The *2009 Report Card for America's Infrastructure* grades 15 categories of infrastructure, including a new category: levees. For the second time, America's infrastructure rates a cumulative grade of D. While not all categories fare as badly or are plagued by the same problems, delayed maintenance and chronic underfunding are contributors to the low grades in nearly every category.

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

TRENDS IN THE GRADES

Grades ranged from a high of C+ for solid waste to a low of D- for drinking water, inland waterways, levees, roads, and wastewater. U.S. surface transportation and aviation systems declined over the past four years, with aviation and transit dropping from a D+ to D, and roads dropping from a D to a nearly failing D-.

Showing no significant improvement since the last report, the nation's bridges, public parks and recreation, and rail remained at a grade of C, while dams, hazardous waste, and schools remained at a grade of D, and drinking water and wastewater remained at a grade of D-. Levees, the newest category, debuted on the 2009 *Report Card* at a barely passing grade of D-.

Just one category—energy—improved since 2005, raised its grade from D to D+.

Water and Environment

DAMS: As dams age and downstream development increases, the number of deficient dams has risen to more than 4,000, including 1,819 high hazard dams. Over the past six years, for every deficient, high hazard potential dam repaired, nearly two more were declared deficient. There are more than 85,000 dams in the U.S., and the average age is just over 51 years old. Because of the lack of progress made in repairing and rehabilitating the nation's dams, this category again earned a grade of D.

DRINKING WATER: Drinking water again earned a D-. America's drinking water systems face an annual shortfall of at least $11 billion to replace aging facilities that are near the end of their useful life and to comply with existing and future federal water regulations. This does not account for growth in the demand for drinking water over the next 20 years. Leaking pipes lose an estimated seven billion gallons of clean drinking water a day. Although Americans still enjoy some of the best tap water in the world, the costs of treating and delivering that water where it is needed continue to outpace the funds available to sustain the system.

HAZARDOUS WASTE: Hundreds of thousands of contaminated sites exist across the country, representing millions of dollars of untapped economic potential. Redevelopment of brownfield sites over the past five years generated an estimated 191,338 new jobs and $408 million annually in extra revenues for localities. In 2008, however, there were 188 U.S. cities with brownfield sites awaiting cleanup and redevelopment. Additionally, federal funding for "Superfund" cleanup of the nation's worst toxic waste sites has declined steadily, dropping to $1.08 billion

TABLE A ★ 2009 *Report Card for America's Infrastructure*

Aviation	D
Bridges	C
Dams	D
Drinking Water	D-
Energy	D+
Hazardous Waste	D
Inland Waterways	D-
Levees	D-
Public Parks and Recreation	C-
Rail	C-
Roads	D-
Schools	D
Solid Waste	C+
Transit	D
Wastewater	D-

AMERICA'S INFRASTRUCTURE G.P.A. **D**

ESTIMATED 5 YEAR INVESTMENT NEED **$2.2 TRILLION**

NOTES Each category was evaluated on the basis of capacity, condition, funding, future need, operation and maintenance, public safety and resilience

A = Exceptional
B = Good
C = Mediocre
D = Poor
F = Failing

in 2008, its lowest level since 1986. Since little has been done to clean up these sites since the last *Report Card*, hazardous waste again earned a grade of D.

LEVEES: The *Report Card*'s new category, levees, earned a D-. More than 85% of the nation's estimated 100,000 miles of levees are locally owned and maintained. The reliability of many of these levees is unknown. Many are more than 50 years old and were originally built to protect crops from flooding. With an increase in development behind these levees, the risk to public health and safety from failure has increased. Rough estimates put the cost at more than $100 billion to repair and rehabilitate the nation's levees.

SOLID WASTE: The category that has consistently had the highest grade on the *Report Card for America's Infrastructure* is solid waste, again earning the highest grade of C+. In 2007, the U.S. produced 254 million tons of municipal solid waste. More than a third was recycled or recovered, representing a 7% increase since 2000. Per capita generation of waste has remained relatively constant over the last 20 years. Despite those successes, the increasing volume of electronic waste and lack of uniform regulations for its disposal creates the potential for high levels of hazardous materials and heavy metals in the nation's landfills, posing a significant threat to public safety.

WASTEWATER: Aging systems discharge billions of gallons of untreated wastewater into U.S. surface waters each

year. The U.S. Environmental Protection Agency estimates that the nation must invest $390 billion over the next 20 years to update or replace existing systems and build new ones to meet increasing demand. Wastewater continues to be among the lowest grades on the *Report Card*, again earning a D- in 2009.

Transportation

AVIATION: Despite surging oil prices, volatile credit markets, and a lagging economy, the Federal Aviation Administration projects a 3% annual growth in air travel. Travelers will be faced with increasing delays and inadequate conditions as a result of the long overdue need to modernize the outdated air traffic control system and the failure to enact a federal aviation program. The increasing delays and the lack of new authorization for federal aviation programs have caused aviation's grade to slip to a D in 2009.

