ASCE

2017

INFRASTRUCTURE REPORT CARD

A COMPREHENSIVE ASSESSMENT OF AMERICA'S INFRASTRUCTURE

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 profession of civil engineering.

ABOUT THE INFRASTRUCTURE REPORT CARD

Every four years, America's civil engineers provide a comprehensive assessment of the nation's 16 major infrastructure categories in ASCE's *Infrastructure Report Card*. 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 28 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:

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 and regional Infrastructure Report Cards on a rolling basis. Visit InfrastructureReportCard.org to learn about your state's infrastructure.

WE MUST COMMIT TODAY TO REALIZE AN AMERICAN INFRASTRUCTURE SYSTEM THAT SECURES OUR NATION'S SHARED PROSPERITY.

Our nation is at a crossroads. Deteriorating infrastructure is impeding our ability to compete in the thriving global economy, and improvements are necessary to ensure our country is built for the future. While we have made some progress, reversing the trajectory after decades of underinvestment in our infrastructure requires transformative action from Congress, states, infrastructure owners, and the American people.

Our nation's infrastructure challenges are significant but solvable. Through strategic, sustained investment, bold leadership, comprehensive planning, and careful preparation for the needs of the future, America's infrastructure will be improved and restored.

For the U.S. economy to be the most competitive in the world, we need a first-class infrastructure system—transport systems that move people and goods efficiently and at reasonable cost by land, water, and air; power transmission systems that deliver reliable, low-cost power from a sustainable range of energy sources; and water systems that protect public health.

To achieve this, leaders on both sides of the political aisle need to make good on promises they have made to improve our nation's infrastructure and ensure these pledges don't fall by the wayside after each election cycle.

Infrastructure is the foundation that connects the nation's businesses, communities, and people, driving our economy, improving our quality of life, and ensuring our public health and safety. Now is the time to renew, modernize, and invest in our infrastructure to maintain our international competitiveness. The longer we wait, the more it will cost.

Visit InfrastructureReportCard.org to explore the full Report Card and download the Infrastructure Report Card app.

AMERICA'S CUMULATIVE INFRASTRUCTURE GPA

The 2017 *Infrastructure Report Card* reveals that we have made some incremental progress toward restoring our nation's infrastructure. But it has not been enough. **As in 2013, America's cumulative GPA is once again a D+.**

The 2017 grades range from a B for Rail to a D- for Transit, illustrating the clear impact of investment — or lack thereof — on the grades. Three categories — Parks, Solid Waste, and Transit — received a decline in grade this year, while seven — Hazardous Waste, Inland Waterways, Levees, Ports, Rail, Schools, and Wastewater — saw slight improvements. Six categories' grades remain unchanged from 2013 — Aviation, Bridges, Dams, Drinking Water, Energy, and Roads.

The areas of infrastructure that improved benefited from vocal leadership, thoughtful policymaking, and investments that garnered results. These improvements demonstrate what can be accomplished when solutions that move projects forward are approved and implemented.

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. Safe and reliable, with minimal capacity issues and minimal risk.

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.

2017 INFRASTRUCTURE REPORT CARD

Over the last four years, several infrastructure categories showed progress, resulting in grade increases. However, the 2017 Report Card's cumulative GPA of D+ reflects the significant backlog of needs facing our nation's infrastructure writ large. Underperforming, aging infrastructure remains a drag on the national economy, and costs every American family $3,400 a year.

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

INFRASTRUCTURE INVESTMENT NEEDS

Infrastructure is the backbone of the U.S. economy and a necessary input to every economic output. It is critical to the nation's prosperity and the public's health and welfare. Infrastructure's condition has a cascading impact on our nation's economy, impacting business productivity, gross domestic product (GDP), employment, personal income, and international competitiveness.

America's infrastructure bill is long overdue. 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 the U.S. has only been paying half of its infrastructure bill for some time and failing to close that gap risks rising costs, falling business productivity, plummeting GDP, lost jobs, and ultimately, reduced disposable income for every American family.

Even though the U.S. Congress and some states have recently made efforts to invest more in infrastructure, these efforts do not come close to the $2.0 trillion in needs. The good news is that closing America's infrastructure gap is possible if Congress, states, infrastructure owners, and voters commit to increasing our investment. To raise the overall infrastructure grade and maintain our global competitiveness, Congress and the states must invest an additional $206 billion each year.

