worsen air quality in the coming years.

Wastewater

D+

The nation's more than 16,000 wastewater treatment plants are functioning, on average, at 81% of their design capacities, while 15% have reached or exceeded it. Growing urban environments signal a trend that these facilities will increasingly accommodate a larger portion of the nation's wastewater demand. Though large-scale capital improvements have been made to systems experiencing sanitary sewer overflows, efforts have slowed in recent years. As many treatment plants and collection networks approach the end of their lifespans, the financial responsibilities for operation and maintenance will become more costly. Estimates indicate that utilities spent over $3 billion in 2019, or more than $18 per wastewater customer, to replace almost 4,700 miles of pipeline nationwide. Recently, the more prevalent use of asset management plans enables 62% of surveyed utilities to proactively manage wastewater infrastructure maintenance rather than reactively respond to pipeline and equipment failures. In 2019, though the annual water infrastructure capital investment gap was $81 billion, the sector has made strides to address current and future needs thr ough resilience-related planning and innovations that produce profitable byproducts or cost savings from wastewater treatment.

#GAMECHANGERS

Game Changers:

ASCE has combed through successful solutions across the major infrastructure sectors to identify the most innovative infrastructure #GameChangers. These are ground breaking infrastructure projects and programs that represent the latest innovations in transportation, water, and energy infrastructure that are transforming the way engineers plan, build, and adapt to the nation's infrastructure needs. ASCE's list of #Gamechangers must meet one of the following criteria: innovative technologies, creative funding mechanisms, and unique collaborations between agencies or private firms.

https://www.infrastructurereportcard.org/solutions/gamechangers/

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