2013 REPORT CARD for America's INFRASTRUCTURE

March 2013

About the American Society of Civil Engineers

The American Society of Civil Engineers, founded in 1852, is the country's oldest national civil engineering organization. It represents more than 140,000 civil engineers in private practice, government, industry, and academia who are dedicated to advancing the science and profession of civil engineering.

ASCE comprises over 600 local affiliates, which include 87 Sections, 158 Branches, and 130 Younger Member Groups, 267 Student Chapters, and 11 International Student Groups. Additionally, the Society has Agreements of Cooperation with 70 engineering organizations in 59 countries and supports 12 international Sections and 19 International Groups.

ASCE advances professional knowledge and improves the practice of civil engineers as the focus point for development of research results and technical, policy, and managerial information. As such ASCE serves as the catalyst for effective and efficient service through cooperation with other engineering and related organizations.

A critical role for ASCE is informing civil engineers about new developments in civil engineering through annual technical conferences and offering courses to help engineers earn continuing education units and professional development hours to meet mandatory continuing professional competency requirements in their states.

To achieve its vision for civil engineering, ASCE has established these strategic priorities: Infrastructure: propose practical solutions to improve America's neglected infrastructure; Raise the Bar: establish educational and legal standards necessary to prepare professional engineers to address the future's most pressing challenges; and Sustainability: embrace civil engineers' role as contributors to a sustainable world.

A Message from the President of the ASCE

We are at a pivotal moment when it comes to maintaining and modernizing our nation's infrastructure. Many of our roads, bridges, water systems, and our national electric grid were put into place over fifty years ago, and these systems are simply overwhelmed or worn out.

The 2013 Report Card for America's Infrastructure gives an overall grade of D+ across 16 categories, up just slightly from the D given in ASCE's 2009 Report Card. Six infrastructure sectors benefited from either an increase in private investment, targeted efforts in cities and states to make upgrades or repairs, or from a one-time boost in federal funding.

Notably, this marks the first time the grades have improved since the American Society of Civil Engineers first graded the condition of America's infrastructure in 1998. However, a D+ grade is still not acceptable.

For the most part, the problem is hidden. Most of us do not notice infrastructure until it stops working – when a bridge is closed causing us to be late for work, when the lights go out, or when there is no water for your morning shower.

But failing infrastructure is not only an inconvenience, it financially impacts our families and our country. Our infrastructure is the foundation of our economy and our quality of life, and repairing and modernizing it has exponential benefits, including: increasing our gross domestic product, growing household income, protecting jobs, and maintaining a strong U.S. position in international markets. Unless we address the backlog of projects and deferred maintenance throughout the country, the cost to each American family will reach $3,100 per year in personal disposable income.

As civil engineers, ASCE's 140,000-plus members are stewards of our nation's infrastructure – charged with the design, construction, operation and maintenance of these critical systems. We developed the Report Card for America's Infrastructure to give the public and decision-makers a comprehensive assessment of the conditions of the nation's infrastructure across many sectors.

Across the country, there are elected officials, engineers, and community leaders who see the problem and are rising to the challenge. The 2013 Report Card includes countless examples of creative, innovative solutions for our infrastructure problems – from riverbank filtration systems in Kentucky, to cutting road construction times in half in Michigan, to turning water treatment waste into fertilizer in Utah.

The 2013 Report Card shows that if we focus our attention with innovative solutions and increased investment we can improve our infrastructure. With strong and sustained leadership at all levels of government, we are confident we can raise the grades.

Gregory E. DiLoreto, P.E., P.L.S., D.WRE, F.ASCE
ASCE President 2013

Overview: Executive Summary

Every family, every community and every business needs infrastructure to thrive. Infrastructure encompasses your local water main and the Hoover Dam; the power lines connected to your house and the electrical grid spanning the U.S.; and the street in front of your home and the national highway system.

Once every four years, America's civil engineers provide a comprehensive assessment of the nation's major infrastructure categories in ASCE's *Report Card for America's Infrastructure* (*Report Card*). Using a simple A to F school report card format, the Report Card provides a comprehensive assessment of current infrastructure conditions and needs, both assigning grades and making recommendations for how to raise the grades. An Advisory Council of ASCE members assigns the grades according to the following eight criteria: capacity, condition, funding, future need, operation and maintenance, public safety, resilience, and innovation. Since 1998, the grades have been near failing, averaging only Ds, due to delayed maintenance and underinvestment across most categories.

Now the 2013 *Report Card* grades are in, and America's cumulative GPA for infrastructure rose slightly to a D+. The grades in 2013 ranged from a high of B- for solid waste to a low of D- for inland waterways and levees. Solid waste, drinking water, wastewater, roads, and bridges all saw incremental improvements, and rail jumped from a C- to a C+. No categories saw a decline in grade this year.

The 2013 *Report Card* demonstrates that we can improve the current condition of our nation's infrastructure — when investments are made and projects move forward, the grades rise. For example, greater private investment for efficiency and connectivity brought improvements in the rail category; renewed efforts in cities and states helped address some of the nation's most vulnerable bridges; and, several categories benefited from short-term boosts in federal funding.

We know that investing in infrastructure is essential to support healthy, vibrant communities. Infrastructure is also critical for long-term economic growth, increasing GDP, employment, household income, and exports. The reverse is also true – without prioritizing our nation's infrastructure needs, deteriorating conditions can become a drag on the economy.

While the modest progress is encouraging, it is clear that we have a significant backlog of overdue maintenance across our infrastructure systems, a pressing need for modernization, and an immense opportunity to create reliable, long-term funding sources to avoid wiping out our recent gains. Overall, most grades fell below a C, and our cumulative GPA inched up just slightly to a D+ from a D four years ago.

We invite you to take a deeper look at the nation's infrastructure conditions in the 2013 *Report Card* – from the state infrastructure facts, to the interactive charts, to our three key solutions.

A brief summary of the findings for each category is below. Click on any heading to get more detailed information on the category and explore the interactive content.

Dams: Dams again earned a grade of D. The average age of the 84,000 dams in the country is 52 years old. The nation's dams are aging and the number of high-hazard dams is on the rise. Many of these dams were built as low-hazard dams protecting undeveloped agricultural land. However, with an increasing population and greater development below dams, the overall number of high-hazard dams continues to increase, to nearly 14,000 in 2012. The number of deficient dams is currently more than 4,000. The Association of State Dam Safety Officials estimates that it will require an investment of $21 billion to repair these aging, yet critical, high-hazard dams.

Drinking Water: The grade for drinking water improved slightly to a D. At the dawn of the 21st century, much of our drinking water infrastructure is nearing the end of its useful life. There are an estimated 240,000 water main breaks per year in the United States. Assuming every pipe would need to be replaced, the cost over the coming decades could reach more than $1 trillion, according to the American Water Works Association (AWWA). The quality of drinking water in the United States remains universally high, however. Even though pipes and mains are frequently more than 100 years old and in need of replacement, outbreaks of disease attributable to drinking water are rare.

Hazardous Waste: There has been undeniable success in the cleanup of the nation's hazardous waste and brownfields sites. However, annual funding for Superfund site cleanup is estimated to be as much as $500 million short of what is needed, and 1,280 sites remain on the National Priorities List with an unknown number of potential sites yet to be identified. More than 400,000 brownfields sites await cleanup and redevelopment. The Environmental Protection Agency (EPA) estimates that one in four Americans lives within three miles of a hazardous waste site. The grade for hazardous waste remained unchanged at a D.

Levees: Levees again earned a near failing grade of D- in 2013. The nation's estimated 100,000 miles of levees can be found in all 50 states and the District of Columbia. Many of these levees were originally used to protect farmland, and now are increasingly protecting developed communities. The reliability of these levees is unknown in many cases, and the country has yet to establish a National Levee Safety Program. Public safety remains at risk from these aging structures, and the cost to repair or rehabilitate these levees is roughly estimated to be $100 billion by the National Committee on Levee Safety. However, the return on investment is clear – as levees helped in the prevention of more than $141 billion in flood damages in 2011.

Solid Waste: In 2010, Americans generated 250 million tons of trash. Of that, 85 million tons were recycled or composted. This represents a 34% recycling rate, more than double the 14.5% in 1980. Per capita generation rates of waste have been steady over the past 20 years and have even begun to show signs of decline in the past several years. The grade for solid waste improved in 2013, and it earned the highest grade of B-.

Wastewater: The grade for wastewater improved slightly to a D. Capital investment needs for the nation's wastewater and stormwater systems are estimated to total $298 billion over the next 20 years. Pipes represent the largest capital need, comprising three quarters of total needs. Fixing and expanding the pipes will address sanitary sewer overflows, combined sewer overflows, and other pipe-related issues. In recent years, capital needs for the treatment plants comprise about 15%-20% of total needs, but will likely increase due to new regulatory requirements. Stormwater needs, while growing, are still small compared with sanitary pipes and treatment plants. Since 2007, the federal government has required cities to invest more than $15 billion in new pipes, plants, and equipment to eliminate combined sewer overflows.

Aviation: Despite the effects of the recent recession, commercial flights were about 33 million higher in number in 2011 than in 2000, stretching the system's ability to meet the needs of the nation's economy. The Federal Aviation Administration (FAA) estimates that the national cost of airport congestion and delays was almost $22 billion in 2012. If current federal funding levels are maintained, the FAA anticipates that the cost of congestion and delays to the economy will rise from $34 billion in 2020 to $63 billion by 2040. Aviation again earned a D.

Bridges: Over two hundred million trips are taken daily across deficient bridges in the nation's 102 largest metropolitan regions. In total, one in nine of the nation's bridges are rated as structurally deficient, while the average age of the nation's 607,380 bridges is currently 42 years. The Federal Highway Administration (FHWA) estimates that to eliminate the nation's bridge backlog by 2028, we would need to invest $20.5 billion annually, while only $12.8 billion is being spent currently. The challenge for federal, state, and local governments is to increase bridge investments by $8 billion annually to address the identified $76 billion in needs for deficient bridges across the United States. However, with the overall number of structurally deficient bridges continuing to trend downward, the grade improved to C+.

Inland Waterways: Our nation's inland waterways and rivers are the hidden backbone of our freight network – they carry the equivalent of about 51 million truck trips each year. In many cases, the inland waterways system has not been updated since the 1950s, and more than half of the locks are over 50 years old. Barges are stopped for hours each day with unscheduled delays, preventing goods from getting to market and driving up costs. There is an average of 52 service interruptions a day throughout the system. Projects to repair and replace aging locks and dredge channels take decades to approve and complete, exacerbating the problem further. Inland waterways received a D- grade once again as conditions remain poor and investment levels remain stagnant.

Ports: This new category for 2013 debuted with a grade of C. The U.S. Army Corps of Engineers estimates that more than 95% (by volume) of overseas trade produced or consumed by the United States moves through our ports. To sustain and serve a growing economy and compete internationally, our nation's ports need to be maintained, modernized, and expanded. While port authorities and their private sector partners have planned over $46 billion in capital improvements from now until 2016, federal funding has declined for navigable waterways and landside freight connections needed to move goods to and from the ports.

Rail: Railroads are experiencing a competitive resurgence as both an energy-efficient freight transportation option and a viable city-to-city passenger service. In 2012, Amtrak recorded its highest year of ridership with 31.2 million passengers, almost doubling ridership since 2000, with growth anticipated to continue. Both freight and passenger rail have been investing heavily in their tracks, bridges, and tunnels as well as adding new capacity for freight and passengers. In 2010 alone, freight railroads renewed the rails on more than 3,100 miles of railroad track, equivalent to going coast to coast. Since 2009, capital investment from both freight and passenger railroads has exceeded $75 billion, actually increasing investment during the recession when materials prices were lower and trains ran less frequently. With high ridership and greater investment in the system, the grade for rail saw the largest improvement, moving up to a C+ in 2013.

Roads: Targeted efforts to improve conditions and significant reductions in highway fatalities resulted in a slight improvement in the roads grade to a D this year. However, forty-two percent of America's major urban highways remain congested, costing the economy an estimated $101 billion in wasted time and fuel annually. While the conditions have improved in the near term, and federal, state, and local capital investments increased to $91 billion annually, that level of investment is insufficient and still projected to result in a decline in conditions and performance in the long term. Currently, the Federal Highway Administration estimates that $170 billion in capital investment would be needed on an annual basis to significantly improve conditions and performance.

Transit: The grade for transit remained at a D as transit agencies struggled to balance increasing ridership with declining funding. America's public transit infrastructure plays a vital role in our economy, connecting millions of people with jobs, medical facilities, schools, shopping, and recreation, and it is critical to the one-third of Americans who do not drive cars. Unlike many U.S. infrastructure systems, the transit system is not comprehensive, as 45% of American households lack any access to transit, and millions more have inadequate service levels. Americans who do have access have increased their ridership 9.1% in the past decade, and that trend is expected to continue. Although investment in transit has also increased, deficient and deteriorating transit systems cost the U.S. economy $90 billion in 2010, as many transit agencies are struggling to maintain aging and obsolete fleets and facilities amid an economic downturn that has reduced their funding, forcing service cuts and fare increases.

Public Parks and Recreation: The popularity of parks and outdoor recreation areas in the United States continues to grow, with over 140 million Americans making use of these facilities a part of their daily lives. These activities contribute $646 billion to the nation's economy, supporting 6.1 million jobs. Yet states and localities struggle to provide these benefits for parks amid flat and declining budgets, reporting an estimated $18.5 billion in unmet needs in 2011. The federal government is also facing a serious challenge as well since the National Park Service estimates its maintenance backlog at approximately $11 billion. The grade for parks remained unchanged at a C-.

Schools: Almost half of America's public school buildings were built to educate the baby boomers – a generation that is now retiring from the workforce. Public school enrollment is projected to gradually increase through 2019, yet state and local school construction funding continues to decline. National

spending on school construction has diminished to approximately $10 billion in 2012, about half the level spent prior to the recession, while the condition of school facilities continues to be a significant concern for communities. Experts now estimate the investment needed to modernize and maintain our nation's school facilities is at least $270 billion or more. However, due to the absence of national data on school facilities for more than a decade, a complete picture of the condition of our nation's schools remains mostly unknown. Schools received a D again this year.

Energy: America relies on an aging electrical grid and pipeline distribution systems, some of which originated in the 1880s. Investment in power transmission has increased since 2005, but ongoing permitting issues, weather events, and limited maintenance have contributed to an increasing number of failures and power interruptions. While demand for electricity has remained level, the availability of energy in the form of electricity, natural gas, and oil will become a greater challenge after 2020 as the population increases. Although about 17,000 miles of additional high-voltage transmission lines and significant oil and gas pipelines are planned over the next five years, permitting and siting issues threaten their completion. Thus, the grade for energy remained a D+.

Conclusion

Infrastructure is the foundation that connects the nation's businesses, communities, and people, driving our economy and improving our quality of life. 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; transmission systems that deliver reliable, low-cost power from a wide range of energy sources; and water systems that drive industrial processes as well as the daily functions in our homes. Yet today, our infrastructure systems are failing to keep pace with the current and expanding needs, and investment in infrastructure is faltering.

We must commit today to make our vision of the future a reality – an American infrastructure system that is the source of our prosperity.

Overview: Key Solutions

The 21st Century Vision for America's Infrastructure

In the 21st century, we see an America that thrives because of high quality infrastructure.

Infrastructure is the foundation that connects the nation's businesses, communities, and people, driving our economy and improving our quality of life. 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; transmission systems that deliver reliable, low-cost power from a wide range of energy sources; and water systems that drive industrial processes as well as the daily functions in our homes. Yet today, our infrastructure systems

are failing to keep pace with the current and expanding needs, and investment in infrastructure is faltering.

In the short term we need a national commitment to bring existing infrastructure into a state-of-good-repair, and in the long term we must modernize and build in a targeted and strategic manner. This means leadership at the federal, state, and local levels of government, by businesses and individuals, to communicate the importance of our nation's infrastructure, to craft innovative solutions that reflect the diverse needs of the nation, and to make the investments the system needs. By employing strategies to use every dollar more efficiently and by deploying creative solutions to infrastructure development such as public–private partnerships, we can implement the right projects on time at the right price.

We must commit today to make our vision of the future a reality — an American infrastructure system that is the source of our prosperity.

Raising the Grades: Key Solutions

Our nation's infrastructure problems are solvable if we have leadership and commit to making good ideas a reality. Raising the grades on our infrastructure will require that we seek and adopt a wide range of solutions. ASCE has developed three key solutions to begin raising the grades:

1. Increase Leadership in Infrastructure Renewal

America's infrastructure needs bold leadership and a compelling vision at the national level. During the 20th century, the federal government led the way in building our nation's greatest infrastructure systems from the New Deal programs to the Interstate Highway System and the Clean Water Act. Since that time, federal leadership has decreased, and the condition of the nation's infrastructure has suffered. Currently, most infrastructure investment decisions are made without the benefit of a national vision. That strong national vision must originate with strong leadership at all levels of government and the private sector. Without embracing a strong national vision, the infrastructure will continue to deteriorate.

2. Promote Sustainability and Resilience

America's infrastructure must meet the ongoing needs for natural resources, industrial products, energy, food, transportation, shelter, and effective waste management, and at the same time protect and improve environmental quality. Sustainability, resiliency, and ongoing maintenance must be an integral part of improving the nation's infrastructure. Today's transportation systems, water treatment systems, and flood control systems must be able to withstand both current and future challenges. As infrastructure is built or rehabilitated, life-cycle cost analysis should be performed for all infrastructure systems to account for initial construction, operation, maintenance, environmental, safety, and other costs reasonably anticipated during the life of the project, such as recovery after

disruption by natural or manmade hazards. Both structural and non-structural methods must be applied to meet challenges. Infrastructure systems must be designed to protect the natural environment and withstand both natural and man-made hazards, using sustainable practices, to ensure that future generations can use and enjoy what we build today, as we have benefited from past generations. Additionally, research and development should be funded at the federal level to develop new, more efficient methods and materials for building and maintaining the nation's infrastructure.

3. Develop and Fund Plans to Maintain and Enhance America's Infrastructure

While infrastructure investment must be increased at all levels, it must also be prioritized and executed according to well-conceived plans that both complement the national vision and focus on systemwide outputs. The goals should center on freight and passenger mobility, intermodality, water use, and environmental stewardship, while encouraging resiliency and sustainability. The plans must reflect a better defined set of federal, state, local, and private sector roles and responsibilities and instill better discipline for setting priorities and focusing funding to solve the most pressing problems. The plans should also complement our broad national goals of economic growth and leadership, public safety, resource conservation, energy independence, and environmental stewardship. Infrastructure plans should be synchronized with regional land use planning and related regulation and incentives to promote non-structural as well as structural solutions to mitigate the growing demand for increased infrastructure capacity.