As ASCE discovered in its 2016 economic study, *Failure to Act: Closing the Infrastructure Investment Gap for America's Economic Future*, failing to close this infrastructure investment gap brings serious economic consequences:

- **$3.9 trillion** in losses to the U.S. GDP by 2025;
- **$7 trillion** in lost business sales by 2025; and
- **2.5 million** lost American jobs in 2025.

On top of those costs, hardworking American families will lose upwards of $3,400 in disposable income each year—about $9 each day.

The time to invest in our nation's infrastructure is now. The longer we wait, the more it costs. Investing now will save our country more in the long run while also creating economic opportunity, enhancing quality of life, and ensuring public health and safety.

Cumulative Infrastructure Needs by System Based on Current Trends, Extended to 2025

ALL VALUES IN BILLIONS OF CONSTANT 2015 DOLLARS

2016–2025 (10 YEARS) Infrastructure Systems	Total Needs	Estimated Funding	Funding Gap
Surface Transportation[1]	$2,042	$941	$1,101
Water/Wastewater Infrastructure[1]	$150	$45	$105
Electricity[1]	$934	$757	$177
Airports[1]	$157	$115	$42
Inland Waterways & Marine Ports[1]	$37	$22	$15
Dams[2]	$45	$5.6	$39.4
Hazardous & Solid Waste[3]	$7	$4	$3
Levees[4]	$80	$10	$70
Public Parks & Recreation[5]	$114.4	$12.1	$102.3
Rail[6]	$154.1	$124.7	$29.4
Schools[7]	$870	$490	$380
TOTALS	**$4,590**	**$2,526**	**$2,064**

1 Data taken from ASCE's *Failure to Act: Closing the Infrastructure Investment Gap for America's Economic Future* (2016).

2 Total needs are federal and non-federal high-hazard dams.

3 Funding only includes publicly funded remediation, not funds from private sector.

4 Total needs number based on discussions with the National Committee on Levee Safety

5 Does not include backlog and estimated spending for U.S. Army Corps of Engineers and city parks.

6 Needs and funding estimates based on market projections and current investment trends.

7 Data from *State of Our Schools: America's K–12 Facilities* (2016). 21st Century School Fund, Inc., U.S. Green Building Council, Inc., and the National Council on Schools Facilities.

*numbers may not add up due to rounding

Visit InfrastructureReportCard.org/failure-to-act-report/ to learn more about ASCE's economic study, *Failure to Act.*

SOLUTIONS TO RAISE THE GRADES

To raise the national infrastructure grade over the next four years, ASCE urges the following starting points, so that every American family, community, and business can thrive. Through strategic, sustained **investment**, bold **leadership**, thoughtful **planning**, and careful **preparation for the needs of the future**, America's infrastructure will be improved and restored.

INVESTMENT

If the United States is serious about achieving an infrastructure system fit for the 21st century, some specific steps must be taken, beginning with **increased, long-term, consistent investment**. To continue to delay such investment only escalates the costs and risks of an aging infrastructure system — an option the country, the economy, and families can no longer afford. To close the $2.0 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 percent to 3.5 percent of U.S. Gross Domestic Product (GDP) by 2025**. This investment must be consistently and wisely allocated, and must begin with the following steps:

1. Put the "trust" back into "trust funds." Dedicated public funding sources on the local, state, and federal levels need to be consistently and sufficiently funded from user-generated fees, with infrastructure trust funds never used to pay for or offset other parts of a budget.

2. Fix the Highway Trust Fund by raising the federal motor fuels tax. To ensure long-term, sustainable funding for the federal surface transportation program the current user fee must be raised and tied to inflation to restore its purchasing power, fill the funding deficit, and ensure reliable funding for the future.

3. Authorize and fund programs to improve specific categories of deficient infrastructure and support that commitment by fully funding them in an expedient, prioritized manner.

4. Infrastructure owners and operators must charge, and Americans must be willing to pay, rates and fees that reflect **the true cost of using, maintaining, and improving infrastructure**.