BRIDGES: More than 26%—more than one in four—of the nation's bridges are either structurally deficient or functionally obsolete. While some progress has been made in recent years to reduce the number of deficient and obsolete bridges in rural areas, the number in urban areas is rising. A $17 billion annual investment is needed to substantially improve current bridge conditions. Currently, only $10.5 billion is spent annually on the construction and maintenance of bridges. There have been no substantial improvements in bridge condition since the last *Report Card*, keeping the grade at a C for 2009.

INLAND WATERWAYS: The nation's waterways offer an efficient and environmentally friendly way to move goods across the country. The average tow barge can carry the equivalent of 870 tractor trailer loads. Of the 257 locks still in use on the nation's inland waterways, 30 were built in the 1800s and another 92 are more than 60 years old. The average age of all federally owned or operated locks is nearly 60 years, well past their planned design life of 50 years. The cost to replace the present system of locks is estimated at more than $125 billion. Despite the economic savings waterways can offer, little has been done to improve their condition since 2005, leaving this category at a grade of D-.

RAIL: A freight train is three times as fuel efficient as a truck, and traveling by passenger rail uses 20% less energy per mile than traveling by car. However, growth and changes in demand create bottlenecks that constrain traffic in critical areas. Freight and passenger rail generally share the same network, and a significant potential increase in passenger rail demand will add to the freight railroad capacity challenges. More than $200 billion is needed through 2035 to accommodate anticipated growth. Similar to the nation's inland waterways, rail offers enormous economic and environmental potential, but few improvements have been made since 2005. This category again rates at a C-.

ROADS: Congestion on the nation's roads is increasing and the cost to improve is ever rising, causing the roads grade to

decrease to a D- in 2009. Americans spend 4.2 billion hours a year stuck in traffic at a cost to the economy of $78.2 billion, or $710 per motorist. Poor conditions cost motorists $67 billion a year in repairs and operating costs. One-third of America's major roads are in poor or mediocre condition and 45% of major urban highways are congested. Current spending of $70.3 billion per year for highway capital improvements is well below the estimated $186 billion needed annually to substantially improve conditions.

TRANSIT: Transit use increased 25% between 1995 and 2005, faster than any other mode of transportation. However, nearly half of American households do not have access to bus or rail transit, and only 25% have what they consider to be a good alternative. The Federal Transit Administration estimates that $15.8 billion is needed annually to maintain conditions and $21.6 billion is needed to improve to good conditions. In 2008, federal capital outlays for transit were only $9.8 billion. Since investment in transit has not kept pace with its growing needs, the 2009 grade has dropped to a D.

Public Facilities

PUBLIC PARKS AND RECREATION: Parks, beaches, and other recreational facilities contribute $730 billion per year to the U.S. economy, support nearly 6.5 million jobs, and contribute to cleaner air and water and higher property values. Despite record spending on parks at the state and local level, the acreage of parkland per resident in urban areas is declining. While significant investments are being made in the National Park Service for its 2016 centennial, the agency's facilities still face a $7-billion maintenance backlog. Even though some progress has been made since 2005 to improve the nation's parkland, lagging public investment means that public parks and recreation still earns a grade of C- in 2009.

SCHOOLS: Spending on the nation's schools grew from $17 billion in 1998 to a peak of $29 billion in 2004. However, by 2007 spending fell to $20.28 billion. No comprehensive, authoritative nationwide data on the condition of America's school buildings have been collected in a decade. The National Education Association's best estimate to bring the nation's schools into good repair is $322 billion. Without up-to-date data, the true extent of the problems facing the nation's schools cannot be known, and therefore schools once again receive a grade of D.

Energy

ENERGY: Progress has been made in grid reinforcement since 2005, and substantial investment in generation, transmission, and distribution is expected over the next two decades. Demand for electricity has grown by 25% since 1990. Public and government opposition and difficulty in the permitting processes are restricting much needed modernization. Projected electric utility investment needs could be as much as $1.5 trillion by 2030. The increase to a grade of D+ is largely due to anticipated

investments in improvements over the next two decades, which began in 2005.

RAISING THE GRADES: SOLUTIONS

The nation's infrastructure faces some very real problems that threaten our way of life if they are not addressed. These problems are solvable if we have the needed vision and leadership. Raising the grades on our infrastructure will require that we seek and adopt a wide range of structural and non-structural solutions in every category, including technical advances, funding and regulatory changes, and changes in public behavior and support.