Finally, the plans must renew the commitment to infrastructure investments in all categories. All available financing options must be explored and debated. Innovative financing programs must be developed and authorized that not only make resources readily available, but also encourage the most effective and efficient use of those resources. Federal investment must be used to complement, encourage, and leverage investment from the state and local government levels as well as from the private sector. In addition, users of the infrastructure must be willing to pay the appropriate price for their use.

About The Report Card: Methodology

The purpose of the *2013 Report Card for America's Infrastructure* is to inform the public of the current condition of America's infrastructure and to deliver the information in a concise and easily accessible manner. Using an easily understood school report card format, each of the 16 categories of infrastructure covered in the *Report Card* is assessed using rigorous grading criteria and the most recent aggregate data sources to provide a comprehensive assessment of America's infrastructure assets.

Grading Scale

To develop the *Report Card* grades, a quantitative and qualitative approach to each of the eight fundamental criteria is used to arrive at each of the 16 category grades. These 16 grades are averaged to create a grade point average (GPA) for U.S. infrastructure overall. Each category uses the same criteria for grading, which accounts for the positive improvement and negative decline of the category grades and overall GPA.

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 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, with increasing vulnerability to risk.

D

POOR: AT RISK

The infrastructure is in poor to fair 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 significant 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.

History

The concept of a report card to grade the nation's infrastructure originated in 1988 with the congressionally chartered National Council on Public Works Improvement report, *Fragile Foundations: A Report on America's Public Works*. When the federal government indicated they would not be updating the report after a decade, ASCE used the approach and methodology to publish the first *Report Card on America's Infrastructure* in 1998. With each new report in 2001, 2005, 2009, and now 2013, the methodology of the *Report Card* has been rigorously assessed so as to take into consideration all of the changing elements that affect America's infrastructure.

In 1988, when *Fragile Foundations* was released, the nation's infrastructure earned a "C," representing an average grade based on the performance and capacity of existing public works. Among the problems identified within *Fragile Foundations* were increasing congestion and 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 five *Report Cards* and found each time that these same problems persist.

Grading Criteria

ASCE's Report Card Advisory Council oversees the data analysis and development of the Report Card with the support of the ASCE Infrastructure Initiatives staff. The Advisory Council is made up of over 30 civil engineers with substantial experience in various types of infrastructure who volunteer their time and expertise for over a year to complete the *Report Card*. The Council members review and assess all relevant data and reports, consult with technical and industry experts, and assign grades according to the following eight criteria:

- **Capacity** – Evaluate the infrastructure's capacity to meet current and future demands.
- **Condition** – Evaluate the infrastructure's existing or near future physical condition.
- **Funding** – Evaluate the current level of funding (from all levels of government) for the infrastructure category and compare it to the estimated funding need.
- **Future Need** – Evaluate the cost to improve the infrastructure and determine if future funding prospects will be able to meet the need.
- **Operation and Maintenance** – Evaluate the owners' ability to operate and maintain the infrastructure properly and determine that the infrastructure is in compliance with government regulations.
- **Public Safety** – Evaluate to what extent the public's safety is jeopardized by the condition of the infrastructure and what the consequences of failure may be.
- **Resilience** – Evaluate the infrastructure system's capability to prevent or protect against significant multihazard threats and incidents and the ability to expeditiously recover and reconstitute critical services with minimum damage to public safety and health, the economy, and national security.
- **Innovation** – Evaluate the implementation and strategic use of innovative techniques and delivery methods.

Research and Grading Process

1. Review and analyze the available data, surveys, and reports for each category in order to:
    - Identify the scope and current condition of infrastructure (e.g. number of bridges, miles of pipe);
    - Review current budgeted expenditures for maintenance and replacements as well as the investment needed to replace existing infrastructure;
    - Identify investment needed to upgrade infrastructure to meet current and future capacity needs.
2. Interview infrastructure stakeholders and industry leaders to discuss the available data, trends, and needs of infrastructure.
    - Identify all available data sources;
    - Examine current trends and developments.
3. Develop a summary report citing the condition, capacity, and trends relating to the grading criteria that includes:
    - Existing and future needs and current funding levels;
    - Progress made in category from previous Report Card;
    - Consequences of inaction.
4. Establish a grading framework based on past grades and the eight identified grading criteria using the traditional letter-grade scale, as outlined above.

The average age of the 84,000 dams in the country is 52 years old. The nation's dams are aging and the number of high-hazard dams is on the rise. Many of these dams were built as low-hazard dams protecting undeveloped agricultural land. However, with an increasing population and greater development below dams, the overall number of high-hazard dams continues to increase, to nearly 14,000 in 2012. The number of deficient dams is estimated at more than 4,000, which includes 2,000 deficient high-hazard dams. The Association of State Dam Safety Officials estimates that it will require an investment of $21 billion to repair these aging, yet critical, high-hazard dams.

Dams: Conditions & Capacity

Our nation's dams provide essential benefits such as drinking water, irrigation, hydropower, flood control, and recreation. The safe operation and proper maintenance of these dams is critical to sustaining these benefits while preventing the possibility of a dam failure. Thousands of our nation's dams are in need of rehabilitation to meet current design and safety standards. They are not only aging, but are subject to stricter criteria as a result of increased downstream development and advancing scientific knowledge predicting flooding, earthquakes, and dam failures.

Dams are classified based on their hazard potential, or anticipated consequences in the case of failure. The failure of a dam that is classified as **high-hazard** is anticipated to cause a loss of life. As of 2012, there are 13,991 dams in the United States that are classified as high-hazard, showing a continued increase in the overall number of dams with that classification. The number has increased from 10,118 high-hazard dams just ten years ago. Another 12,662 dams are currently labeled as **significant hazard**, meaning a failure would not necessarily cause a loss of life, but could result in significant economic losses.

The average age of our nation's dams is 52 years. By 2020, 70% of the total dams in the United States will be over 50 years old. Fifty years ago dams were built with the best engineering and construction standards of the time. However, as the scientific and engineering data have improved, many dams are not expected to safely withstand current predictions regarding large floods and earthquakes. In

addition, many of these dams were initially constructed using less-stringent design criteria for low-hazard dams due to the lack of development below the dam.

The U.S. Census Bureau estimates a population increase of 130 million people within the United States by 2050. This population growth will likely move development further into the unpopulated areas below aging dams, increasing the populations at risk and reclassifying many low or significant hazard dams as high-hazard. However, "high-hazard" does not necessarily mean the dam is deficient, but instead that the consequences are expected to include loss of life should the dam fail.

Dam failures can not only risk public safety, but they can cost our economy millions of dollars in damages. For example, the Iowa Lake Delhi dam failure in 2010 cost an estimated $50 million in damages and $120 million in economic losses, and swept away half a dozen homes. Since dam failures can cause severe consequences to public safety and the economy, emergency action plans (EAPs) for use in the event of an impending dam failure or other uncontrolled release of water remain vital. While the number of high-hazard dams with an EAP has increased, only 66% of dams have EAPs, far below the national goal of 100%.

The complexity of monitoring the conditions of our nation's dams is partly because they are owned and operated by many different entities. While some of the nation's dams are owned and operated by federal, state, and local governments, the majority, 69%, are owned by a private entity. The federal government owns 3,225 dams, or approximately 4% of the nation's dams. It may be surprising to some that the U.S. Army Corps of Engineers owns only 694 dams.

Other than 2,600 dams regulated by the Federal Energy Regulatory Commission, the remaining dams in the nation are not regulated by the federal government, but instead rely on state dam safety programs for inspection. State dam safety programs have primary responsibility and permitting, inspection, and enforcement authority for 80% of the nation's dams. Therefore, state dam safety programs bear a large responsibility for public safety, but unfortunately, many state programs lack sufficient resources, and in some cases enough regulatory authority, to be effective. In fact, the average number of dams per state safety inspector totals 207. In South Carolina, just one and a half dam safety inspectors are responsible for the 2,380 dams that are spread throughout the state. Alabama remains the only state without a dam safety regulatory program.

*Dams: **Investment & Funding***

The federal National Dam Safety program, which provides grants to states to improve programs through training, technical assistance, inspection, and research, expired in September 2011. This program, administered by the Federal Emergency Management Agency (FEMA), is dedicated to protecting the lives of American citizens and their property from the risks associated with the failure or mis-operation of America's dams. Additionally, a national dam rehabilitation and repair program, which would fund the repair, removal, or rehabilitation of the nation's publicly owned, nonfederal, high-hazard dams, still has not been established.

Funding needs are significant, and vary according to who owns and operates the dam. The Association of State Dam Safety Officials estimates that the total cost to rehabilitate the nation's non-federaland federal dams is over $57 billion. To rehabilitate just those dams categorized as most critical, or high-hazard, would cost the nation $21 billion, a cost that continues to rise as maintenance, repair, and rehabilitation are delayed. Overall, state dam safety program staffing has increased over the past several years. However, in 2011 state programs spent over $44 million on their regulatory programs, a decrease from recent years.

The U.S. Army Corps of Engineers estimates that more than $25 billion will be required to address dam deficiencies for Corps-owned dams. At current investment rates, these repairs would take over 50 years to complete. The Bureau of Reclamation has identified approximately 20 of its high and significant hazard dams where risk reduction actions are justified. The cost of those actions is estimated at $2 billion over the next 15 years.

The dam safety engineering practice is moving towards a risk-based decision-making process for the design, rehabilitation, and operation of dams. Risk-based decisions enable the dam owner to better utilize limited funding, and prioritize projects, by focusing on repairs and operational changes that reduce risk to acceptable levels, thus improving community resilience. Engineers, dam owners, regulators, and emergency management professionals should be engaging those communities affected by a dam failure, in order to provide a fair portrayal of risk. Through broader community collaboration, stakeholders will be better able to support land use decisions, emergency action planning, and maintenance and rehabilitation funding, which will reduce community risk in the long term.

Dams: Conclusion

As our nation's dams continue to age and the size of the population protected by dams continues to increase, more people downstream are at a potential risk. Many state dam safety programs are operating with limited resources and authority, thereby reducing critical inspections and regulatory actions necessary to maintain the safety of dams. Additionally, the number of dams needing repair continues to grow, while the funding required also increases over time. Some modest gains have been realized by increasing the number of emergency action plans for high-hazard dams and completing some dam safety repairs; however, a significant commitment from the federal, state, local, and private sector to America's dams is long overdue.

Raising the Grades: Solutions that Work Now

- **Reauthorize the National Dam Safety Program** by 2014 and fully fund the program for each year under the reauthorization.
- **Establish a national dam rehabilitation and repair funding program** to cost share repairs to publicly owned, nonfederal, high-hazard dams.
- **Develop emergency action plans** for every high-hazard dam by 2017.

- **Implement a national public awareness campaign** to educate individuals on the location and condition of dams in their area.
- **Encourage incentives to governors and state legislatures** to provide sufficient resources and regulatory authorities to their dam safety programs.
- **Require federal agencies that own, operate or regulate dams to meet the standards** of Federal Guidelines for Dam Safety.

At the dawn of the 21st century, much of our drinking water infrastructure is nearing the end of its useful life. There are an estimated 240,000 water main breaks per year in the United States. Assuming every pipe would need to be replaced, the cost over the coming decades could reach more than $1 trillion, according to the American Water Works Association (AWWA). The quality of drinking water in the United States remains universally high, however. Even though pipes and mains are frequently more than 100 years old and in need of replacement, outbreaks of disease attributable to drinking water are rare.

*Drinking Water: **Conditions & Capacity***

Nearly 170,000 public drinking water systems are located across the United States. Of these, 54,000 are community water systems that collectively serve more than 264 million people.

Although new pipes are being added to expand service areas, drinking-water systems degrade over time, with the useful life of component parts ranging from 15 to 95 years. Especially in the country's older cities, much of the drinking water infrastructure is old and in need of replacement. Failures in drinking water infrastructure can result in water disruptions, impediments to emergency response, and damage to other types of infrastructure. Broken water mains can damage roadways and structures and hinder fire-control efforts. Unscheduled repair work to address emergency pipe failures may cause additional disruptions to transportation and commerce.

It is estimated that more than one million miles of water mains are in place in the United States. The conditions of many of these pipes are unknown, as they are buried underground out of sight, and owned and operated by various local entities. Some pipes date back to the Civil War era and often are not examined until there is a problem or a water main break. These breaks are becoming more common, as there are an estimated 240,000 water main breaks per year in the United States.

Determining pipe condition through cost-effective structural assessment will allow worst-condition pipes to be addressed first, avoiding potential failures and associated risks, damages, and costs. These structural condition assessments will also help avoid premature replacement of structurally sound pipes to save resources and time. As a result of these benefits, demand for and value from these assessments is expected to increase significantly over the next 20 years.

The Environmental Protection Agency (EPA) estimates that approximately 4,000 to 5,000 miles of drinking water mains are replaced annually. The annual replacement rate is projected to peak around 2035 at 16,000 to 20,000 miles of aging pipe replaced each year. Meanwhile, pipes installed during the middle of the 20th century are likely to begin to fail in large numbers.

There are other pressures on the nation's drinking water systems that impact the cost of infrastructure. Financial impacts of meeting regulatory requirements are a continuing issue for many communities. In the case of drinking water systems, the most pressing rules are new, either recently issued or pending, as the result of standard setting by the EPA to implement the Safe Drinking Water Act Amendments of 1996. These rules impose new or stricter drinking water limits on numerous contaminants, including arsenic, radioactive contaminants, and microbials and disinfection byproducts, among others. Funding has remained the same, often requiring localities to put less toward routine maintenance.

Drinking Water: Investment & Funding

In 2012, the American Water Works Association (AWWA) concluded that the aggregate replacement value for more than one million miles of pipes was approximately $2.1 trillion if all pipes were to be replaced at once. Since not all pipes need to be replaced immediately, it is estimated that the most urgent investments could be spread over 25 years at a cost of approximately $1 trillion.

"The need will double from roughly $13 billion a year today to almost $30 billion (in 2010 dollars) annually by the 2040s, and the cost will be met primarily through higher water bills and local fees.

"Delaying the investment can result in degrading water service, increasing water service disruptions, and increasing expenditures for emergency repairs. Ultimately we will have to face the need to 'catch up' with past deferred investments, and the more we delay the harder the job will be when the day of reckoning comes."

By 2050, the aggregate investment needs would total more than $1.7 trillion, according to the AWWA.

By contrast, the Environmental Protection Agency (EPA) needs estimates are more conservative as they do not factor in population growth. Their results in 2007 found a 20-year capital investment need of almost $334.8 billion for approximately 53,000 community water systems and 21,400 not-for-profit noncommunity water systems (including schools and churches). Among the major necessary investments, the nation required $199 billion for transmission and distribution systems, $67 billion for treatment systems, and $39 billion for water storage.

The needs are greater than $1,000 per person in five regions: Far West, Great Lakes, Mid-Atlantic, Plains, and Southwest. Capital spending has not kept pace with needs for water infrastructure. The trend toward state and local governments' assuming the bulk of the investment requirements in the coming decades will continue, with local governments' paying an increasing share of the costs. In 2008, state and local governments estimated their total expenditures at $93 billion annually for wastewater and drinking water infrastructure. Congressional appropriations have declined over the five-year period 2008 to 2012, totaling only $6.9 billion—an average of $1.38 billion annually or $27.6 billion over 20 years, 8% of EPA's identified needs over 20 years.

*Drinking Water: **Conclusion***

America's drinking water systems are aging and must be upgraded or expanded to meet increasing federal and state environmental requirements that add to the funding crisis. Not meeting the investment needs of the next 20 years risks reversing the environmental, public health, and economic gains of the last three decades.

In all likelihood, businesses and households will be forced to adjust to unreliable water delivery by strengthening sustainable practices employed in production and daily water use. The solutions already being put forward and implemented in the United States and abroad include voluntary limitations or imposed regulations governing the demand for water, as well as technologies that recycle water for industrial and residential purposes (e.g., using recycled shower water for watering lawns). These types of policies have reduced the demand for water and therefore have lessened the impacts on existing infrastructure.

Raising the Grades: Solutions that Work Now

- **Raise awareness for the true cost of water.** Current water rates do not reflect the true cost of supplying clean, reliable drinking water. Replacing the nation's antiquated pipes will require significant local investment, including higher water rates.
- **Reinvigorate the State Revolving Loan Fund (SRF) program** under the Safe Drinking Water Act by reauthorizing minimum federal funding of $7.5 billion over five years
- **Eliminate the state cap on private activity bonds for water infrastructure** projects to bring an estimated $6 billion to $7 billion annually in new private financing to bear on the problem
- **Explore the potential for a Water Infrastructure Finance Innovations Authority** (WIFIA) that would access funds from the U.S. Treasury at Treasury rates and use those funds to support

loans and other credit mechanisms for water projects. The loans would be repaid to the Authority and then to the U.S. Treasury with interest

- **Establish a federal Water Infrastructure Trust Fund** to finance the national shortfall in funding of infrastructure systems under the Clean Water Act and the Safe Drinking Water Act

There has been undeniable success in the cleanup of the nation's hazardous waste and brownfields sites. However, annual funding for Superfund site cleanup is estimated to be as much as $500 million short of what is needed, and 1,280 sites remain on the National Priorities List with an unknown number of potential sites yet to be identified. More than 400,000 brownfields sites await cleanup and redevelopment . The Environmental Protection Agency (EPA) estimates that one in four Americans lives within three miles of a hazardous waste site.

*Hazardous Waste: **Conditions & Capacity***

During more than a century of industrial development in the United States, large volumes of hazardous waste were generated and disposed of, often in an environmentally unsound manner. Broadly defined, hazardous waste is waste that is dangerous or potentially harmful to our health or the environment. This includes discarded commercial products, such as cleaning fluids or pesticides, or the by-products of manufacturing processes. Recognizing that hazardous waste disposal without planning and management endangers the public health; Congress passed the Resource Conservation and Recovery Act (RCRA) in 1976 to manage hazardous waste from generation to disposal. States may implement stricter requirements than the federal regulations, and to date 42 states are authorized to manage their own programs. Total hazardous waste production in the United States in 2009 was slightly over 35 million tons.

To clean up hazardous waste produced and improperly disposed of prior to the enactment of RCRA, Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in 1980, creating the Superfund hazardous substance cleanup program administered by the Environmental Protection Agency (EPA). In the more than 30 years since enactment, scientists and

engineers have developed increasingly sophisticated approaches to identifying and remediating contaminated sites.

The National Priority List (NPL), maintained by the EPA, lists the known sites that release or threaten release of hazardous substances, pollutants, or contaminants throughout the United States and its territories. The NPL is intended primarily to guide the EPA in determining which sites warrant further investigation.

Since 1980, the EPA has investigated more than 47,000 sites suspected of releasing hazardous substances into the environment. Just over 1,600 sites have been placed on the NPL, and cleanup has been implemented at more than two-thirds of those sites.