LEADERSHIP & PLANNING

Smart investment will only be possible with leadership, planning, and a clear vision for our nation's infrastructure. **Leaders from all levels of government, business, labor, and nonprofit organizations must come together to ensure all investments are spent wisely**, prioritizing projects with critical benefits to the economy, public safety, and quality of life, while also planning for the costs of building, operating, and maintaining the infrastructure for its entire lifespan. To do so, we must:

1. Require all projects greater than $5 million that receive federal funding use **life cycle cost analysis** and develop a plan for funding the project, including its maintenance and operation, until the end of its service life.

2. Create incentives for state and local governments and the private sector to invest in maintenance.

3. Develop tools to ensure that projects most in need of investment and maintenance are prioritized, to **leverage limited funding wisely**.

4. Streamline the project permitting process across infrastructure sectors, with safeguards to protect the natural environment, to provide greater clarity to regulatory requirements, bring priority projects to reality more quickly, and secure cost savings.

5. Identify a pipeline of infrastructure projects attractive to **private sector investment and public-private partnerships**.

ASCE recognizes civil engineers' unique leadership role in addressing our infrastructure challenges. ASCE issued its "Grand Challenge," a call to action for the entire civil engineering profession to increase the value and capacity of infrastructure and increase and optimize infrastructure investments by transforming the way we plan, deliver, operate, and maintain our nation's infrastructure.

PREPARING FOR THE FUTURE

We must utilize new approaches, materials, and technologies to ensure our infrastructure is more **resilient** — to more quickly recover from significant weather and other hazard events — and **sustainable** — improving the "triple bottom line" with clear economic, social, and environmental benefits.

1. Develop active community resilience programs for severe weather and seismic events to establish communications systems and recovery plans to reduce impacts on the local economy, quality of life, and environment.

2. Consider emerging technologies and shifting social and economic trends — such as autonomous vehicles, distributed power generation and storage, and larger ships — when building new infrastructure, to assure long-term utility.

3. Improve land use planning at the local level to consider the function of existing and new infrastructure, the balance between the built and natural environments, and population trends in communities of all sizes, now and into the future.

4. Support research and development into innovative new materials, technologies, and processes to modernize and extend the life of infrastructure, expedite repairs or replacement, and promote cost savings.

To learn more, visit ASCEGrandChallenge.com.

AVIATION

U.S. airports serve more than two million passengers every day. The aviation industry is marked by technologically advanced and economically efficient aircraft, however, the associated infrastructure of airports and air traffic control systems is not keeping up. Congestion at airports is growing; it is expected that 24 of the top 30 major airports may soon experience "Thanksgiving-peak traffic volume" at least one day every week. With a federally mandated cap on how much airports can charge passengers for facility expansion and renovation, airports struggle to keep up with investment needs, creating a $42 billion funding gap between 2016 and 2025.

2M
passengers are served daily at U.S. airports

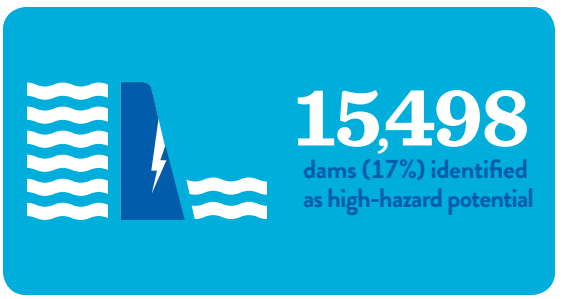
BRIDGES

The U.S. has 614,387 bridges, almost four in 10 of which are 50 years or older. 56,007 — 9.1% — of the nation's bridges were structurally deficient in 2016, and on average there were 188 million trips across a structurally deficient bridge each day. While the number of bridges that are in such poor condition as to be considered structurally deficient is decreasing, the average age of America's bridges keeps going up and many of the nation's bridges are approaching the end of their design life. The most recent estimate puts the nation's backlog of bridge rehabilitation needs at $123 billion.

9.1%
of bridges are rated structurally deficient

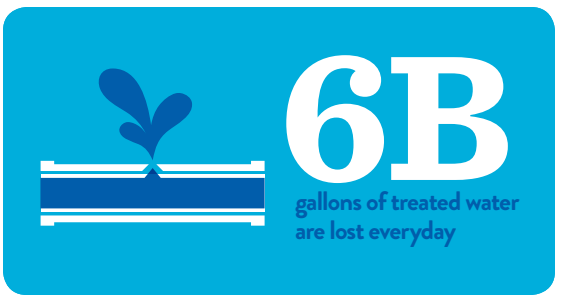
DAMS

Dams provide vital service and protection to our communities and economy. The average age of the 90,580 dams in the country is 56 years. As our population grows and development continues, the overall number of high-hazard potential dams is increasing, with the number climbing to nearly 15,500 in 2016. Due to the lack of investment, the number of deficient high-hazard potential dams has also climbed to an estimated 2,170 or more. It is estimated that it will require an investment of nearly $45 billion to repair aging, yet critical, high-hazard potential dams.