ASCE has developed five key solutions to begin raising the grades. They are:

- ★ **INCREASE** federal leadership in infrastructure to address the crisis;
- ★ **PROMOTE** sustainability and resilience in infrastructure to protect the natural environment and withstand natural and man-made hazards;
- ★ **DEVELOP** national, state, and regional infrastructure plans that complement a national vision and focus on system-wide results;
- ★ **ADDRESS** life-cycle costs and ongoing maintenance to meet the needs of current and future users;
- ★ **INCREASE** and improve infrastructure investment from all stakeholders.

RAISING THE GRADES: CASE STUDIES

While the conditions listed in the *Report Card* mean low grades for all categories, there are positive examples from across the country that demonstrate some progress is being made. Throughout the report, case studies of how public and private organizations have addressed specific problems are included to demonstrate how these innovative solutions can be applied on a larger scale. The case studies for each category may not contribute to an overall improvement of the grade, but they illustrate that the problems facing the nation's infrastructure are solvable with some creativity and determination.

HISTORY

The concept for a report card to grade the nation's infrastructure originated in 1988 with a congressionally chartered commission, the National Council on Public Works Improvement. Titled *Fragile Foundations: A Report on America's Public Works*, the council's report issued recommendations on how to improve the nation's infrastructure. As a way to guide the study, the authors used the report card concept to establish a baseline evaluation of the infrastructure. This first report card included eight categories of infrastructure and assigned letter grades on the basis of performance and capacity of existing public works.

In 1988, when the report was released, the nation's infrastructure earned a "C," representing an average grade. Among the problems identified within *Fragile Foundations* were increasing congestion and

ABOVE: Crews work to rescue stranded drivers after a major water main broke in Montgomery County, Maryland on December 23, 2008. *Photo courtesy of The Gazette / Gazette.Net.*

deferred maintenance and age of the system; the authors of the report worried that fiscal investment was inadequate to meet the current operations costs and future demands on the system. Since 1998 ASCE has released four *Report Cards* and found each time that these same problems persist.

METHODOLOGY

The *Report Card* advisory council comprises 28 engineers with expertise in the disciplines represented in the report. For nearly a year the council worked to analyze current data and conditions within the 15 categories, consult with additional technical and industry experts, and assess and assign grades.

In assigning grades, the council considered several fundamental criteria. These included capacity, condition, operations and maintenance, current and future funding, public safety, and resilience. The grade determination was based on both publicly available data and the subjective judgments of the engineers serving on the advisory council.

The 2005 *Report Card* featured a category called "Security" that sought to rate the ability of infrastructure to meet man-made threats. In the four years since that report, engineers have begun to look at security in the context of infrastructure's overall resilience—or the ability to withstand and recover from both natural and man-made hazards. Since the likelihood of natural disaster is sometimes much higher than that of a man-made threat, and resilience must be determined on a system by system basis, the 2009 *Report Card* now incorporates resilience as a grading factor in each category.

THE NEED FOR INVESTMENT

In 2009, ASCE estimates that $2.2 trillion needs to be invested over five years to bring the condition of the nation's infrastructure up to a good condition—an increase of more than half a trillion dollars since the 2005 *Report Card*'s estimate of $1.6 trillion. This number, adjusted for a 3% rate of inflation, represents capital spending at all levels of government and includes what is already being spent. Current spending amounts to only about half of the needed investment, which means the U.S. must invest an additional $1.1 billion over the next five years. ★

TABLE B ★ Estimated 5-Year Investment Needs in Billions of Dollars

CATEGORY	5-YEAR NEED (BILLIONS)	ESTIMATED ACTUAL SPENDING *	AMERICAN RECOVERY AND REINVESTMENT ACT (P.L. III-005)	FIVE-YEAR INVESTMENT SHORTFALL
Aviation	87	45	1.3	(40.7)
Dams	12.5	5	0.05	(7.45)
Drinking Water and Wastewater	255	140	6.4	(108.6)
Energy	75	34.5	11	(29.5)
Hazardous Waste and Solid Waste	77	32.5	1.1	(43.4)
Inland Waterways	50	25	4.475	(20.5)
Levees	50	1.13	0	(1.13)
Public Parks and Recreation	85	36	0.835	(48.17)
Rail	63	42	9.3	(11.7)
Roads and Bridges	930	351.5	27.5	(549.5)
Discretionary grants for surface transportation			1.5	
Schools	160	125	0**	(35)
Transit	265	66.5	8.4	(190.1)
	2.122 trillion* **	**903 billion**	**71.76 billion**	**(1.176 trillion)**
Total Need** **	**$2.2 trillion**			

* 5 year spending estimate based on the most recent available spending at all levels of government and not indexed for inflation
** The American Recovery and Reinvestment Act included $53.6 billion for a State Fiscal Stabilization Fund for education, as of press time, it was not known how much would be spent on school infrastructure.
*** Not adjusted for inflation
**** Assumes 3% annual inflation

SOURCES For source information see page 150.