The EPA is also charged with identifying the parties responsible for contamination of NPL sites and enforcing the cleanup of sites. If a party fails to comply with such an order, it may be fined up to $25,000 for each day that noncompliance continues. Organizations that EPA has deemed "potentially responsible parties" have funded cleanup of more than 70% of the sites on the NPL, at an estimated value of nearly $30 billion.

Where responsible parties cannot be found, the EPA is authorized to clean up a site itself, using a special trust fund. However, the fund is unable to finance the cleanup of even a small number of identified the sites on the NPL, and as a result, many sites go untreated. The EPA estimates that one in four Americans lives within three miles of a hazardous waste site.

Unfortunately, additional sites continue to be identified even as the number of current sites waiting for remediation increases due to insufficient funds. As of the end of 2010, there are 1,280 sites listed on the NPL, an additional 347 have been delisted, and 62 new sites have been proposed to be added to the NPL. There are likely more potential Superfund sites in the United States, but how many is unknown.

Brownfields are a type of hazardous waste site that includes abandoned factories and other industrial facilities, gasoline stations, oil storage facilities, dry cleaning stores, and other businesses that used polluting substances. It is estimated that there are as many as 425,000 brownfields throughout the United States. Some estimates show that there are 5 million acres of abandoned industrial sites in our nation's cities – roughly the same amount of land occupied by 60 of our largest cities.

In 2002, the Brownfields Revitalization and Environmental Restoration Act established the federal brownfields redevelopment assistance program, run by the EPA with assistance from the U.S. Army Corps of Engineers, which is designed to help local governments with the cleanup of these commercial sites. According to the U.S. Conference of Mayors, over the past 17 years, 84% of cities report that they have successfully redeveloped brownfield sites, returning land to productive use and creating an estimated 160,000 jobs between 2003 and 2010. This trend should continue, as the number of reported brownfields sites has risen substantially, from just under 12,000 in 1993 to nearly 30,000 in 2010.

Hazardous Waste: Investment & Funding

Even as needs have grown, annual congressional appropriations for Superfund have declined by 40% since its peak of $2 billion in 1998. The amount that private parties have spent is unknown as they are not required to report actual spending. However, estimates put that number at near $30 billion over the life of the program.

The Superfund program has in the past received funding from two sources: general funds from the U.S.Treasury and balances in the Superfund trust fund. Prior to 1996, revenues for the trust fund came from dedicated excise taxes and an environmental corporate income tax. Those taxes expired in December 1995, however, and the amount of unobligated money in the fund gradually declined to zero by the end of fiscal year 2003. Since 2003, the Superfund trust fund has been funded almost entirely through general revenues. A congressionally mandated study in 2001 estimated a "best case" funding shortfall of $500 million a year between 2000 and 2009, and while there has been no follow-up study, it is clear the shortfall has continued and will continue into the future. A 2004 EPA report estimated that it would take $209 billion over 30 to 35 years to clean up the nation's waste sites.

The brownfields grants program at EPA has been funded at a relatively steady rate for the past 10 years, with $166.6 million allocated in 2003 and $167.8 million allocated for 2012.

Hazardous Waste: Conclusion

The cleanup of the nation's hazardous waste sites has the potential to spur economic growth and community development and restore environmental vitality. However, the needed funding has not been provided. Well-funded Superfund and brownfield programs, with participation from local and state governments and private entities, are necessary to ensure that contaminated sites are identified and remediated.

Raising the Grades: Solutions that Work Now

- **Reauthorize the federal Superfund taxes on chemicals, petroleum, and corporations** or create another federal funding mechanism to revive the Hazardous Substance Superfund cleanup program and remove the cost of cleanup from the general fund.
- **Create economic incentive programs** that consider environmental costs and encourage hazardous waste reduction "at the source" (point of generation) and the design of reuse programs.
- **Reauthorize the Brownfields Revitalization and Environmental Restoration Act** that would assist localities redeveloping brownfields sites.
- **Continue to fund existing federal programs** to finance the revitalization of America's brownfields.
- **Create a Brownfields Redevelopment Action Grant (BRAG) program** within EPA to provide investment funds for local governments to leverage private investment in brownfields redevelopment in order to help preserve farmland and open spaces.

The nation's estimated 100,000 miles of levees can be found in all 50 states and the District of Columbia. Many of these levees were originally used to protect farmland, and now are increasingly protecting developed communities. The reliability of these levees is unknown in many cases, and the country has yet to establish a National Levee Safety Program. Public safety remains at risk from these aging structures, and the cost to repair or rehabilitate these levees is roughly estimated to be $100 billion by the National Committee on Levee Safety. However, the return on investment is clear – as levees helped in the prevention of more than $141 billion in flood damages in 2011.

Levees: ***Conditions & Capacity***

Levees play a critical role in reducing the risk to public safety from potentially devastating flood events throughout the United States. Levees are man-made structures designed and constructed along the water's edge to contain, control, or divert the flow of water in a flood event. In the mid to late 19th century, many of our nation's levees were originally designed and built to protect farmland. However, with continued development in our nation's floodplains, these levees are now protecting major urban and residential areas. Due to increased concerns regarding the resilience of our national levee systems, in 2007 Congress directed agencies to gather data on the condition of our nation's levees, thereby creating the National Levee Inventory. However, Congress has yet to pass legislation creating a National Levee Safety Program.

According to the Federal Emergency Management Agency (FEMA)'s Midterm Levee Inventory (MLI), levees are found in approximately 30% of the nation's 3,068 counties, with 43% of the nation's overall population living in a county with at least one levee. While the true extent of the nation's entire levee system is still unknown, it is estimated that as many as 100,000 miles or more of levees exist, with tens of millions of people living or working in these levee- protected areas. Currently, 35,682 miles of levees can be found in FEMA's levee inventory; however, the full condition of each of these levees is not yet determined. As nearly 85% of the nation's estimated levees are locally owned, operated, and maintained, it is difficult to collect information from such disparate local entities.

The National Levee Database (NLD), operated by the U.S. Army Corps of Engineers (USACE), is an inventory of most of the levees that the USACE has designed, maintained, and inspected, and is available to the public. The NLD inventory currently comprises approximately 14,700 miles of levees, or about 2,350 systems. The FEMA levee inventory will eventually be combined with this national inventory to provide a single comprehensive source for users to identify areas of concern and to access information about levees in their neighborhood. The goal is to obtain additional data from states and local authorities to include almost all levees in the country.

The levees in the NLD average more than 55 years old and protect approximately 14 million people who live or work behind the structures. In 2011, these levees helped in the prevention of more than $141 billion in flood damages, and they provide a 6:1 return on flood damages prevented compared to initial construction costs. Larger levee systems such as the Mississippi River and Tributaries system can provide as much as a 24:1 return ratio. Unfortunately, of the USACE monitored levees that have been rated, only 8% are found to be in acceptable condition, while about 69% are minimally acceptable, and 22% are labeled as unacceptable.

During the past 50 years there has been significant development on lands protected by levees. Combining tremendous development and rising sea levels with minimal federal, state, and local resources to repair and maintain these levees is placing people and infrastructure protected by levees at risk in a flood. The lack of formal federal, state, and local government oversight, sufficient technical standards, and effective communication of the risks of living behind a levee is placing people and property in danger of flooding.

Both the USACE and FEMA have invested in coordinated efforts to increase awareness and outreach to people living and working around levees. These agencies are now working collaboratively to share information and data, synchronize work efforts, and align program requirements while actively involving local, state, and other federal agencies. For example, FEMA and the USACE participate in a task force to address concerns related to levees and to better align National Flood Insurance Program (NFIP) levee accreditation requirements with levee inspections performed by USACE. FEMA and the USACE are also partnering to develop joint messaging and publications to explain their respective roles in addressing levees and to help communities better understand their own levee-related roles and responsibilities.

FEMA is currently working not only to map the nation's levees, but to increase awareness of potential hazards and mitigate those hazards. The program is designed to deliver quality data to increase public awareness, by building on already existing flood hazard data and maps that were produced during the Flood Map Modernization program. Ideally, those areas that are most in need of updated maps will be provided that information as efficiently and expeditiously as possible.

Levees: ***Investment & Funding***

Levees maintained and operated by the USACE receive federal funding through the USACE Civil Works budget. However, the majority of the nation's levees are not owned and operated by the federal

government, and therefore must rely on cash-strapped state and local governments for investment. Currently, rough estimates put the cost to repair and rehabilitate the nation's levees at more than $100 billion. Annual floods can increase these costs. For example, after severe flooding in the Midwest in 2011, the cost to repair damaged levees on the Mississippi and Missouri rivers is estimated to be more than $2 billion. On average, levee and flood control facility damages average $4.2 bill ion annually for Corps levees. If this amount was extrapolated to the estimated 100,000 miles of nonfederal levees in the nation, the annual expected damage would be approximately $15 billion per year. The USACE Civil Works budget, however, is on average just below $5 billion annually, with only approximately $415 million going toward flood control.

Finally, after the federal government invested billions over the past several years on the New Orleans area levee systems, which did perform well during Hurricane Isaac, a significant challenge still remains. The Corps, local parishes, and levee districts will need to continue to fund the operation and maintenance of this levee system if it is to continue to perform effectively. Like other infrastructure, the initial capital costs and investments will not provide their full benefit unless properly maintained.

*Levees: **Conclusion***

In the past four years, significant federal funding has gone to the levee system in New Orleans, while the State of California has invested significantly in the state's levees. While these are large and critical systems, they are just one piece of the nation's overall flood control system. As a nation we need to make significant investments in levees nationally.

Over the past four years we have learned more regarding the locations and conditions of the nation's levees; however, those conditions tend to be worse than originally expected. While federal funds will be important for establishing and maintaining a strong national levee program, it is also necessary for states, communities, and levee owners to raise funds to conduct the needed operation and maintenance. It will not be economically reasonable to upgrade all levee systems to provide the desired level of risk reduction. Therefore, alternative solutions, such as insurance, land use requirements behind levees, and effective warning and evacuations systems, must also be considered.

Raising the Grades: Solutions that Work Now

- **Establish a National Levee Safety Program** that authorizes an entity to oversee a program for nonfederal levees, requires safety inspections, and maps flood-prone areas
- **Complete the National Levee Inventory** for both federal and nonfederal levees
- **Adopt a levee hazard potential classification system**
- **Complete levee mapping as outlined in the National Flood Insurance Program reform bill** and implement FEMA's new levee mapping and analysis program
- **Increase funding at all levels of government** and leverage private funds to address structural and nonstructural solutions that reduce risk to people and property
- **Require insurance where appropriate**, and create emergency action plans for levee-protected areas

- **Ensure that operation and maintenance plans** cover all aspects of a complex levee system
- **Assess levees using updated hydrology and hydraulic analyses** that incorporate the impact of urbanization and climate change, particularly for coastal levees

In 2010, Americans generated 250 million tons of trash. Of that, 85 million tons were recycled or composted. This represents a 34% recycling rate, more than double the 14.5% in 1980. Per capita generation rates of waste have been steady over the past 20 years and have even begun to show signs of decline in the past several years.

Solid Waste: Conditions & Capacity

In 2010, the United States produced 250 million tons of municipal solid waste (MSW) of all types—an increase from the 243 million tons produced in 2009, but down from the 255 million tons produced in 2007. These numbers can be compared to the 88 million tons produced in 1960 and the 151 million tons produced in 1980. This increase can be attributed in part to increased population. Organic materials continue to be the largest component of solid waste. Paper and paperboard account for 29% and yard trimmings and food scraps account for another 27%. Other materials include plastics, which make up 12%; metals at 9%; rubber, leather, and textiles at 8%; wood at 6%; glass at 5%; and other miscellaneous waste make up 3%.

The Environmental Protection Agency (EPA) reports that the number of landfills has steadily declined over the years; however, the average size of each landfill has increased. At the national level, landfill capacity is sufficient, although there are some local areas where capacity is an issue. Federal and state regulations require that solid waste landfills include features that protect the environment from contaminants which may be present in the solid waste stream, including siting plans to avoid environmentally sensitive areas, as well as on-site environmental monitoring systems which sense any sign of groundwater contamination or landfill gas. In addition, landfills must collect potentially harmful landfill gas emissions.

Diesel-fueled waste collection vehicles have traditionally been the backbone of the waste collection industry. The recent relatively low price of natural gas compared to the price of diesel fuel has increased the interest of the industry in natural gas as an alternative fuel. Waste collection and transfer vehicles currently account for 11% of the total of U.S. natural gas vehicles.

In the last several decades, the recycling and composting of MSW has changed dramatically. While the per-person generation of solid waste increased from 3.66 to 4.43 pounds per day between 1980 and 2010, the recycling rate has also increased from less than 10% of MSW generated in 1980 to about 34% in 2010. The percentage of MSW disposed in landfills has therefore decreased, from 89% in 1980 to about 54% in 2010. Since 1990, the total amount of MSW going to landfills has dropped from 145 million to 135 million tons in 2010. The net per capita discard rate (after recycling, composting, and combustion for energy recovery) was 2.4 pounds per person per day, lower than the 2.5 pounds per day in 1960.

Recycling and composting diverted 85 million tons (approximately 34%) from being disposed of in landfills in 2010, up from just 15 tons recycled in 1980. This recycling and composting also avoided the release of approximately 186 million metric tons of carbon dioxide equivalent into the air in 2010, roughly equal to removing 36 million cars from the nation's roads for one year. Recycling recovered about 65 million tons of waste in 2010, including 72% (7 million tons) of newspaper and 35% of metals (8 million tons). Additionally, composting diverted over 20 million tons of wastes, including 58% of yard trimmings.

One area of concern continues to be the growing amount of used electronics being disposed of. In addition to the loss of valuable resources contained in electronics such as copper, gold, aluminum, electronics have the potential to leak toxic substances with known adverse health effects. The EPA estimates that 438 million electronic products were sold in 2009, which represents a doubling of sales from 1997, driven by a ninefold increase in mobile device sales. That same year, the EPA found that only about 25% of electronics were collected for recycling, with computers collected at the highest rate (38%).

Food waste makes up 13.9% of MSW generated; however, only about 2.8% is recovered or recycled, with the rest being disposed of in landfills. Because food waste degrades rapidly, collection of gas produced by food waste is not economically feasible. Separate collection of residential food waste makes it cost-prohibitive and was the primary deterrent to expanding food waste recovery efforts. Yet in many communities, edible food residuals are donated to the needy, while inedible food residuals are blended into compost or reprocessed into animal feed. In some areas, composting operations are working with high-volume commercial and institutional food producers to recover their food byproducts, saving these firms significant disposal costs. On average, Americans throw away 25-30% of their food purchases.

Combustion with energy recovery diverted an additional 29 million tons (11.7%) of solid waste, but these results could improve. Energy recovery from waste is the conversion of nonrecyclable waste materials into useable heat, electricity, or fuel through a variety of processes, including combustion,

gasification, pyrolization, anaerobic digestion, and landfill gas (LFG) recovery. Energy recovery, or "waste-to-energy" as it is often called, produced approximately 2,720 megawatts of electricity in 2010, about 0.2% of total power generated and consumed in the United States that year. Advances in technology for recovering energy from waste hold promise as an alternative to land disposal and current waste-to-energy practices. Recovery of methane from decaying waste in more than 550 MSW landfills also provides a renewable fuel for electricity generation while reducing greenhouse gas emissions. According to the EPA, the benefits are the equivalent of cutting oil consumption by 58 million barrels a year and not burning 373,000 railcars of coal a year.

The fragmented and local-based nature of the waste disposal industry makes pinpointing its size difficult. A 2001 snapshot of the U.S. waste disposal enterprise showed that an estimated 27,000 organizations, private sector companies, and public or quasi-government organizations were providing solid waste collection and/or disposal in the United States. More than 55% of these were in the public sector, while the remaining, approximately 45%, were privately held.

Solid Waste: Investment & Funding

In the United States, city and county governments are responsible for solid waste disposal and recycling. Each individual municipality can choose whether to provide these services itself or can contract these services out to private companies. Solid waste collection is paid for either through local taxes or direct fees charged for the service.

The U.S. solid waste industry grew just 2% in 2011 to $55 billion in 2011. The industry accounts for approximately one-half of 1% of the gross domestic product (GDP) of the United States, producing $96 billion and 948,000 jobs for the U.S. economy.

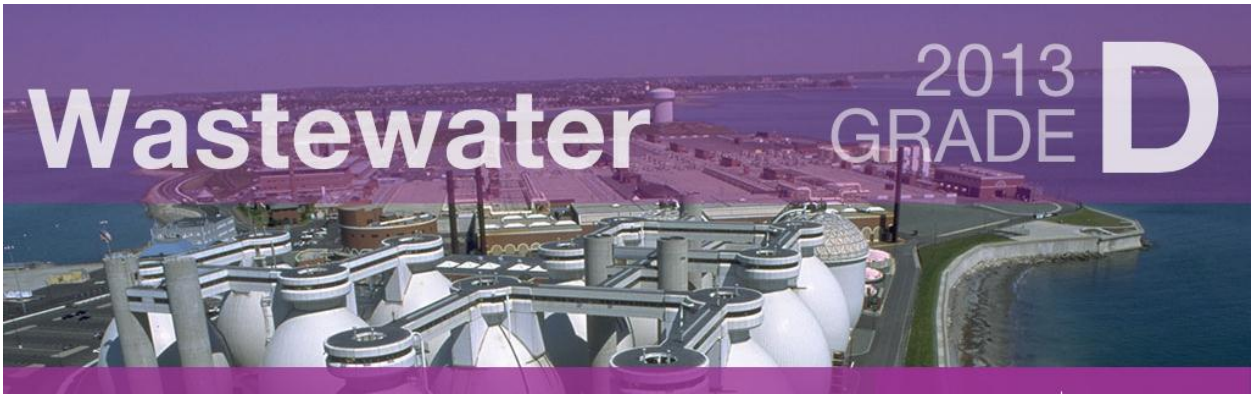
Solid Waste: Conclusion

Innovative technologies and recycling efforts have proven successful in improving the safety, sustainability, and efficiency of the nation's waste disposal system. However, the continued under-use of waste-to-energy practices highlights the need for research and development of new policies and management practices.

Raising the Grades: Solutions that Work Now

- **Implement a comprehensive approach to waste management** that reduces the volume of waste landfilled, increases the amount of materials recovered and recycled, and reduces the emissions of greenhouse gases from landfills
- **Support the Environmental Protection Agency (EPA)'s Resource Conservation Challenge** (RCC) strategic plan, with goals of achieving the national recycling rate of 40% for municipal solid waste (MSW), beneficial use of secondary materials, priority and toxic chemical reduction, and reuse and recycling for electronics

- **Encourage greater use of landfill gas to energy conversion** to reduce greenhouse gas emissions and create new energy resources
- **Allow the interstate movement of municipal solid waste** to new regional landfills that meet all federal requirements
- **Implement source reduction policies** that call for better design, packaging, and life span of commercial products
- **Develop national standards** to promote proper, effective, and efficient collection and recycling of waste electronics
- **Decrease the environmental impact of waste collected** through use of renewable energy sources and optimize operation of waste collection vehicles



Capital investment needs for the nation's wastewater and stormwater systems are estimated to total $298 billion over the next twenty years. Pipes represent the largest capital need, comprising three quarters of total needs. Fixing and expanding the pipes will address sanitary sewer overflows, combined sewer overflows, and other pipe-related issues. In recent years, capital needs for the treatment plants comprise about 15%-20% of total needs, but will likely increase due to new regulatory requirements. Stormwater needs, while growing, are still small compared with sanitary pipes and treatment plants. Since 2007, the federal government has required cities to invest more than $15 billion in new pipes, plants, and equipment to eliminate combined sewer overflows.