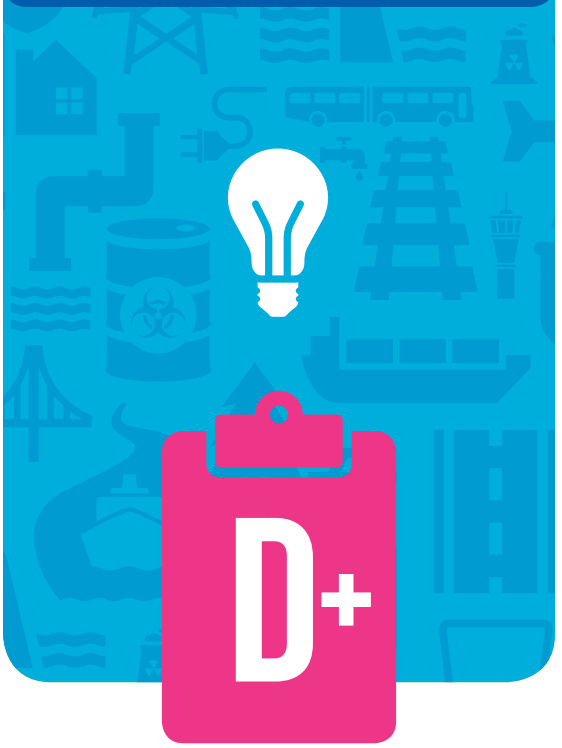


DRINKING WATER

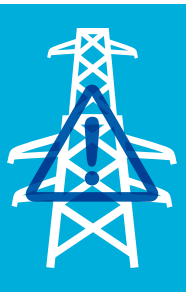
Drinking water is delivered via one million miles of pipes across the country. Many of those pipes were laid in the early to mid-20th century with a lifespan of 75 to 100 years. The quality of drinking water in the United States remains high, but legacy and emerging contaminants continue to require close attention. While water consumption is down, there are still an estimated 240,000 water main breaks per year in the United States, wasting over two trillion gallons of treated drinking water. According to the American Water Works Association, an estimated $1 trillion is necessary to maintain and expand service to meet demands over the next 25 years.



ENERGY



Much of the U.S. energy system predates the turn of the 20th century. Most electric transmission and distribution lines were constructed in the 1950s and 1960s with a 50-year life expectancy, and the more than 640,000 miles of high-voltage transmission lines in the lower 48 states' power grids are at full capacity. Energy infrastructure is undergoing increased investment to ensure long-term capacity and sustainability; in 2015, 40% of additional power generation came from natural gas and renewable systems. Without greater attention to aging equipment, capacity bottlenecks, and increased demand, as well as increasing storm and climate impacts, Americans will likely experience longer and more frequent power interruptions.



3,571
total power outages reported in one year

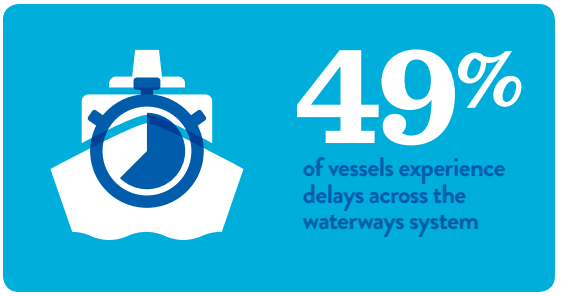
HAZARDOUS WASTE

Over 18,000 sites and an associated 22 million acres of land are related to the primary hazardous waste programs that comprise much of the nation's hazardous waste infrastructure, and more than half of the U.S. population lives within three miles of a hazardous waste site. The current capacity of the nation's hazardous waste infrastructure is generally adequate, owing in no small measure to significant improvements in managing materials through recycling and reuse, rather than disposal. There have also been significant improvements in remediation technologies, resulting in faster and less resource-intensive cleanup approaches.