Wastewater: Conditions & Capacity

There are between 700,000 and 800,000 miles of public sewer mains in the United States. Many of these pipes were installed after World War II, meaning they are now approaching the end of their useful life. Capital investments in those pipes account for between 80% and 85% of all wastewater system investment requirements in the United States.

The United States has approximately 14,780 wastewater treatment facilities and 19,739 wastewater pipe systems as of 2008. In 2002, 98% of publicly owned treatment systems were municipally owned. Although access to centralized treatment systems is widespread, the condition of many of these

systems is also poor, with aging pipes and inadequate capacity leading to the discharge of an estimated 900 billion gallons of untreated sewage each year.

The problems associated with aging wastewater treatment systems are daunting. To cite one example, Indianapolis' antiquated sewage system dumps close to 7.8 billion gallons of sewage and storm water into creeks and rivers each year. The city now is carrying out a $3.1 billion sewage infrastructure project designed to trap and purify most of the sewage before it washes into the city's streams.

At the start of the 21st century, many of those neglected systems are in need of maintenance and repairs. Most assessment reports by government agencies and interest groups agree that the bill amounts to hundreds of billions of dollars over the next two decades. In 2009, the Environmental Protection Agency (EPA) reported to Congress that the states had assessed 16% of America's stream miles and found that 36% of those miles were unfit for use by fish and wildlife, 28% were unfit for human recreation, 18% were unfit for use as a public water supply, and 10% were unfit for agricultural use.

One symptom of the problem of aging pipes is represented by CSOs, which affect more than 700 American cities and towns and represent a major challenge to the implementation of the Clean Water Act, which regulates sewage treatment. During periods of significant rainfall, the capacity of a combined sewer may be exceeded. When this occurs, excess flow, a mixture of storm-water and sanitary wastewater, is discharged at CSO points, typically to rivers and streams. Release of this excess flow is necessary to prevent flooding in homes, basements, businesses, and streets.

EPA and the U.S. Justice Department have made eliminating CSOs a national priority. Since 2007, the agencies have signed consent decrees under the Clean Water Act requiring cities operating publicly owned treatment works (POTWs) to invest more than $15 billion in new pipes, plant, and equipment to eliminate CSOs. Some cities, however, are employing nonstructural solutions to address the problem of CSOs at lower overall cost and with good results for the environment.

Wastewater: Investment & Funding

Wastewater infrastructure in the United States is aging, and investment is not able to keep up with the need. State and local governments incur approximately 98 percent of the capital investments annually to maintain and improve the infrastructure. In 2008, state and local governments estimated their total expenditures at $93 billion annually for wastewater and drinking water infrastructure.

The Congressional Budget Office, EPA, and other groups have estimated that it could take more than $300 billion to address the nation's sewage collection and treatment infrastructure needs over 20 years to keep our surface waters safe and clean. This is twice the current level of investment by all levels of our government. Congressional appropriations have declined over the five-year period 2008 to 2012, totaling only $10.5 billion—an average of $2.1 billion annually or $42 billion over 20 years.

Capital needs for wastewater and stormwater are largely to address pipes, treatment systems themselves, and federal stormwater requirements. By far, pipes represent the largest capital need, comprising three quarters of total needs in recent years. Fixing and expanding the pipes will address sanitary sewer overflows, combined sewer overflows, and other pipe-related issues. Capital needs for the treatment plants themselves comprise only about 15%-20% of total needs in recent years. Storm-water needs, while growing, are still small compared with sanitary pipes and treatment plants.

In 2008, EPA reported that the U.S. 20-year investment needs for aging wastewater treatment totaled just over $298 billion, or almost $15 billion annually. The total represented a 17% increase over the 2004Clean Watershed Needs Survey (CWNS) results. Meanwhile, annual appropriations for the Clean Water State Revolving Fund (CWSRF) totaled $9 billion over the five years from 2008 to 2012, an average of slightly more than $1.8 billion annually, well short of the annual need. Congressional appropriations totaled approximately $10.5 billion between 2008 and 2012—about $2.1 billion annually or $42 billion over 20 years, 14% of the 20-year needs.

Of the total needs, over $202 billion in the CWNS was the nationwide capital investment needed to control wastewater pollution for up to a 20-year period. The 2008 report included estimates of $134 billion for wastewater treatment and collection systems, $55 billion for combined sewer overflow corrections, and $9 billion for storm-water management.

Wastewater: Conclusion

Wastewater systems will incur growing costs over the next 20 years as they expand capacity to serve current and future growth. Other costs will result from stricter permitting standards, nutrient removal requirements, technology updates, and new process methods, among others. Beyond budget and financing options, the nation needs to consider multiple solutions to the wastewater infrastructure quandary.

Raising the Grades: Solutions that Work Now

- **Raise awareness for the true cost of water.** Water is vital for our everyday life, but we pay much less for it than cable, or any other utility. Current water rates do not reflect the true cost of supplying clean, reliable drinking water. Replacing the nation's antiquated pipes will require additional local investment, including higher water rates.
- **Reinvigorate the State Revolving Loan Fund (SRF) under the Clean Water Act** by reauthorizing minimum federal funding of $20 billion over five years.
- **Eliminate the state cap on private activity bonds for water infrastructure** projects to bring an estimated $6 billion to $7 billion annually in new private financing to bear on the problem.
- **Explore the potential for a Water Infrastructure Finance Innovations Authority (WIFIA)** that would access funds from the U.S. Treasury at Treasury rates and use those funds to support loans and other credit mechanisms for water projects. The loans would be repaid to the Authority and then to the U.S. Treasury with interest.

- **Establish a federal Water Infrastructure Trust Fund** to finance the national shortfall in funding of infrastructure systems under the Clean Water Act and the Safe Drinking Water Act.
- **Separate Potable and Nonpotable Water.** A large portion of public supply water is used for watering lawns, flushing toilets, and washing clothes. These uses do not require potable water, but in most localities, all publicly supplied water is treated to meet federal drinking-water standards. It is becoming cost-effective for municipalities to construct separate lines for potable and nonpotable uses as water becomes scarcer and treatment more costly.

Despite the effects of the recent recession, commercial enplanements were about 33 million higher in number in 2011 than in 2000, stretching the system's ability to meet the needs of the nation's economy. The Federal Aviation Administration (FAA) estimates that the national cost of airport congestion and delays was almost $22 billion in 2012. If current federal funding levels are maintained, the FAA anticipates that the cost of congestion and delays to the economy will rise from $34 billion in 2020 to $63 billion by 2040.

Aviation: Conditions & Capacity

The U.S. aviation industry is made up primarily of airports, the air traffic control system, and aircraft (commercial and private). The United States has 3,330 existing public use airports and 25 proposed airports, which make up the National Plan of Integrated Airport Systems (NPIAS). NPIAS airports are those which the FAA considers significant to national air transportation and are eligible to receive Airport Improvement Program (AIP) grants. Of these airports, 499 accommodate scheduled air carrier service including:

- 29 large hub airports;
- 36 medium hub airports;
- 74 small hub airports;
- 239 nonhub primary airports; and

- 121 nonprimary commercial service airports.

The NPIAS system also includes 2,563 general aviation airports and 268 reliever airports. Airports not included in the NPIAS system include facilities closed to the public or those that do not meet the NPIAS criteria. The total U.S. aviation system includes approximately 617,128 pilots, 222,520 general aviation aircraft, 7,185 air carriers, and a total 19,734 landing areas. Among airports the 29 major hubs play a dominant role in the economy, and the top 15 metropolitan areas with their 35 airports account for 80% of U.S. passenger origins and destination movements, totaling 343 million trips. Similar to passenger travel, freight air shipments are also concentrated in major metro areas, with 70% of domestic air tonnage originating in key metro markets.

The U.S. airport system accommodates more than $562 billion in cargo annually in addition to 728 million passenger enplanements. By 2040, the U.S. airport system will carry more than one billion passengers and that air freight tonnage could grow by nearly 200%. A growth in demand could have major ramifications for the U.S. economy. In 2011, the FAA reported that the total output of aviation-related goods and services amounted to $1.3 trillion in 2009, and generated more than 10 million jobs.

Since 2003, the FAA has been planning and developing the Next Generation Air Transportation System (NextGen), which would replace the nation's 1960s radar technology with a satellite-based air traffic control system. The NextGen system is intended to improve the efficiency and safety of air traffic flow into and out of airports. By improving the flow of air traffic, NextGen is expected to increase capacity of the air transportation system so that future growth can be accommodated while maintaining safety. FAA's capital investment in NextGen is anticipated to be over $11 billion by 2018, and full implementation of NextGen is projected to cost at least $32 billion by 2025. However, this does not include the research, airport and associated airfield improvements, or the aircraft equipment needed to realize all the benefits of NextGen.

Despite tough economic times, the aviation industry has proved to be fairly stable for passenger travel. Passenger enplanements for U.S. airlines at home and abroad increased slightly by 3.5% in 2011. This continues the post-September 11, 2001 trend, from a low of 612 million passengers in 2002, to 728 million passengers in 2011. In addition to the airline passenger industry, air cargo is important to the U.S. economy, as 30% of exports and 20% of imports measured by value in 2008 were shipped by air. The FAA forecasts an annual average rate of growth of 5.1% through 2030.

The FAA continues to have as its performance goal that 93% of runways in NPIAS airports are maintained in excellent, good, or fair condition. Data for 2011 indicate that 97.5% of runways at NPIAS airports meet that goal, with pavement at commercial airports being better, with 98% meeting the goal. Capacity of runways is also limited by their length as shorter runways cannot accommodate larger airplanes.

In 2011, U.S. air carriers reporting performance reported an overall on time rate of 79.6%. For 2011, 18% of flights were delayed and almost 2% of flights were cancelled.

General aviation is an important part of the aviation community, with more than 222,520 aircraft, including business jets, leisure, law enforcement, medical transportation, agricultural services, and others. The FAA notes that between 2000 and 2009, general aviation flight hours dropped nearly 25%, with fuel costs and aviation security changes as the primary reasons. General aviation's total economic impact was estimated to be $76.5 billion in 2009, down sharply from the $97.2 billion in 2008.

The cost of airport congestion and delays to the national economy was $21.9 billion (adjusted to 2010 dollars) in 2007. If current funding levels are maintained, the FAA further estimates that the cost will rise from $24 billion in 2012 to $34 billion in 2020 and can be expected to reach $63 billion by 2040.

Aviation: Investment & Funding

The primary source of the FAA's capital programs and general operations is the Airport and Airway Trust Fund (Trust Fund). The Trust Fund receives its revenue from excise taxes paid by users of the national aviation systems, including airline passengers, and also taxes charged on ticket purchases and aviation fuel, as well as the shipment of cargo. The Trust Fund provided 68.8% of the FAA budget in 2011, with the rest coming from general treasury appropriations. The Trust Fund's purpose was to establish sources of funding that would increase concurrently with the use of the system, and assure timely and long-term commitments to capacity increases.

Generally, four sources of funding are used to finance airport development – airport cash flow, revenue and general obligation bonds, federal, state, and local grants (including the Trust Fund-financed Airport Improvement Program), and Passenger Facilities Charges (PFCs). Since fiscal year (FY) 2001, AIP grants have exceeded $3 billion annually, and for the last seven years, PFC collections have exceeded $2 billion annually. Combined, AIP grants and PFC collections account for 40% of annual U.S. airport capital spending. In 2008, commercial service airports reported spending $10.9 billion in development projects.

When Congress reauthorized the FAA in 2012, the AIP was authorized at $13.4 billion over four years or approximately $3.35 billion annually. This represents a slight cut to the AIP, which in the last few fiscal years received $3.5 billion annually. The nation's airports, including both commercial and general aviation airports, have an estimated $80.1 billion in total projects between 2011 and 2015 that are considered essential by the airport and airport users. With current funding trends, the total gap between anticipated funding and the capital needs projected by airports is about $2.2 billion a year between 2012 and 2020. If the funding needs of NextGen are added, that increases to about $4.3 billion from 2012 to 2020, during the largest implementation phase.

Aviation: Conclusion

The NextGen program, if fully and successfully implemented, promises to enhance air safety, create new efficiencies, and increase capacity. This would in turn save the airlines billions of dollars and alleviate the inconvenience now facing air travelers and goods on which this country is dependent.

Meanwhile, an aviation system that was once the envy of the world is beginning to be overtaken by countries with ambitious investment programs for development of dozens of airports, and U.S. airports are no longer ranked among the world's best by air travelers. General aviation airports in the NPIAS program continue to be at risk, as funding for improvements and upkeep remains limited.

Raising the Grades: Solutions that Work Now

- **Accelerate efforts to modernize the nation's air traffic control system** by implementing the NextGen to meet the 2021 deadline.
- **Select a dedicated funding source for implementation of NextGen**, such as the existing Aviation Fuel Tax. Avoid any new fees that would compromise the use of the system or public safety.
- **Increase or eliminate the cap on the Passenger Facilities Charges** (PFCs) to allow airports the flexibility to invest in their own facilities.
- **Manage the Airport and Airway Trust Fund** so as to maximize investment in the nation's aviation infrastructure and preclude its being used to pay for passenger screening or related security costs.
- **Preserve the current budget firewalls** to allow for full use of Airport and Airway Trust Fund revenues for investment in the nation's aviation transportation system. Congress should be proactive and reauthorize FAA programs prior to the September 2015 deadline.
- **Encourage airports to use innovative technology and processes** when expanding and enhancing their infrastructure.

Over two hundred million trips are taken daily across deficient bridges in the nation's 102 largest metropolitan regions. In total, one in nine of the nation's bridges are rated as structurally deficient, while the average age of the nation's 607,380 bridges is currently 42 years. The Federal Highway Administration (FHWA) estimates that to eliminate the nation's bridge deficient backlog by 2028, we would need to invest $20.5 billion annually, while only $12.8 billion is being spent currently. The

challenge for federal, state, and local governments is to increase bridge investments by $8 billion annually to address the identified $76 billion in needs for deficient bridges across the United States.

Bridges: Conditions & Capacity

The health of our nation's bridges is directly tied to the nation's ability to compete in a global marketplace. Therefore, it is of growing concern that the bridges in our nation's metropolitan areas, which are an indispensable link for both millions of commuters and freight on a daily basis, are decaying more rapidly than our rural bridges. Approximately 210 million trips are taken daily across deficient bridges in the nation's 102 largest metropolitan regions.

The percentage of bridges that are either functionally obsolete or structurally deficient has been declining slowly over the last decade as states and cities have increased efforts to prioritize repairs and replacements. In 2012, one in nine, or just below 11%, of the nation's bridges were classified as structurally deficient. The number of bridges defined as functionally obsolete has also declined, with currently 24.9% of the nation's bridges defined in either deficiency category. However, while billions have been spent annually on bridge construction, rehabilitation, and repair in the last twenty years, current funding levels are not enough to repair or replace the nation's large-scale, urban bridges, which carry a high percentage of the nation's traffic. To illustrate, the nation's 66,749 structurally deficient bridges make up one-third of the total bridge decking area in the country, showing that those bridges that remain classified as structurally deficient are significant in size and length, while the bridges that are being repaired are smaller in scale.

At the state level, 22 states have a higher percentage of structurally deficient bridges than the national average, while five states have more than 20% of their bridges defined as structurally deficient. Pennsylvania tops the list with 24.4%, while Iowa and Oklahoma are not far behind, each having just over 21% of their bridges classified as structurally deficient. When looking at the highest percentage of deficient bridges (combined structurally deficient and functionally obsolete bridge categories), the nation's capital tops all 50 states, with 77%, or 185 of 239, of bridges in the District of Columbia falling into at least one of these categories.

While it is important to look at the decrease in the overall number of bridges that are classified as either structurally deficient or functionally obsolete, there are other critical aspects to assess when grading the nation's bridges. Looking beyond deficiency classifications, the total percentage of postings on the nation's bridges has declined gradually over the past five years. While the number of bridges closed to traffic has climbed from 2,816 in 2007 to 3,585 in 2012, the number of bridges posted for load restrictions has decreased from 67,969 to 60,971 in that same period. Posted bridges are not necessarily a public safety risk, but they can create congestion and force emergency vehicles and trucks to take lengthy detours when the bridge is closed, making it harder, and more costly, for goods to get to market.

Finally, the average age of the nation's bridges has also slightly declined, as bridges have been constructed or replaced, from 43 years in 2009 to 42 years currently. Regardless, the FHWA calculates

that more than 30% of existing bridges have exceeded their 50-year design life, meaning that maintenance, repair, and rehabilitation programs will still require significant investment in the upcoming years. Unfortunately, preserving aging bridges while replacing deficient bridges is a significant challenge for cash-strapped state and local governments to manage.

Bridges: Investment & Funding

Federal, state, and local bridge investments are not keeping pace with the growing costs of aging bridges. The FHWA estimates that the current cost to repair or replace only the deficient bridges eligible under the Federal Highway Bridge Program is almost $76 billion. This total is up from 2009, when FHWA estimated that the total cost was $71 billion. If bridge maintenance continues to be deferred over the next 25 years, these backlog costs will rise. To put these numbers in perspective, over the last 30 years Congress has provided approximately $77 billion to the states through the federal-aid bridge program.8 New York, with more than $9 billion in needs, followed by Pennsylvania with $7 billion in needs, and then California with $6 billion in needs, are currently the states facing the largest cost to repair and replace their aging bridge infrastructure. Nevada has the lowest price tag to repair or replace its deficient bridges at $69 million.

The investment backlog for the nation's bridges is estimated to be $121 billion, according to FHWA. This figure represents all cost-beneficial bridge needs, not just the replacement or rehabilitation of eligible deficient bridges. The $121 billion estimate includes $102 billion in investment needs for federal-aid highway bridges. Of that $102 billion in federal highway needs, $60 billion is for the National Highway System bridges, which in turn includes $38 billion for Interstate System bridges. The Federal Highway Administration estimates that to eliminate the bridge backlog by 2028, the nation would need to invest $20.5 billion annually; however, at this time only $12.8 billion is being spent annually on the nation's bridges.

Finally, recently passed surface transportation legislation from Congress, Moving Ahead for Progress in the 21st Century (MAP-21), eliminated the Highway Bridge Program, instead rolling it into the National Highway Performance Program (NHPP). However, the off-system bridges are not included in the NHPP, but have been placed in the Surface Transportation Program. With the nation's bridges divided between two programs without guaranteed set-asides for repair, bridges may need to compete with other transportation programs for funding, which could have a negative impact on conditions.

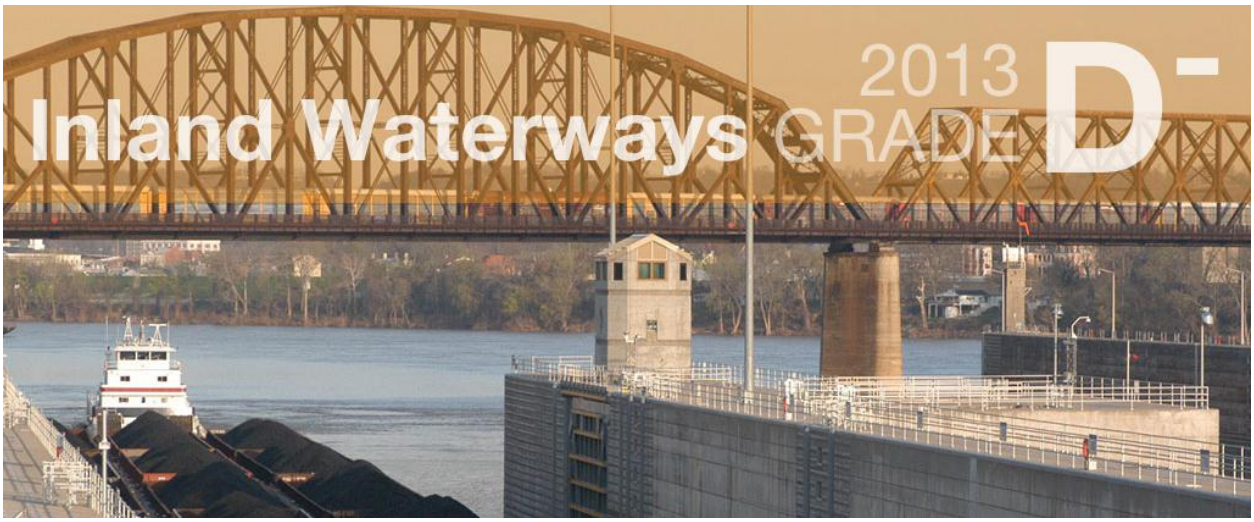
Bridges: Conclusion

While the overall number of deficient bridges continues to decline, there is still a long road ahead. With the total number of structurally deficient or functionally obsolete bridges at more than 20%, the nation needs to remain focused on aging bridges and work diligently to decrease the total number to below 15% over the next decade.

Most importantly, states will have to focus on repairing or replacing those large-scale bridges in urban areas where their upkeep has been consistently deferred due to the significant cost to repair these structures.

Raising the Grades: Solutions that Work Now

- **Make the repair of structurally deficient urban bridges a top national priority** through the implementation of a risk-based prioritization model.
- **Increase annual investment levels for bridge repair, reconstruction, and renovation** by approximately $8 billion annually from all levels of government, to a total annual funding level of $20.5 billion.
- **Develop a national strategic plan for addressing the nation's structurally deficient and functionally obsolete bridges** in the upcoming decades, including long-term transportation research in order to develop more resilient bridges.
- **Set a national goal to decrease the number of just structurally deficient bridges to 8% by 2020** and decrease the percentage of the population driving over all deficient bridges by 75% by 2020.



Our nation's inland waterways and rivers are the hidden backbone of our freight network – they carry the equivalent of about 51 million truck trips each year . In many cases, the inland waterways system has not been updated since the 1950s, and more than half of the locks are over 50 years old . Barges are stopped for hours each day with unscheduled delays, preventing goods from getting to market and driving up costs. There is an average of 52 service interruptions a day throughout the system. Projects to repair and replace aging locks and dredge channels take decades to approve and complete, exacerbating the problem further.

Inland Waterways: Conditions & Capacity

Our nation's inland waterways and rivers are the hidden backbone of our freight network – they carry the equivalent of about 51 million truck trips each year. For that reason, they are often called "inland marine highways." These marine highways provide a crucial way to carry large amounts of cargo that would otherwise travel by truck or by rail, easing congestion on the surface transportation system.

The inland waterways system includes 12,000 miles of commercially navigable channels, with over 200 lock chambers. Major water channels, from the Mississippi to the Columbia-Snake river systems (the latter in the Pacific Northwest), carry barges that are the preferred method for moving bulk cargo such as grain and steel, as well as hazardous materials. More than 566 million tons of freight move through the inland waterway system annually, valued at more than $152 billion. Actual traffic on inland waterways has remained stable in recent years, although the Department of Transportation has projected that it will increase over the next 25 years.

An intricate system of waterways ties inland ports to ocean ports. For example, the Mississippi River connects to ports on the Gulf of Mexico, the Columbia and Snake rivers connect to Pacific Northwest ports, and interconnecting rivers form a marine highway network in the heart of the nation, from the Gulf Ports to the Great Lakes. It is estimated that 346 million tons of goods were transferred from inland waterways to deep water ports in 2010, primarily for export.

For customers that ship goods through the inland waterway system, the price of services has increased since 2005 as the system ages and causes delays. The greatest threats to the performance of the nation's inland waterway system are delays caused by insufficient funds for proper operation and maintenance of the facilities. Many of the locks are too small for modern barges, and are susceptible to closures. When a lock or dam reaches poor condition, barges have to stop more often to allow for scheduled maintenance. These scheduled lock outages to address maintenance issues are increasing. Unscheduled delay is most often the result of high volumes at transit points, as well as occasional failures in equipment, resulting in increased operating costs. Unscheduled delays are especially costly because vessel operators are unable to anticipate and offset the costs of these incidents.

Ninety percent of locks and dams on the U.S. inland waterway system experienced some type of unscheduled delay or service interruption in 2009, averaging 52 delays a day. The hours lost due to unscheduled delays has increased significantly since the 1990s, which costs industry and consumers hundreds of millions of dollars annually. For 2011, the total number of hours of delay experienced by barges throughout the entire inland waterway system reached the equivalent of 25 years. The greatest total delay in 2011 at a particular lock was at the Markland Lock on the Ohio River with 52,032 hours. The Ohio and Upper Mississippi systems have a disproportionate share of delays compared to other rivers across the country.

Inland Waterways: Investment & Funding

Construction and rehabilitation costs for the inland waterways, including the locks, are currently shared between the federal government and users through the Inland Waterway Trust Fund. Operations and maintenance costs for inland waterways are currently covered in full by the federal government.

The Inland Waterways Trust Fund has been depleted in recent years, with current tax revenues coming in at about $85 million per year. It is currently supported by a $0.20 per gallon tax on barge fuel, and expenditures cannot exceed revenues in a given year. Future financing is uncertain. It is estimated that the total capital investment needs over the next 20 years is about $18 billion, or an annual average of nearly $900 million. The need for additional funding is clear enough that many barge operators have supported increasing the fuel tax by $0.06–$0.08 per gallon to pay for required improvements.

According to the U.S. Army Corps of Engineers, maintaining existing levels of unscheduled delays on inland waterways, and not further exacerbating delays, will require more than $13 billion by 2020, while current funding levels are expected to be just $7 billion during this period. Roughly 27% of these needs entail the construction of new lock and dam facilities, and 73% are estimated for the rehabilitation of current facilities.

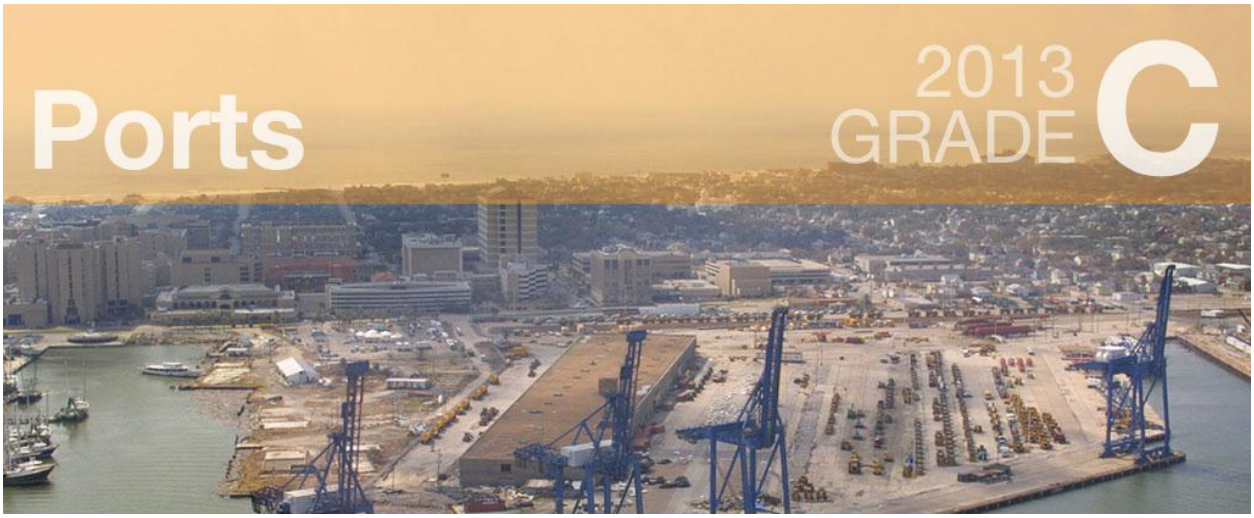
In addition, the time it takes to complete these projects drives up the cost and creates an enormous backlog, particularly since funding for the U.S. Army Corps of Engineers remains stagnant. If tax revenues, and therefore funding levels, continue at current rates, the 22 planned major construction and rehabilitation projects will not be complete until the year 2090, according to the best-case scenario schedule developed by the Corps. In recent years, there has been a trend toward cost overruns and project delays, which is a significant reason for the decline in the Inland Waterways Trust Fund. The Corps itself acknowledges that the current project delivery model is no longer appropriate, and that a national strategy is necessary.

Inland Waterways: Conclusion

Inland waterways carry much of our nation's bulk cargo, but the system that stretches across the country is suffering from age and rapidly growing reliability issues. Barges are stopped for hours each day with unscheduled delays, preventing goods from getting to market and driving up costs. The length of time it takes to complete a single project is a growing issue. Without action, the costs of congestion and the inability to handle cargo loads efficiently and safely will continue to increase and have negative consequences on the nation's economic growth.

Raising the Grades: Solutions that Work Now

- **Establish a national freight strategy and policy** that incorporate all modes of transportation, including waterways and ports, draw on successful state-level strategies, and include other key stakeholders such as shippers, retailers, and manufacturers
- **Increase overall spending on inland waterways** and secure additional financing for projects, either by increasing the barge fuel tax or implementing a user fee for the inland waterway system
- **Prioritize capital projects** according to risk and reliability, as well as economic return



The U.S. Army Corps of Engineers estimates that more than 95% (by volume) of overseas trade produced or consumed by the United States moves through our ports. To sustain and serve a growing economy and compete internationally, our nation's ports need to be maintained, modernized, and expanded. While port authorities and their private sector partners have planned over $46 billion in capital improvements from now until 2016, federal funding has declined for navigable waterways and landside freight connections needed to move goods to and from the ports.

Ports: Conditions & Capacity

Our ports serve as a critical entry point for a majority of imports, and allow U.S. businesses to access global markets and to compete in a global economy.

- Approximately 76 % of America's international exports accessed global markets by water in 2010, valued at over $460 billion
- Approximately 70 % (by tonnage) of U.S. imports arrived to the U.S. by water in 2010, valued at over $940 billion

This trade volume is handled by a sizable network of ports and the vessels they serve. Nearly 40,000 privately owned commercial vessels operate in the United States, including tugs, barges, ferries, and lake vessels. Much of the activity is concentrated at a handful of the largest ports in the nation. The top ten U.S. ports accounted for 60% of oceangoing vessel calls.

The United States has over 300 commercial harbors, through which pass 2.3 billion tons of cargo a year, and over 600 smaller harbors. In 2010, 51% of the potential capacity of container years in U.S. ports was fully utilized. The system accommodated over 16,800 annual commercial vessel calls.

While port terminal facilities themselves seem to have benefited from significant new investment and improvements, the connections to the ports – the navigation channels leading to the docks as well as the landside connections – need to be brought to modern standards. The terminals require navigable waterway maintenance and dredging, along with rail and highway connector improvements to function optimally. Without these corresponding improvements, the terminals will see limited benefits in terms of moving additional goods.

While the number of vessel calls has decreased by 7% in the past five years, the average size of vessels calling at U.S ports increased by 9%. The average size of container ships has been increasing in anticipation of the Panama Canal expansion project, which will allow much larger ships known as post-Panamax ships through the Canal. According to the DOT, the number of port calls in the United States from these ships increased from about 1,700 calls in 2004 to 4,400 in 2009. In addition, trade volume through ocean ports is expected to more than double between 2012 and 2021, and to double again shortly after 2030.

The navigation channels coming into the ports need to be deep enough – in most cases, 45 feet deep – to accommodate the new larger ship sizes. Many port harbors are too shallow for these ships. According to the U.S. Army Corps of Engineers, most West Coast ports are able to accommodate these larger vessels due to their naturally deep harbors. However, in 2010, only five Atlantic ports and one Gulf port could accommodate moderately large vessels (more than 5,000 20-foot equivalent units).

For example, the Port of Savannah needs dredging to deepen its river and harbor to accept the larger container ships that the Panama Canal expansion will make possible. While the upfront cost is substantial, the investment can often pay for itself in reduced shipping costs for private companies and consumers. The Port of Savannah estimates that deepening channels by just six feet would reduce shipping costs by 15 to 20% as larger container ships require less individual trips. Factors such as shallow channels and waterways, inefficient cargo handling at ports, and slow, congested landside connections can all drive up the cost of shipping and the cost passed on to customers. Thus, the demands of the growing numbers and size of ships is often exceeding the capacity of current infrastructure, requiring significant additional investment to maintain current levels of performance at deep water ports. From 2012 to 2020, it is estimated that 75% of the capital investment needs of U.S. ports will be for port expansion, with 25% of needs for rehabilitation of existing assets. After 2040, the majority of investment needs will shift to rehabilitation.

The inadequate connections from the port terminals to the surrounding roads and rail lines is one of the biggest challenges causing delays when moving goods from ports to market. The connecting roads to ports were found to have twice the percentage of mileage with deficient pavement when compared to non-Interstate routes. Connectors to rail terminals had 50% more mileage in the deficient category. Most often, problems were due to poor or nonexistent shoulders, as well as narrow road widths and turn lanes. These roadway functions are even more critical for the large freight trucks that must deliver goods from busy ports to inland destinations.

Better connections and direct links from port terminals to rail networks help relieve congestion on the roads and reduce delays in moving cargo, which keeps prices down. Containers are typically driven from ships to rail yards that can be five miles away, so extending tracks and making rail improvements can save time and fuel. For example, a project to improve rail connections to and from the Port of Mobile, Alabama, is expected to reduce transportation costs by about $25 per container.

Ports: Investment & Funding

The sources of funding for ports are diverse, with private investment by port authorities and non-port entities contributing significantly to enabling the ports simply to maintain existing conditions.

U.S. ports and their private sector terminal partners plan to spend more than $46 billion over the next five years on port terminal facilities, according to the American Association of Port Authorities. That equates to over $9 billion per year, of which more than one-third is spending by the port authorities themselves. This number is conservative, and reflects that ports are upgrading harbors, docks, and terminals to compete for business. It includes new construction and modernization, as well as spending on piers, handling equipment, storage facilities, and even road improvements and security measures.

While this type of local investment makes up the majority of funding for ports, the accommodation of large vessels requires dredging, paid for in large part by the federal government through the Harbor Maintenance Trust Fund overseen by the U.S. Army Corps of Engineers. Federal funding for dredging navigation channels has slowed and decreased, even though the money collected from port users through the Fund is double what is currently spent. For example, the 2012 budget allocated $758 million for harbor maintenance dredging, while the revenues for 2011 were almost $1.5 billion. Overall funding for deepwater ports declined 15% from 2010 to 2012, and is expected to increase only briefly in 2013.

The federal government has also provided some funding through its competitive grant program (Transportation Investment Generating Economic Recovery, or TIGER) since 2009. Over $350 million was awarded from 2009 to 2012 for at least 26 port or port-connector projects.

In the future, most U.S. ports will require additional investment to accommodate increased vessel sizes and additional freight cargo throughput due to forecast population growth and demographic shifts in population; post-Panamax vessels transiting the 2015 Panama Canal widening; redeployment

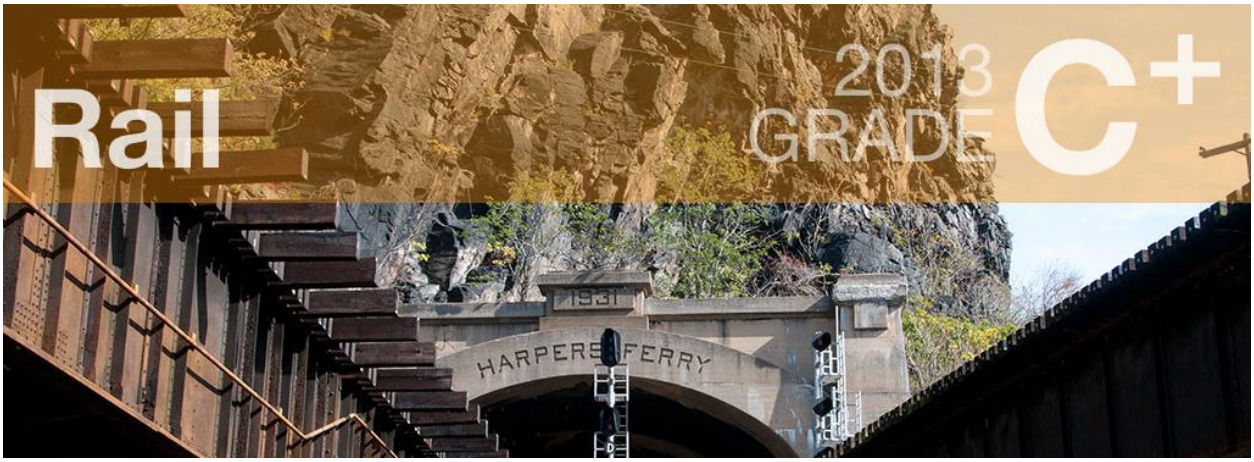
of existing Panamax vessels to supply chain routes currently serviced by smaller vessels; and shifting of U.S. import trade from the Far East to the India-Indochina region of the world. Significant federal infrastructure investment in addition to what U.S. ports and their private partners are forecast to spend will be required to close the funding gap, provide adequate waterside and landside access to port terminals, and ensure American economic growth and jobs.