53%
of Americans live within three miles of a hazardous waste site

INLAND WATERWAYS

The United States' 25,000 miles of inland waterways and 239 locks form the freight network's "water highway." This intricate system, operated and maintained by the U.S. Army Corps of Engineers, supports more than half a million jobs and delivers more than 600 million tons of cargo each year, about 14% of all domestic freight. Most locks and dams on the system are well beyond their 50-year design life, and nearly half of vessels experience delays. Investment in the waterways system has increased in recent years, but upgrades on the system still take decades to complete.



LEVEES

A nationwide network of 30,000 documented miles of levees protects communities, critical infrastructure, and valuable property, with levees in the U.S. Army Corps of Engineers Levee Safety Program protecting over 300 colleges and universities, 30 professional sports venues, 100 breweries, and an estimated $1.3 trillion in property. As development continues to encroach in floodplains along rivers and coastal areas, an estimated $80 billion is needed in the next 10 years to maintain and improve the nation's system of levees. In 2014 Congress passed the Water Resources Reform and Development Act, which expanded the levee safety program nationwide, but the program has not yet received any funding.

PARKS & RECREATION

A vast network of infrastructure goes into supporting more than seven billion outdoor recreational outings. Americans enjoy park and recreation facilities maintained by entities at all levels of government. At the federal level, the National Park Service, U.S. Forest Service, and U.S. Army Corps of Engineers are the main providers of park facilities. States and localities provide the bulk of park and recreational facilities that seven in 10 Americans use on a regular basis. National forests and grasslands capture and filter drinking water for 180 million people. America's parks and public lands also support industries such as lodging, restaurants and bars, grocery and convenience stores, and gas stations.

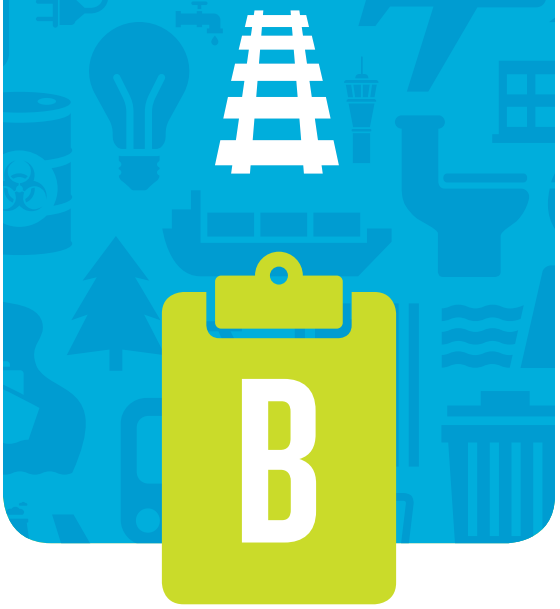
$11.9B
in National Park Service deferred maintenance

PORTS

The United States' 926 ports are essential to the nation's competitiveness, serving as the gateway through which 99% of overseas trade passes. Ports are responsible for $4.6 trillion in economic activity — roughly 26% of the U.S. economy. As ships get bigger, congestion at landside connections to other components of the freight network increasingly hinders ports' productivity. Similarly, on the water side, larger ships require deeper navigation channels, which only a few U.S. ports currently have. To remain competitive globally and with one another, ports have been investing in expansion, modernization, and repair.

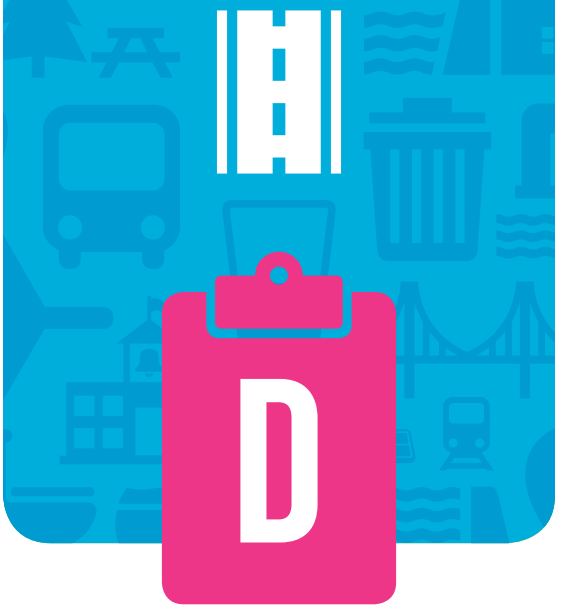
99%
of America's overseas trade passes through ports