Ports: Conclusion

With the Panama Canal expansion set to be complete in 2015, our nation's ports need to be ready to take advantage of the opportunities for trade and commerce. While ports themselves have made investments to improve their terminal infrastructure, the connections to roads, rail, and water channels have not received the same attention from the federal government.

Raising the Grades: Solutions that Work Now

- **Target federal investments** to modernize and maintain navigation channels at authorized widths and depths. Restore previous funding levels for the U.S. Army Corps of Engineers
- **Direct funds from the Harbor Maintenance Trust Fund** to their intended purpose – dredging and maintaining the harbors. Currently, about half of those funds go to maintenance
- **Streamline the project approval and delivery process** at the federal level, so that projects take years instead of decades
- **Develop a national freight plan** that prioritizes improvements for road and rail connections and coordinates among multiple agencies and jurisdictions
- **Establish reliable funding mechanisms** for port terminal facility improvements
- **Adopt new technologies**, in partnership with federal agencies, to reduce wait times at docks and boost efficiency for loading and unloading cargo
- **Create a port infrastructure development program** at the federal level, with a comprehensive database of marine terminals at U.S. ports that is up to date and can be used to evaluate the adequacy of connections and identify areas of improvement required to increase the flow of freight



Railroads are experiencing a competitive resurgence as both an energy-efficient freight transportation option and a viable city-to-city passenger service. In 2012, Amtrak recorded its highest year of ridership with 31.2 million passengers, almost doubling ridership since 2000, with growth anticipated to continue. Both freight and passenger rail have been investing heavily in their tracks, bridges, and tunnels as well as adding new capacity for freight and passengers. In 2010 alone, freight railroads renewed the rails on more than 3,100 miles of railroad track, equivalent to going coast to coast. Since 2009, capital investment from both freight and passenger railroads has exceeded $75 billion, actually increasing investment during the recession when materials prices were lower and trains ran less frequently.

Rail: Conditions & Capacity

The U.S. rail network is made up of more than 160,000 miles of track, 76,000 rail bridges, and 800 tunnels across the nation that are shared by all operators moving freight and passengers. The 565 U.S. freight railroads are categorized into 3 classes based on their distance served and earnings – 7 Class I freight railroad systems, 21 regional or Class II railroads, and 537 short line or Class III railroads. In addition to freight, the rail network hosts passenger rail service that is provided by a single intercity passenger rail provider, Amtrak, as well as operators of the nation's 27 regional commuter rail lines.

Freight Rail

Each owner of the rail network is responsible for maintaining the condition of its track and right of way, as well as railroad bridges and tunnels. After a period of underinvestment, freight railroads nearly doubled their capital investment from 1990 to 2010 to maximize productivity by replacing aging and inefficient infrastructure as well as shedding lines that were underutilized. Regional and short line railroad operators took over many of the rail network's "fingers" that connected customers in rural areas to the main arteries or "highways" of the Class I network. Short line railroads also connect many shippers in rural areas to main Class I and II railroads, which then transport goods over longer distances. However, many regional and short line railroad operators only maintain their

segments to the most efficient level of operation, and high fixed costs in addition to new regulations can force operators to discontinue service.

Railroads transport 43% of the nation's intercity freight and about one-third of U.S. exports, such as wheat and coal. Railroad freight tonnage growth is estimated to grow by 22% by 2035, rising from 12.5 billion tons to 15.3 billion tons. Class I railroads have initiated several public-private partnerships with states and port-connection projects to build the capacity to meet expected demand. However, as freight volumes increase relative to the network's capacity, overall congestion on the railroad network will increase for both freight and passenger rail. Already congestion bottlenecks, in areas such as Chicago and the Northeast Corridor, are costing the U.S. economy about $200 billion a year, or 1.6% of U.S. economic output, and they will continue to escalate without adding capacity to meet future needs. To ensure freight stays productive and to capitalize on modal efficiencies, investment will be needed along nationally significant corridors and to advance intermodal options.

Passenger Rail

Although Amtrak owns only 730 miles of the 160,000 mile national rail network, they have put an increased focus on reaching a state of good repair for their assets and made necessary long-term investments when federal funding is available, or when they receive one-time grants like the American Recovery and Reinvestment Act of 2009 (ARRA). These investments and a greater on-time performance are credited for the record-high ridership on Amtrak in 2012 with 31.2 million passengers, showing almost 50% increase in ridership since 2000. In addition, commuter railroad ridership has grown more than 28% over the last decade and now exceeds 468 million passengers per year. However, ridership growth has led to some segments reaching 75% of their capacity. By 2040, Amtrak is planning for traffic in the densely populated and congested Northeast Corridor to quadruple today's ridership, reaching 43.5 million passengers. To meet future demand in the Northeast Corridor for both Amtrak and the eight commuter railroads that use the corridor, estimated investments are about $10 billion over the next 15 years to achieve a state of good repair and to increase train capacity by 40%. Maintaining adequate track capacity to address expanding passenger and freight needs is among the largest challenges in creating a competitive passenger railroad network.

Rail: Investment & Funding

Freight Rail

After years of underinvestment, the deregulation in the 1980s has been followed by one of the highest rates of private and public investment in the core rail infrastructure by the Class I railroads and regional railroads, as well as federal and state investments leading to improved conditions on the majority of the U.S. rail network. Since the 1980s, the freight railroads have spent almost $500 billion maintaining and modernizing the railroad network using capacity and revenue projections to plan capital investments. Types of capital investment included adding tracks next to existing tracks, straightening curves that require slower speeds, and expanding tunnel heights to taller double-stack intermodal containers on trains.

Reinvestment by the freight railroads into the network averages about 40 cents of every revenue dollar. Even in the economic downturn, the railroad industry continued their aggressive investment level, averaging about $20 billion each year from 2009 through 2012 to modernize their network. Freight railroads were able to capitalize on the reduced frequency of trains and lower material prices to continue their aggressive capital and maintenance expenditure policy, which places them in a greatly improved position to handle the increased traffic levels that are beginning to appear.

Passenger Rail

Amtrak now recovers 76% of its operating cost from ticket revenue, with the remainder coming from the federal government and 15 states that provide operating and capital support for passenger corridor service. Federal support for Amtrak averages about $1.50 per American per year. Long-term funding is uncertain, as Amtrak's capital funding is planned over a long-term period but must be given a prescribed yearly funding level under its own bill in Congress. The federal government has also put forward some significant investment programs and regulations that have affected the rail industry, including the Passenger Rail Investment and Improvement Act (PRIIA) of 2008, which will create a national rail plan, the High-Speed and Intercity Passenger Rail Program, which outlines potential corridors for faster passenger service, the Transportation Investment Generating Economic Recovery (TIGER) Grants, where many rail projects found additional investment, and the Rail Safety Improvement Act of 2008, mandating safety improvements, including the implementation of Positive Train Control on certain track lines. With PRIIA, the states' role in passenger rail investment and operations has also expanded, as 15 routes that are less than 750 miles will become the primary financial responsibility of states in 2014 in addition to the state-supported commuter rail services.

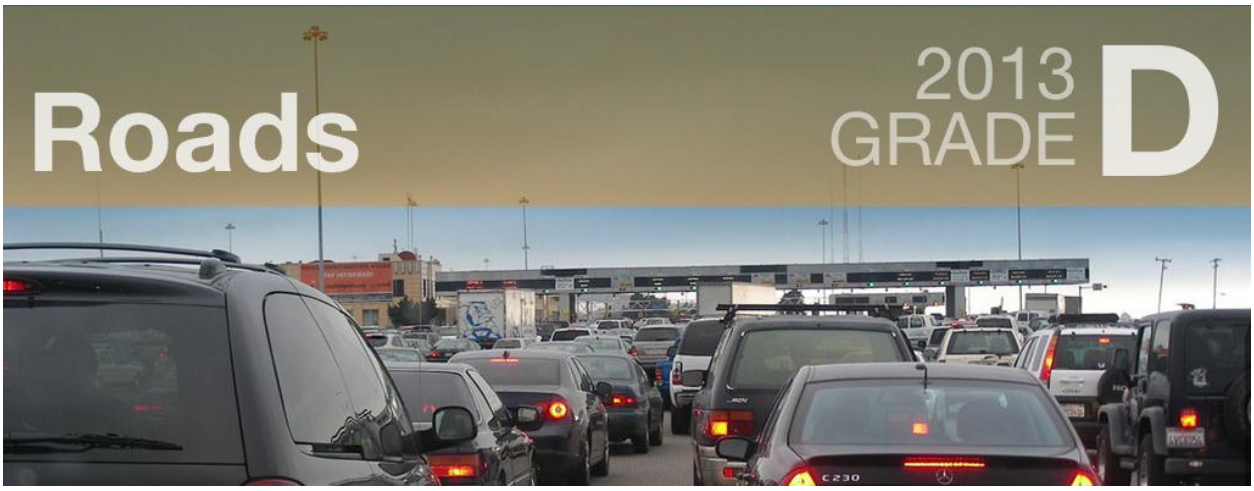
Rail: Conclusion

The railroads have invested heavily in their tracks, bridges, and tunnels, as well as adding new capacity for freight and passengers. While the freight railroads carry the majority of the responsibility for track upkeep, both freight and passenger railroads have made significant investments using both private and public funding. Intercity and commuter passenger ridership are showing year-over-year growth as a viable commuting option for dense urban areas. Meeting capacity demands will be an ongoing challenge as rail ridership and freight rail continue to gradually increase.

Raising the Grades: Solutions that Work Now

- **Integrate rail into a national multimodal transportation policy** that recognizes and takes advantage of efficiencies in the movement of people and goods
- **Improve passenger rail in dense urban corridor markets** and as an alternative to air and automobile travel for intercity markets
- **Increase and expand passenger rail commuter services** in urban areas and intercity passenger services linking major cities in the nation's mega-regions

- **Support a regulatory and financial environment** that encourages continued private investment in the nation's freight railroad system



Forty-two percent of America's major urban highways remain congested, costing the economy an estimated $101 billion in wasted time and fuel annually. While the conditions have improved in the near term, and Federal, state, and local capital investments increased to $91 billion annually, that level of investment is insufficient and still projected to result in a decline in conditions and performance in the long term. Currently, the Federal Highway Administration estimates that $170 billion in capital investment would be needed on an annual basis to significantly improve conditions and performance.

Roads: Conditions & Capacity

The nation's system of roadways serves as a critical link moving people and goods throughout the country. Our road network includes more than 4 million miles of public roadways, carrying almost 3 trillion vehicle miles traveled in 2011 alone. These 4 million miles of roads provide the nation's nearly 11 million trucks with direct access to our ports, rail terminals, and city centers, driving our economy and enabling goods to get to market.

Currently, 32% of America's major roads are in poor or mediocre condition, costing U.S. motorists who are traveling on deficient pavement $67 billion a year, or $324 per motorist, in additional repairs and operating costs. While the nation has seen some improvements in pavement conditions due to a short surge of investment from the American Recovery and Reinvestment Act, these were not sustained, long-term investments. Of added concern are the vehicular restrictions for some roadways due to poor pavement, which can create longer routings for trucks in cases where detours are required. Deficient pavements are more common in urban versus rural areas, with 47% of urban interstate vehicle miles traveled (VMT) over deficient pavements compared to 15% of rural interstates. The ultimate cost of poor road conditions is significantly more over time than the cost to maintain those same roads in good condition. For example, after 25 years the cost per lane mile for

reconstruction can be more than three times the cost of preservation treatments over the same time period, which can lead to a longer overall life span for the infrastructure.

Additionally, current estimates show that 42% of America's major urban highways are congested, down from 45% in 2008. While Americans still wasted 1.9 billion gallons of gasoline and an average of 34 hours in 2010 due to congestion, costing the U.S. economy $101 billion in wasted fuel, the average cost per motorist has only increased by $3 over the past four years. A major part of the problem is that VMT on America's highways increased by 39% between 1990 and 2009, so people are driving longer distances on average. However, newly constructed road mileage has only increased by 4% during that same time. While VMT has been decreasing over the last few years due to continued congestion and the recession, the trend is not likely to continue over a long period of time.

In many cases, our nation's roadways can benefit from significant performance improvements without adding new highway lanes. Adverse community impacts such as induced sprawl, difficulties in obtaining needed right of way, and the expense of adding capacity to highway infrastructure, suggest that every effort must be made to better manage the current roadway network. Cities and states across the country are increasingly using technology to reduce congestion and improve traffic flow, including wider use of performance pricing, variable speed limits, and more efficient signal timing. Convenient and accessible alternative modes of transportation, as well as an increased use of telecommuting, are other examples of how the demand for capacity increases and greater improvement can be better managed.

Safety also continues to be a major focus for investment. Statistics indicate that roadway conditions are a significant factor in approximately one-third of all U.S. traffic fatalities. Roadway fatalities have been on the decline annually, totaling 32,885 fatalities in 2010, or a drop of nearly 24% since 2005. Nevertheless, these crashes cost the U.S. economy $230 billion each year. Reducing exposure to obstructions, adding or improving median barrier systems, and widening lanes and shoulders offer opportunities to reduce crashes, injuries, and fatalities. The 2012 surface transportation bill nearly doubles funding for the Highway Safety Improvement Program.

Roads: Investment & Funding

In 2010, it was estimated that deficiencies in America's surface transportation systems cost households and businesses nearly $130 billion. However, the Federal Highway Trust Fund (HTF), which contributes the bulk of federal funding for transportation, is on a path to bankruptcy as it relies on dwindling gas tax revenues. The gas tax has remained the same since 1993, and revenues are decreasing further due to more efficient vehicles. The Congressional Budget Office sees the crisis worsening when considering newly proposed fuel economy standards that will lower fuel tax revenues by an additional 21% by 2040. Such a decrease would result in a $57 billion drop in the Highway Trust Fund between 2012 and 2022.

Estimates state that to maintain all of the nation's highways at their current condition would cost $101 billion in annual capital investment between 2008 and 2028. In order to improve the nation's

highways, investment would need to rise to $170 billion annually, or an additional $79 billion annually from current investments, during that same time period. Of that $170 billion, $85 billion would need to be directed toward improving the physical condition of existing assets in order to achieve the Department of Transportation's State of Good Repair benchmark. This investment would bring the number of federal-aid highway vehicle miles traveled on pavements with a good ride quality up from 46% in 2008 to 74% by 2028.

Unfortunately, federal, state, and local governments are only spending $91 billion annually on capital investments, meaning that each year our roads deteriorate further. If present trends continue, the unfunded gap in highway funding, which is 48% of the total need in 2010, is expected to increase to 54% by 2040.

Other studies have also concluded that the current investment level is insufficient. The National Surface Transportation Infrastructure Financing Commission estimates that to maintain the nation's highways, an annual investment of $131 billion is needed from 2008 to 2035, in 2008 dollars. In order to improve the nation's highways, the annual investment between 2008 and 2035 climbs to $165 billion each year, in 2008 dollars.

Reliable revenue sources must be identified in order to increase investments in our nation's highway network. Federal transportation loan programs and innovative financing mechanisms play a critical role in funding the nation's highways, but these programs cannot replace dedicated federal revenue.

Roads: Conclusion

Current investment trends are doing little to improve roadway conditions and may result in a decrease of conditions and performance. With each passing year the economic cost of underfunding maintenance and repair produces a mounting burden on our economy and increases costs to make improvements. While conditions have improved slightly, federal, state, and local governments, as well as the private sector, must work to develop sustainable and reliable revenue sources for our road network. The nation can no longer rely solely on the fuel tax to generate the necessary future revenues for the Highway Trust Fund.

Raising the Grades: Solutions that Work Now

- **Develop performance-based investment strategies** which will ensure that available resources are directed to those projects with the highest performance return on investment
- **Optimize usage of existing highway capacity** to ensure the best use of available funding
- **Encourage the use of asset management programs** to provide for the most efficient use of maintenance and repair investment
- **Use freight movement efficiency** as a measure of the overall surface transportation system's performance and contribution to economic strength
- **Increase investment from all levels of government and the private sector**, to repair and improve the nation's highway systems

- **Ensure the sustained sufficiency and reliability of the Highway Trust Fund** by identifying and incorporating necessary additional revenue streams
- **Continue the Highway Safety Improvement Program successes** by investing in projects that will reduce injuries and fatalities

America's public transit infrastructure plays a vital role in our economy, connecting millions of people with jobs, medical facilities, schools, shopping, and recreation, and it is critical to the one-third of Americans who do not drive cars. Unlike many U.S. infrastructure systems, the transit system is not comprehensive, as 45% of American households lack any access to transit, and millions more have inadequate service levels. Americans who do have access have increased their ridership 9.1% in the past decade, and that trend is expected to continue. Although investment in transit has also increased, deficient and deteriorating transit systems cost the U.S. economy $90 billion in 2010, as many transit agencies are struggling to maintain aging and obsolete fleets and facilities amid an economic downturn that has reduced their funding, forcing service cuts and fare increases.

Transit: Conditions & Capacity

Connecting riders to transit is critical to the health of the nation's economy; however, access to transit options remains a significant burden for many Americans. Just over 55% of U.S. households reported that they have access to public transportation service, down slightly from almost 57% in 2001. Among urban households, 69% have access to transit, while just 14% of rural households have access to transit. Transit usage tracks fairly closely with employment, indicating that a significant portion of riders depend on transit to commute to a job. Among households in large metropolitan areas with no access to a private automobile, over 90% live in neighborhoods with access to transit service of some kind. However, they can reach only about 40% of the jobs in their area via transit within 90 minutes, potentially limiting employment opportunities.

Access to transit varies by region, with Northeast and Western cities having the highest access rates and cities in the South having the lowest. Among metropolitan areas with the best access to jobs for zero-vehicle households, Honolulu was number one with 70%, and 13 of the top 20 cities were in the

West. The South had 11 of the 20 worst access rates, including six of the eight largest metropolitan areas in Florida. As the population ages, access to transit will become increasingly important as older drivers will want and need viable alternatives to driving. As a result, communities are beginning to address the challenges of an aging population in their transportation planning. New Mexico, for example, has included access to transit in rural areas, especially for the elderly, disabled, and low-income residents, in its key metrics being monitored for setting performance goals for their transportation programs.

Investment in major urban transit systems has led to an increased percentage of newer transit vehicles for most modes in the past three years. Overall, the percentage of vehicles older than their minimum useful life decreased to 16% in 2011 as compared with 17% in 2009. The condition of transit buses, which are responsible for carrying the majority of transit riders (53% of unlinked passenger trips in 2008), remains barely adequate, consistent with trends over the past decade. In addition, 30% of urban bus maintenance facilities are rated below a three on a five-point scale (with five being the best rating).

Rail-based systems carry just over a third of all transit trips (35%) but have the greatest maintenance needs of all transit modes, with a backlog of $59 billion as compared with $18 billion for nonrail systems. In addition, these systems have larger than average annual normal replacement needs (i.e., annual costs required to maintain a state of good repair): $8 billion as compared with the average of $6 billion across all other transit modes. Fixed guideways, which include tracks and roadways dedicated to transit, require the largest replacement costs and have more than tripled since 1970. Fixed guideways also have widely varying conditions, with not only the greatest share of assets in excellent condition (defined as 4.8–5.0 on a five-point scale) in terms of replacement value, but also the highest share of assets in poor condition (defined as 1.0–1.9 on a five-point scale). This represents a major financial challenge for transit authorities to keep these systems in good operating order and can likely be attributed to the following: Rail systems are some of the oldest assets still in use (especially heavy rail systems in cities like New York, Chicago, and Boston), as well as a major area of growth in recent years (especially light rail systems in Denver, Salt Lake City, Charlotte, etc.).

Just as troubling as the maintenance backlog is the fact that many transit agencies do not systematically monitor the conditions of their facilities to keep their fleets in good and consistent operation. Many agencies don't conduct regular, comprehensive asset condition assessments, lagging behind other transportation sectors in this respect. For example, nearly all state Departments of Transportation maintain some record of the condition of their pavement and bridge assets. As transit systems grow, good asset management practices will be essential to effectively manage complex systems and growing ridership.

Nevertheless, many transit agencies have been leaders in using technology to make their systems more convenient and reliable even as they have had to make cuts in service, including offering real-time arrival information and online route planning. These practices have played a role in increasing ridership.

Transit: Investment & Funding

The expansion of transit systems in recent years has been made possible through a substantial increase in overall funding for transit – more than 36% since 2000, totaling over $52 billion from all sources in 2008. However, the recent economic downturn is reversing those gains as states and localities struggle to adjust to reduced revenues and federal funding remains constant, as it has for the past two decades. Voters in many areas have been supportive of funding transit through ballot initiatives, supporting 47 of 59 such initiatives on state and local ballots in 2012. In fact, since 2000, 70% of public transit ballot initiatives have passed. Recent polling research further supports this trend, indicating that two out of every three Americans support increased local investment to expand and improve transit systems. In addition, a recent infusion of almost $4 billion in federal funds from the American Recovery and Reinvestment Act (ARRA) has helped to improve some conditions, reducing the backlog of repair and rehabilitation of transit assets needed by about 5%. However, this is only temporary. The Federal Transit Administration (FTA) still estimates a maintenance backlog of nearly $78 billion needed to bring all transit systems up to a state of good repair (generally defined as achieving a rating of 2.5 or higher on a scale of 1–5).

Despite these trends, the Federal Transit Administration estimates that a funding gap of $25 billion per year exists, and this gap is expected to grow. If current trends continue, the 2010 investment gap of 40% is expected to grow to 55% by 2040. Without a significant increase in funding for maintenance and operations of these systems, conditions will inevitably decline as systems and assets age. These deficiencies, which currently cost the U.S. economy about $90 billion per year in lost time and wasted fuel, will cost us $570 billion in 2020 and over $1 trillion in 2040, should current funding trends continue.

The Federal Transit Administration's State of Good Repair initiative directed $48 million in grants in 2010 and 2011 to 31 transit agencies to develop and improve asset management practices. However, with over 650 different agencies across the country, the needs in this area remain significant

Transit: Conclusion

Americans continue to demonstrate their desire to have robust public transportation options, evidenced by increasing ridership and continued support of local and state-level funding issues. However, nearly half of Americans lack access to a good transit system, and transit agencies remain hard pressed to keep up with the demand of operating and maintaining the systems that exist. Continued investment in transit systems of all kinds is needed to support people's ability to access jobs and enjoy independent mobility as they age.

Raising the Grades: Solutions that Work Now

- **Increase access to transit** in urban, suburban, and rural communities so that all Americans have more and better transportation choices

- **Adequately fund maintenance of transit vehicles and facilities** to keep systems in state of good repair and reduce life-cycle costs
- **Continue federal investment in transit** through a robust surface transportation program (authorization and appropriation) and a solvent Highway Trust Fund
- **Require transit systems to adopt comprehensive asset management systems** to maximize investments
- **Include transit in state and local project development processes** and metrics to track performance of transportation systems
- Local, regional, and state government entities – especially in smaller urban and rural areas – should **prioritize transit investments that can enhance sustainable land-use decisions**

The popularity of parks and outdoor recreation areas in the United States continues to grow, with over 140 million Americans making use of these facilities a part of their daily lives. These activities contribute $646 billion to the nation's economy, supporting 6.1 million jobs. Yet states and localities struggle to provide these benefits for parks amid flat and declining budgets, reporting an estimated $18.5 billion in unmet needs in 2011. The federal government is also facing a serious challenge as well since the National Park Service estimates its maintenance backlog at approximately $11 billion.

Public Parks & Recreation: Conditions & Capacity

Americans regularly enjoy park and recreation facilities maintained by entities at all levels of government. At the federal level, the National Park System, the United States Forest Service, and the 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 Americans use on a day-to-day basis.

State parks and recreation areas cover nearly 14 million acres and served over 740 million visitors in 2010, an increase of 10 million since 2007. City parks have the highest visitation rates, with over 60

parks receiving in excess of 1 million visitors in 2011. City and suburban parks are typically easily accessible, year-round facilities that provide tangible benefits to communities in the form of increased land values and lower incidence of obesity and related diseases. A recent study in Mecklenburg County, North Carolina (includes Charlotte) found that the county's $2.4 million investment in parks and recreation facilities and programs yielded a return of at least $9.5 million in environmental, economic, and social benefits to the community, a nearly four-fold return on investment.

Yet, states and localities still struggle to provide these resources. Across the country, cities and localities have increasingly been faced with declining state and federal funding for parks. Staffing is often a significant portion of the budget, and therefore many cuts come in the form of eliminating paid positions. Administrators often ask employees to take on extra duties rather than cut services, but in some localities facilities have faced limited hours or closure due to budget cuts. Park authorities are stretched to maintain the facilities they currently run, let alone increase offerings for growing populations. The nation's largest cities report at least $5.8 billion in deferred maintenance costs.

National Park Service (NPS) facilities hosted 279 million visits in 2011, and NPS expects this number to rise in the coming years. The National Park System comprises 397 "units," including 124 historical parks or sites, 75 monuments, 58 national parks, 25 battlefields or military parks, and several other types of preserves and recreation areas. Annually, NPS sites support 246,000 jobs and provide $12 billion in economic impacts to surrounding communities.

Chronic underfunding of NPS budgets has led to an $11 billion backlog of deferred maintenance at NPS sites, including a backlog of $4.7 billion for roads and bridges that run throughout the park systems. NPS estimates that it requires $412 million annually to keep all its roads in good condition, while it is currently spending only about $240 million per year. Cuts proposed by the administration and Congress will likely mean closures, limited access, and limited services to park units in 2013. In addition, other areas will suffer, such as seasonal staff hiring for heavy volume time periods, to make up the funding shortfalls.

Much like the NPS, the United States Forest Service, which manages a vast series of National Forests, Grasslands, and other natural areas, also has a significant deferred maintenance backlog. Flat budgets have led to a $5.3 billion backlog, with deficient roads accounting for nearly 60% of that total cost.

At other federally owned and operated parks, the situation is similar. The U.S. Army Corps of Engineers (USACE) recreation sites host more than 370 million visits annually at 422 lake and river projects in 43 states, making USACE the number one federal provider of outdoor recreation. The Corps manages 12 million acres of recreation sites, and 20% of all recreation visits to federal lands are to these sites. Visitation has steadily increased in recent years, and this upward trend is likely to continue; 91% of Corps lakes and rivers with recreation areas are located within 50 miles of a metropolitan area. Visitors to Corps facilities spend $18 billion annually and support 350,000 jobs. In the face of declining funding for operations, the Corps has developed a strategic plan for its recreation services that will guide future program and operational changes.

Public Parks & Recreation: Investment & Funding

Funding for parks of all types remains a challenge. In the 1970s, states relied on the federal government to provide 17% of overall state budget revenues; in 2011 that figure dropped to 5%. Since many park and recreation budgets rely on general fund resources, across-the-board cuts in state and local budgets have hit park and recreation budgets especially hard. Some states, such as Arizona, Louisiana, and Nevada, have no source of general funds or dedicated revenue to fund recreation facilities, relying solely on funds generated by the parks and outside sponsorships and donations. As a result, cities and states are relying more and more on private funds to build and run their facilities, in the form of donations to private foundations, corporate sponsorships, and other public-private partnerships.

The Land and Water Conservation Fund, a federal fund that provides grants to states and localities to fund acquisition of public outdoor recreation facilities and land, distributed just over $37 million in grants in 2011. Ninety-four percent of states received less than 10% of their reported needs, and the total reported unmet need for states was almost $19 billion in 2011.

In spite of these challenges, communities remain supportive of direct funding for park and recreation facilities through ballot initiatives and bond referenda. 2012 saw a record number of these proposals, with 81% receiving approval.

Despite steady increases in visits and continued acquisitions of additional sites and land, NPS budgets have remained flat for the past decade, with slight increases at the end of the Bush Administration and the American Recovery and Reinvestment Act (ARRA) in 2009. In fact, adjusted to 2001 dollars, the NPS appropriation shrank by 13% from 2001 to 2011. This continued underfunding has created a backlog of deferred maintenance at NPS sites, estimated to be around $11 billion, up from around $6 billion in 2008. The NPS estimates that its annual maintenance and construction funding falls about $325 million short of the amount needed to prevent the backlog from growing. ARRA funding amounted to about 9% of the maintenance backlog in 2009, leaving significant unmet needs.

Public Parks & Recreation: Conclusion

States and communities have recognized the many benefits that good park and recreational facilities bring to their communities and continue to look for ways to increase outdoor opportunities in the hope of attracting new residents, tourists, and economic development. However, flat and declining budgets at all levels have resulted in large deferred maintenance backlogs that threaten the long-term value of these facilities to growing populations.

Raising the Grades: Solutions that Work Now

- **Broadly apply the principle of "the beneficiary pays"** by charging appropriate user fees at the local, state, and federal levels and allow those sites to keep collected funds to support on-site

maintenance and operations. Enact legislation to this effect where necessary to allow the U.S. Army Corps of Engineers to retain all collected fees for local use

- **Fully fund the Land and Water Conservation Fund** to support land acquisition at the federal, state, and local levels
- **Increase appropriations** for the National Park Service, the U.S. Forest Service, and other federal providers of recreational facilities to address maintenance backlogs
- **Support renegotiation of franchise fees** with concessionaires of park and recreation facilities to increase return to support operation and maintenance of facilities
- **Leverage partnerships between the National Park Service and other recreation facilities operators** and private groups to better utilize facilities and compensate for usage

Almost half of America's public school buildings were built to educate the baby boomers – a generation that is now retiring from the workforce. Public school enrollment is projected to gradually increase through 2019, yet state and local school construction funding continues to decline. National spending on school construction has diminished to approximately $10 billion in 2012, about half the level spent prior to the recession, while the condition of school facilities continues to be a significant concern for communities. Experts now estimate the investment needed to modernize and maintain our nation's school facilities is at least $270 billion or more. However, due to the absence of national data on school facilities for more than a decade, a complete picture of the condition of our nation's schools remains mostly unknown.

Schools: Conditions & Performance

School facilities exist to provide students a productive learning experience, but poor facility conditions have been shown to affect student performance. School facilities also play a role in the community as emergency shelters during natural and man-made disasters, and they must be resilient and maintained to meet standards for emergencies.

The condition of K-12 school facilities in the United States is primarily a local and state responsibility, and there is limited national information. The most recent comprehensive report on school facilities collecting similar state-by-state information was released more than a decade ago. This report, U.S. Department of Education Condition of America's Public School Facilities: 1999, identified an investment of $127 billion needed to bring the nation's schools into good operating condition. School facilities experts estimate that today's necessary renovations and maintenance of the nation's school facilities could cost $270 billion or more.

The primary need identified in the 1999 conditions report was improvement of the condition of school facilities through repairs, renovations, and additions to facilities. Almost half of U.S. public school buildings were built for the baby boom generation born between 1950 and 1969, and now the children who attended them are retiring.

Schools: Investment & Funding

Since the start of the recession in 2008, state funding for education has declined, with 35 states now providing less than 2008 funding levels. Additionally, 26 states are providing less funding for 2012-13 than the year before. School construction for new building and modernizations in 2012 slowed to about $10 billion, only half of the average annual funding level from 2000 until the recession started in 2008. From 2000 to 2008, approximately $20 billion was spent annually on school construction, with a peak of $29 billion spent in 2004, showing a rise and fall with state budgets. In the four years since 2008, the funding pipeline for school facilities construction has continued to slide, from a modest $16.4 billion down to a projected $10.3 billion estimated for 2012. Since 1980, the federal investment has typically been only 8%, while the states pick up 48% of the total cost and local funding provides about 44%.

Since the U.S. colonies were established, schools have been funded primarily through one source of revenue – property taxes. Many states rely on property taxes to support their school construction budgets, and use new taxes or shift state general funds to provide funding for school construction when the existing revenue isn't sufficient. Up until the recession that began in 2008, property taxes were a fairly stable revenue option that consistently grew along with student enrollment. However, after property values readjusted at lower levels due to the recession, increasing property tax rates to cover funding shortfalls may not be viable. Some states and localities have diversified their funding options in order not to rely as heavily on property taxes. Moreover, other state spending priorities such as underfunded pensions and increasing health costs could crowd out spending for education facilities.

Additionally, many districts require voter approval for large capital projects or tax increases to fund school construction bonds, adding a layer of uncertainty to school capital spending plans. In addition, schools that rely on state and county funding saw legislatures tighten their purse strings or even cut spending on education during the recession, since education is not provided the same protections in state and local spending as other areas.

School construction projects are not only driven by facilities' condition, but also by capacity needs. In the fall of 2012, more than 49.8 million students entered public schools, up modestly from 49.3 million in 2009. These students attend school in more than 98,800 public school facilities. The 1999 Condition Report showed that close to 10% of schools reported enrollment 25% greater than the permanent building capacity. Student populations are still projected to grow gradually over the next 5 years. Total elementary and secondary enrollment is anticipated to set new records every year from 2010 to 2019, but funding is not projected to be as readily available, suggesting that the number of schools experiencing excess capacity may increase.

As more school districts begin to focus on the lifecycle costs of their facilities, rising energy costs have proven to be a motivator for certain types of school construction projects. Energy costs, from heating to technology, are typically a school district's second highest expenditure after personnel; so many school districts are looking to make their school facilities more sustainable. School energy efficiency improvements have become even more compelling with the escalating cost of energy throughout the nation.

Highlighting a need for significant operations and maintenance, the 1999 Condition Report identified that over 59,000 schools – representing 76% of America's schools – needed to "spend money on repairs, renovations, or modernizations to put the school into good overall condition." Some states and localities have made great strides to reduce their facilities' investment needs and modernize their schools, and even at the federal level some action is being considered. In 2011, a federal school facilities modernization effort was introduced in Congress to fund $30 billion against the current investment backlog and upgrade about 35,000 deteriorating school buildings. Although there are no current data, these efforts show wide recognition that school facility repair and upgrade needs in the nation are significant.

Schools: Conclusion

With the significant decrease in school construction spending over the last four years and the increase in the number of facilities and the number of students attending those facilities, the lack of national and comparable data to assess the condition and capacity needs of school facilities is concerning. Even at the state level, often only a limited amount of information is collected from the school districts and a limited number of staff devoted to providing facility operators with asset management plans and project maintenance needs for the state. Databases and asset management plans outlining the condition of our nation's schools are essential to identifying issues systemwide and making efficient school facilities investments as they are needed.

Raising the Grades: Solutions that Work Now

- **Publish regular updates of the report on the Condition of America's Public School Facilities** to ensure a clear view of conditions nationwide
- **Encourage school districts** to adopt regular, comprehensive major maintenance, renewal, and construction programs

- **Expand federal and state tax credits and matching funds** to support increased use of school construction bonds and simplify the process for local school districts to obtain facility construction financing for improvements and modernizations
- **Explore alternative financing**, including lease financing and financing as well as ownership and use arrangements, to facilitate school construction projects
- **Implement comprehensive preventive maintenance programs** for each school district's assets to extend the life of school facilities
- **Require life-cycle cost analysis principles** and multi-use possibilities to evaluate the total costs of projects to capture efficiency and promote sustainability
- **Encourage school facility reviews** on a state level and provide input to develop a national database of conditions and available funding

America relies on an aging electrical grid and pipeline distribution systems, some of which originated in the 1880s. Investment in power transmission has increased since 2005, but ongoing permitting issues, weather events, and limited maintenance have contributed to an increasing number of failures and power interruptions. While demand for electricity has remained level, the availability of energy in the form of electricity, natural gas, and oil will become a greater challenge after 2020 as the population increases. Although about 17,000 miles of additional high-voltage transmission lines and significant oil and gas pipelines are planned over the next five years, permitting and siting issues threaten their completion.

Energy: Conditions & Capacity

The Electric Grid

The electric grid in the United States consists of a system of interconnected power generation, transmission facilities, and distribution facilities, some of which date back to the 1880s. Today, we have an aging and complex patchwork system of power generating plants, power lines, and substations that must operate cohesively to power our homes and businesses. There are thousands of

power generating plants and systems spread across the United States and almost 400,000 miles of electric transmission lines. With the addition of new gas-fired and renewable generation, the need to add new transmission lines has become even greater.

Aging equipment has resulted in an increasing number of intermittent power disruptions, as well as vulnerability to cyber attacks. Significant power outages have risen from 76 in 2007 to 307 in 2011. Many transmission and distribution system outages have been attributed to system operations failures, although weather-related events have been the main cause of major electrical outages in the United States in the years 2007 to 2012. While 2011 had more weather-related events that disrupted power, overall there was a slightly improved performance from the previous years. Reliability issues are also emerging due to the complex process of rotating in new energy sources and "retiring" older infrastructure.

Oil and Gas Distribution

The coal, oil, and gas industry includes facilities such as coal mines and oil and gas wells, processing plants (e.g., refineries), and systems to transfer raw materials from collection through processing plants to consumers. There are nominally 150,000 miles of crude oil and product pipelines and over 1,500,000 miles of natural gas transmission and distribution pipelines in the United States, many located underground and crossing multiple states. In general, this energy infrastructure is owned by private industry. Since 2008, a series of oil and gas pipeline failures have led to deaths, injuries, significant property damage, and environmental impacts. Such failures, including those in San Bruno, California, and Marshall, Michigan, have demonstrated a need for greater pipeline management and maintenance programs. New federal safety requirements were enacted in 2011 to address the increase in the number of incidents due to aging infrastructure and maintenance concerns.