RAIL



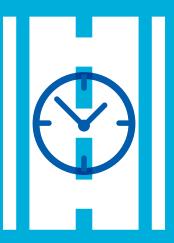
For more than 150 years the rail network has been a critical component of the U.S. transportation system and economy. Today it carries approximately one-third of U.S. exports and delivers five million tons of freight and approximately 85,000 passengers each day. The private freight rail industry owns the vast majority of the nation's rail infrastructure, and continues to make significant capital investment — $27.1 billion in 2015 — to ensure the network's good condition. U.S. rail still faces clear challenges, most notably in passenger rail, which faces the dual problems of aging infrastructure and insufficient funding.

ROADS



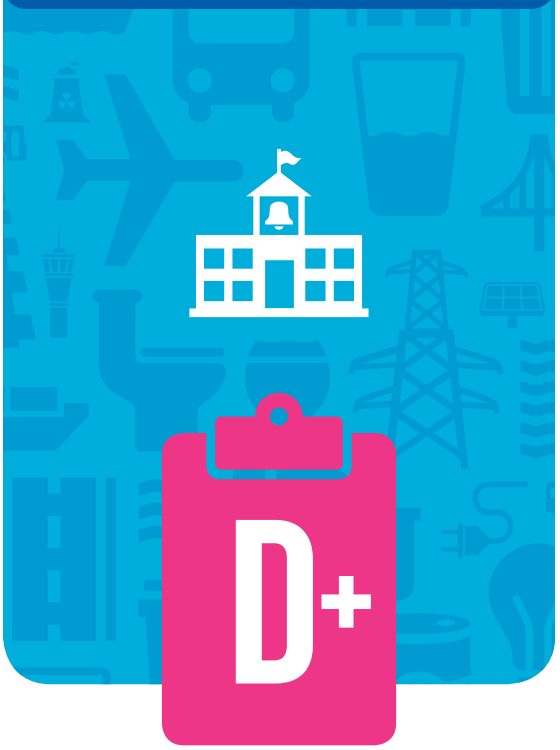
America's roads are often crowded, frequently in poor condition, chronically underfunded, and are becoming more dangerous. More than two out of every five miles of America's urban interstates are congested and traffic delays cost the country $160 billion in wasted time and fuel in 2014. One out of every five miles of highway pavement is in poor condition and our roads have a significant and increasing backlog of rehabilitation needs. After years of decline, traffic fatalities increased by 7% from 2014 to 2015, with 35,092 people dying on America's roads.

$27B
in improvements in one year by the freight railroads



6.9B
hours delayed in traffic — 42 hours per driver

SCHOOLS



Every school day, nearly 50 million K-12 students and six million adults occupy close to 100,000 public school buildings on an estimated two million acres of land. The nation continues to underinvest in school facilities, leaving an estimated $38 billion annual gap. As a result, 24% of public school buildings were rated as being in fair or poor condition. While there have been a number of insightful reports in recent years, state and local governments are plagued by a lack of comprehensive data on public school infrastructure as they seek to fund, plan, construct, and maintain quality school facilities.

1 IN 2
public schools need improvements to reach "good" condition

SOLID WASTE

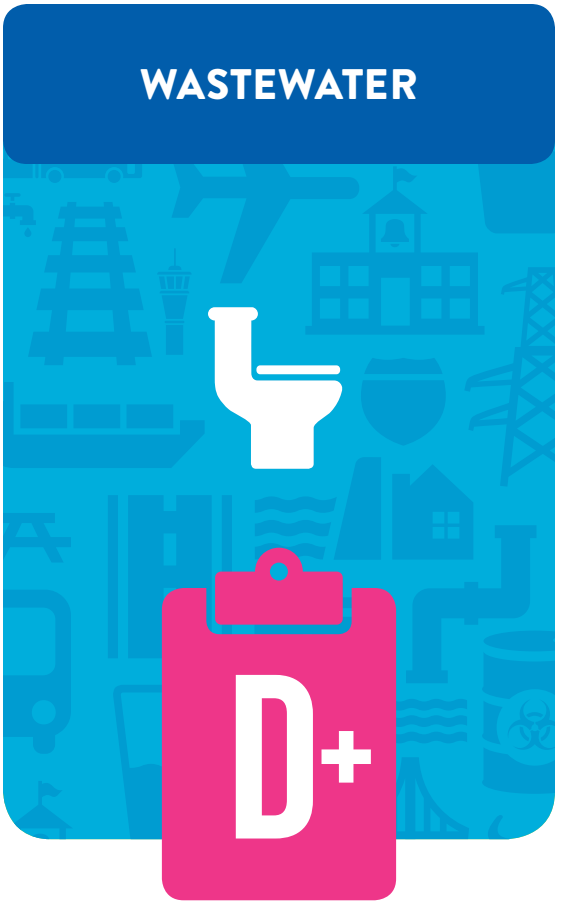
Overall management of municipal solid waste (MSW) across America is currently in fair condition. In many cases, the transport and disposal of MSW is self-funded and managed by the private sector, and therefore is sufficiently funded. Americans generate about 258 million tons of MSW annually, of which approximately 53% is deposited in landfills—a share that has plateaued in recent years. Currently, 34.6% of MSW is recycled and 12.8% is combusted for energy production. There is a need to change the way we think of how solid waste is generated, managed, and potentially used as a resource. Americans need to recognize that what is routinely discarded may in fact be a reusable resource.

53%
of municipal solid waste is deposited in landfills

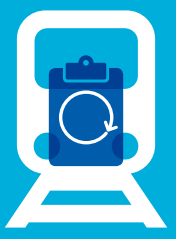
TRANSIT

Transit in America continues to grow, carrying 10.5 billion trips in 2015, and adding new lines and systems every year. Yet the symptoms of overdue maintenance and underinvestment have never been clearer. Despite increasing demand, the nation's transit systems have been chronically underfunded, resulting in aging infrastructure and a $90 billion rehabilitation backlog. While some communities are experiencing a transit boom, many Americans still have inadequate access to public transit.

WASTEWATER



The nation's 14,748 wastewater treatment plants protect public health and the environment. Years of treatment plant upgrades and more stringent federal and state regulations have significantly reduced untreated releases and improved water quality nationwide. It is expected that more than 56 million new users will be connected to centralized treatment systems over the next two decades, and an estimated $271 billion is needed to meet current and future demands. Through new methods and technologies that turn waste into energy, the nation's 1,269 biogas plants help communities better manage waste through reuse.



$90B
in transit maintenance backlog

56M
new users will be connected to centralized treatment systems

GAME CHANGERS

While all categories of American infrastructure require modernization and improvement, civil engineers, local communities, all levels of government, and the private sector have already started to develop innovative approaches to address our nation's significant infrastructure needs. To spotlight these efforts, ASCE seeks to continually identify infrastructure Game Changers—groundbreaking infrastructure projects that are transforming the way we plan and build projects across the country and the Report Card's 16 categories.

To learn more about Game Changers in each infrastructure category and in your state, visit InfrastructureReportCard.org/GameChangers

HELP RESTORE AMERICA'S INFRASTRUCTURE

Infrastructure plays a critical but often forgotten role in the daily lives of all Americans, securing public health and safety and improving quality of life. Aging, underperforming infrastructure costs hardworking families and businesses of all sizes, through wasted time and fuel, higher prices, vehicle repair costs, lost work hours due to power or water disruptions, and drained disposable income.

All Americans share a role in renewing the nation's infrastructure, beginning with learning about and appreciating the infrastructure all around them, sharing this Report Card, and advocating for long-term investment, visionary leadership, thoughtful planning, and thorough preparation for the future. We can't afford not to act.

Take the first step by visiting InfrastructureReportCard.org and downloading the Infrastructure Report Card app. Explore the Report Card, videos, infographics, and interactive content. Share it on social media. Then contact your elected officials at all levels of government to urge them to raise America's infrastructure grades.

Visit InfrastructureReportCard.org to explore the full Report Card and download the Infrastructure Report Card app.

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The 2017 Infrastructure Report Card is made possible with support from the ASCE Foundation.

Make your donation at www.ascefoundation.org or call 703-295-6342.

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