Capacity

In the near term, it is expected that energy systems have adequate capacity to meet national demands. From 2011 through 2020, demand for electricity in all regions is expected to increase 8% or 9% in total, based on population growth and projections from the U.S. Energy Information Administration. The rate of growth in energy use is expected to be stable and relatively low due to moderate population growth, an extended economic recovery, and increased energy efficiency. Supply forecasts show that the United States will add about 108 gigawatts (10% of current capacity) in generating capacity by 2016, mostly through new natural gas-fired and renewables generation as enhanced environmental regulations, old coal-fired facility retirements, and lower natural gas prices take hold.

After 2020, capacity expansion is forecast to be a greater problem, particularly with regard to generation, regardless of the energy resource mix. Excess capacity, known as planning reserve margin, is expected to decline in a majority of regions, and generation supply could dip below resource requirements by 2040 in every area except the Southwest without prudent investments. The

adequacy of energy pipelines and related operations is also a growing concern, partially due to capacity constraints in refineries and oil and gas transmission systems.

Congestion at key points in the electric transmission grid has been rising over the last five years, which raises concerns with distribution, reliability and cost of service. Preliminary findings of the 2012 National Electric Congestion Study indicate that critical areas of congestion still exist in the Northeast and in southern California.

This congestion can lead to system-wide failures and unplanned outages. The public has a low tolerance for these outages, even in extreme weather events. Additionally, these outages put public safety at risk and increase costs to consumers and businesses. The average cost of a one-hour power outage is just over $1,000 for a commercial business. Utilities also often pass on "congestion charges" to consumers when transmission lines are overloaded.

New transmission lines are being planned in response to the need for integrating and delivering new energy sources. During the next five years, about 17,000 circuit miles of additional high-voltage transmission lines are planned, which is much larger than the historical average of 6,500 miles.

However, the permitting and siting of these transmission lines often meet with public resistance, which can result in significant project delays or eventual cancellations while driving up costs. Over three times as many low-voltage line projects, which are typically built in more urban areas, were delayed in 2011, compared to high-voltage lines. The result is that while new transmission lines are needed, many are being delayed due to permitting issues.

Energy: Investment & Funding

From 2001 through 2010, annual capital investment in electricity infrastructure averaged $63 billion, including over $35 billion in generation, $8 billion in transmission, and nearly $20 billion in local distribution lines. Funding comes from a variety of sources, including government agencies, regulated utilities, private companies and developers, and nonprofit cooperatives.

Investment for transmission has been increasing annually since 2001 at a nearly 7% annual growth rate. For local distribution systems, however, national-level investment peaked in 2006 and has since declined to less than the level observed in 1991. Construction spending has decreased in recent years, although the aging of local distribution networks, lack of funding for maintenance, and resulting equipment failures have received public attention and put pressure on some utilities to make improvements.

The investment gap for distribution infrastructure is estimated to be $57 billion by 2020, much larger than the investment gap for transmission infrastructure of $37 billion.

The increase in adoption of smart grid technologies – computer-based, automated systems for the delivery of electricity – has led to additional investment in recent years. For example, as part of the

American Reinvestment and Recovery Act, the United States invested more than $4.5 billion for electricity delivery and energy reliability modernization. These funds were matched by more than $5.5 billion from local agencies and the private sector to fund smart grid and energy storage technologies across the country, with additional funding going toward workforce training. Additionally, the Rural Utilities Service provided $7.1 billion in loans in 2010 to support the modernization of the electric infrastructure serving rural America, including more than $152 million for the installation of smart meters.

To date, 25 states have already adopted policies relating to smart grid technology. At least nine states discussed smart grid deployment bills in the 2011 legislative sessions, and more than 70 million smart meter units were deployed in 2010, compared to 46 million in 2008. Ensuring that these systems work together will be an ongoing challenge.

The coal, oil, and gas industry has similar concerns with congestion and safe and efficient delivery of resources. In particular, the proliferation of shale gas recovery in several regions of the country has not been accompanied by the expansion of the transportation systems necessary to carry the gas and associated liquids to the market.

Energy: Conclusion

Looking ahead in the 21st century, our nation is increasingly adopting technologies that will automate our electric grid and help manage congestion points. In turn, this will require robust integration of transmission and distribution systems so that the network continues to be reliable.

Investments in the grid, select pipeline systems, and new technologies have helped alleviate congestion problems in recent years, but capacity and an aging system will be issues in the long term. In addition, with an automated, dynamic energy grid system comes the increased risk of cybersecurity threats. Protecting the nation's energy delivery systems from cyberattacks and ensuring that these systems can recover is vital to national security and economic well-being.

Raising the Grades: Solutions that Work Now

- **Adopt a national energy policy** that anticipates and adapts to future energy needs and promotes the development of sustainable energy sources, while increasing the efficiency of energy use, promoting conservation, and decreasing dependence on fossil fuels as sources are depleted. Such a policy must be adaptable and scalable to local and state policy.
- **Provide mechanisms for timely approval of transmission lines** to minimize the time from preliminary planning to operation.
- **Identify and prioritize risks to energy security**, and develop standards and guidelines for managing those risks.
- **Design and construct additional transmission grid infrastructure** to efficiently deliver power from remote geographic generation sources to developed regions that have the greatest demand requirements.

- **Create incentives to promote energy conservation** and the concurrent development and installation of highly efficient coal, natural gas, nuclear, and renewable (solar, wind, hydro, biomass, and geothermal) generation.
- **Continue research to improve and enhance the nation's transmission and generation infrastructure** as well as the deployment of technologies such as smart grid, real-time forecasting for transmission capacity, and sustainable energy generation which provide a reasonable return on investment.

Grade Sheet: America's Infrastructure Investment Needs

With each *Report Card*, ASCE estimates the investment needed in each infrastructure category to maintain a state of good repair. That is, approximately what amount of investment is needed to get to a grade of B?

Cumulative Infrastructure Needs by System Based on Current Trends Extended to 2020
(Dollars in $2010 billions)

The table below provides the estimated cumulative investment needs by infrastructure category based on current trends extended to the year 2020 (dollars in $2010 billions).

Infrastructure Systems	Total Needs	Estimated Funding	Funding Gap
Surface Transportation[1]	$1,723	$877	$846
Water/Wastewater Infrastructure[1]	$126	$42	$84
Electricity[1]	$736	$629	$107
Airports[1,2]	$134	$95	$39
Inland Waterways & Marine Ports[1]	$30	$14	$16
Dams[3]	$21	$6	$15
Hazardous & Solid Waste[4]	$56	$10	$46
Levees[5]	$80	$8	$72
Public Parks & Recreation[6]	$238	$134	$104
Rail[7]	$100	$89	$11
Schools[8]	$391	$120	$271
TOTALS	$3,635	$2,024	$1,611
Yearly Investment Needed	$454	$253	$201

[1] *Data taken from ASCE Failure to Act Series published 2011-13.*
[2] *Airport needs and gaps include anticipated cost of NextGen: $20 billion by 2020 and $40 billion by 2040.*
[3] *Total needs are federal and non-federal high hazard dams.*
[4] *Funding only includes publicly funded remediation, not funds from private sector.*
[5] *Total needs numbers is based on discussions with the National Committee on Levee Safety*
[6] *Total needs and funded included all costs associated with Parks and Recreation. Funding gap is capital needs only.*
[7] *These numbers are based on market projection and current investment trends.*
[8] *These numbers are based on the last available national data collection and brought to current market dollars*

Note: In previous versions of the *Report Card*, this figure was estimated on a five-year basis. In 2013, ASCE completed our economic study series (*Failure to Act*) on America's current and future infrastructure investment needs. These studies provided investment need estimates until 2020, and we use the same timeframe to provide a look forward for all the categories in the 2013 *Report Card*.

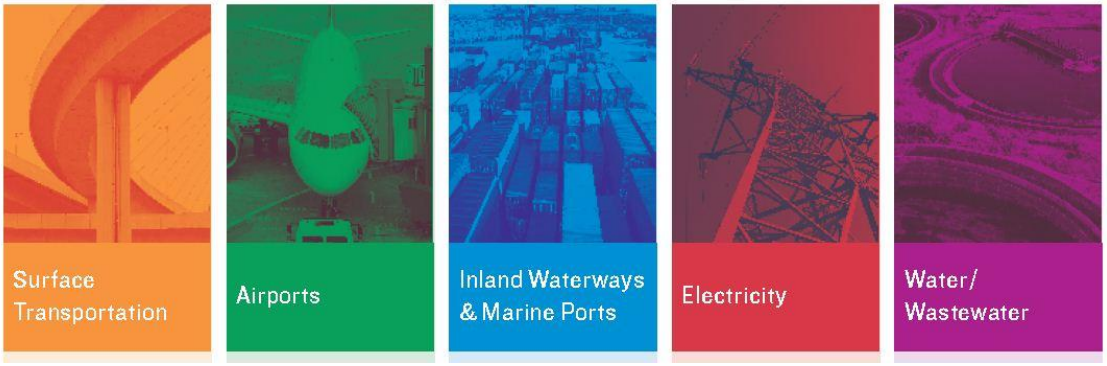
Grade Sheet: Economic Implications

The grades in the 2013 Report Card for America's Infrastructure are a comprehensive assessment of current infrastructure conditions across America. It is important to note that these infrastructure conditions have impacts on our economy as well.

In 2011, ASCE commissioned a series of economic reports called Failure to Act to provide an objective analysis of the economic implications for the United States of current investment trends in key infrastructure sectors. These first-of-a-kind reports were prepared for ASCE by the Economic Development Research Group of Boston to answer this central question:

What is the value to America's economy in the long term if we invest in our infrastructure today?

The results of the Failure to Act series focus on:



- Surface Transportation (including roads, bridges, and transit)
- Water and Wastewater
- Energy Transmission
- Airports, Inland Waterways and Marine Ports

Together, these reports cover 9 of the 16 categories addressed by the Report Card for America's Infrastructure.

Analyzing current investment trends for each infrastructure sector, the report conveys the economic impacts in terms of change in GDP, household income, employment, and exports in the years 2020 and 2040. In short, investing in infrastructure is an engine for long-term economic growth, increasing GDP, employment, household income, and exports. The reverse is also true – without investing, infrastructure can become a drag on the economy.

For more information on these reports, please visit www.asce.org/failuretoact.

Grade Sheet: Previous Grades

The concept of a report card to grade the nation's infrastructure originated in 1988 with the congressionally chartered National Council on Public Works Improvement report, *Fragile Foundations: A Report on America's Public Works*. When the federal government indicated they would not be updating the report after a decade, ASCE used the approach and methodology to publish the first *Report Card on America's Infrastructure* in 1998. With each new report in 2001, 2005, 2009, and now 2013, the methodology of the *Report Card* has been rigorously assessed so as to take into consideration all of the changing elements that affect America's infrastructure.

Category	1988*	1998	2001	2005	2009	2013
Aviation	B-	C-	D	D+	D	D
Bridges	-	C-	C	C	C	C+
Dams	-	D	D	D+	D	D
Drinking Water	B-	D	D	D-	D-	D
Energy	-	-	D+	D	D+	D+
Hazardous Waste	D	D-	D+	D	D	D
Inland Waterways	B-	-	D+	D-	D-	D-
Levees	-	-	-	-	D-	D-
Public Parks and Recreation	-	-	-	C-	C-	C-
Rail	-	-	-	C-	C-	C+
Roads	C+	D-	D+	D	D-	D
Schools	D	F	D-	D	D	D
Solid Waste	C-	C-	C+	C+	C+	B-
Transit	C-	C-	C-	D+	D	D
Wastewater	C	D+	D	D-	D-	D
Ports	-	-	-	-	-	C
America's Infrastructure GPA	C	D	D+	D	D	D+
Cost to Improve	-	-	$1.3 trillion	$1.6 trillion	$2.2 trillion	$3.6 trillion

**The first infrastructure grades were given by the National Council on Public Works Improvements in its report Fragile Foundations: A Report on America's Public Works, released in February 1988. ASCE's first Report Card for America's Infrastructure was issued a decade later.*

About The Report Card: Advisory Council

The grades and recommendations of the 2013 *Report Card for America's Infrastructure* are determined by a committee made up of 32 ASCE members, all experts in their areas of practice.

2013 *Report Card for America's Infrastructure* Advisory Council

Robert Victor, P.E., M.ASCE
Advisory Council Chairman,
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Robert Victor, P.E., M.ASCE, is an associate vice president with AECOM and is based in its Arlington, Virginia office. Prior to his time there, he worked in Pittsburgh, St. Louis, Seattle, Baltimore, and New Delhi and Mumbai, India, on a variety of transportation projects. Victor holds a bachelor of science in civil engineering degree from the University of Michigan and a master of science from the University of Illinois. He is a licensed professional engineer in six states. Victor currently sits on ASCE's Board of Direction and chairs its Committee on America's Infrastructure.

Geoffrey Baskir, AICP, M.ASCE
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Geoffrey Baskir, AICP, M.ASCE, is a supervising airport planner with Parsons Brinckerhoff, Inc. and is based in Herndon, Virginia. During a 32-year career, Baskir was responsible for planning and programming activities related to the redevelopment of Reagan National and Dulles International airports in Washington, D.C., and the development of programming documents for terminal facilities at Los Angeles International Airport. He is a governor with ASCE's Transportation and Development Institute and chair of the Aircraft/Airport Compatibility Committee of the Transportation Research Board.

John Bennett, P.E., M.ASCE
Columbia, Maryland

John Bennett, P.E., M.ASCE, recently retired from Amtrak's Policy Development Department unit, has more than three decades of experience in rail and public transportation strategy, policy, planning, and management, with extensive experience in capital program development and management. His collaborative planning experience includes multiyear investment programs for the $100-million New York Penn Station Central Control project, infrastructure investment requirements to add capacity and upgrade deferred investments for Amtrak's Northeast Corridor, and numerous regional transportation plans focusing on intercity and passenger rail investments.

Janey Camp, Ph.D., P.E.
Vanderbilt University
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Janey Smith Camp, Ph.D., P.E., is a research assistant professor in the Department of Civil and Environmental Engineering at Vanderbilt University, Nashville, Tennessee. Dr. Camp specializes in enterprise risk management, particularly as applied to extreme weather events and infrastructure adaptation, and has led several such projects, including a case study of the impacts on critical infrastructure of the May 2010 flood in Nashville, helping to organize an international summit, held at Vanderbilt University in June 2011, on climate science and thresholds of extreme weather events that prompt transportation infrastructure adaptation investment. She is engaged in a variety of professional activities involving infrastructure condition and resilience, is the recipient of the ASCE Tennessee Section's 2011 Young Engineer Award, and was recognized as the Eastern Region Younger Members Council 2012 Outstanding Younger Member in Community Activities.

Richard Capka, P.E., M.ASCE
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Richard Capka, P.E., M.ASCE, is chief operating officer for Dawson & Associates. He served as federal highway administrator and acting administrator for the U.S. Department of Transportation from 2005 to 2008 and as CEO/executive director of the Massachusetts Turnpike Authority from 2001 to 2002. Capka retired from a 30-year career in the U.S. Army Corps of Engineers in 2001 as a brigadier general. Among his posts, he served as commander of the Corps' South Atlantic Division, South Pacific Division, and the Baltimore District.

Stephen Curtis, P.E., D.PE, Dipl, M.ASCE
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Stephen Curtis, P.E., D.PE, Dipl, M.ASCE, is the program director – waterfront services for Collins Engineers Inc., headquartered in Chicago, and serves as the practice area leader for the firm's port and waterfront projects. During his 38 years of civil engineering practice, Curtis has served as a program, project, and construction manager for commercial private/public ports and waterfront development; bridge, highway, and intermodal freight rail; military base facility/utility; and potable water and wastewater treatment facility large-scale, complex projects. He is one of the at-large directors on the ASCE Board of Direction, a past president of the Coasts, Oceans, Ports, and Rivers Institute, and a past chair of the Ports and Harbors Technical Committee.

Gordon Davids, P.E., M.ASCE
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Gordon Davids, P.E., M.ASCE, is chief engineer – bridges of C&S Engineers, headquartered in Severna Park, Maryland. He retired in 2011 as chief engineer – structures in the Federal Railroad Administration (FRA) Office of Safety after a railroad and federal service career that began in 1958. He was in responsible charge of the FRA Railroad Bridge Safety Program from its inception in 1992, and was instrumental in development of FRA policy and several regulations concerning railroad infrastructure safety. In addition to ASCE, he is a life member of the American Railway Engineering and Maintenance of Way Association (AREMA), and active in several AREMA committees that provide industry practices for railroad structures.

Larry Frevert, P.E., PWLF, M.ASCE
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Larry Frevert, P.E., PWLF, M.ASCE, works part time as a senior consultant for TREKK Design Group, based in Kansas City, Missouri. He retired from public service following 36 years of combined service to the Missouri Department of Transportation and the City of Kansas City, Missouri, planning, designing, managing, operating, and maintaining public infrastructure. This service included eight years as deputy director/acting director of public works for Kansas City. Following retirement from public service and prior to joining TREKK, he spent six years with HDR Engineering as a vice president and national program director for public works. In 2007–08, he served as president of the American Public Works Association.

Henry Hatch, P.E., NAE, D.WRE, D.NE, Dist.M.ASCE
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Henry Hatch, P.E., NAE, D.WRE, D.NE, Dist.M.ASCE, retired from the U.S. Army as a lieutenant general, the chief of engineers, and commander of the U.S. Army Corps of Engineers. He is a past chair of the NRC Board on Infrastructure and the Constructed Environment, the NRC Federal Facilities Council, and a past national president of the Society of American Military Engineers. He is a registered professional engineer in the District of Columbia, a Distinguished Member of ASCE, a Distinguished Graduate of the United States Military Academy, and a member of the National Academy of Engineering.

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Andrew Herrmann, P.E., SECB, F.ASCE, chairman, is a principal of Hardesty & Hanover, LLP, Consulting Engineers, headquartered in New York City, ASCE's 2012 national president, and the past chair of the Report Card for America's Infrastructure. During his 39 years in transportation, Herrmann has been responsible for the design, inspection, rehabilitation, construction support, analysis, and rating of fixed and movable bridges, highways, railroads, and major transportation projects.

Chuck Hookham, P.E., M.ASCE
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Chuck Hookham, P.E., M.ASCE, is vice president of HDR Engineering, Inc. and is located in HDR's Ann Arbor, Michigan office. He has over 30 years of experience in power generation and transmission, industrial, infrastructure, and oil and gas industries, responsible for services ranging from initial development and environmental permitting through full-scale engineering, procurement, and construction (EPC) delivery of projects valued at over $1 billion. He serves on multiple ASCE Committees, including the Board Committee on Critical Infrastructure and Energy Division ExCom, and in leadership roles in many other technical organizations.

Fraser Howe, P.E., F.ASCE
METRO Consulting Group
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Fraser Howe, P.E., F.ASCE, received his bachelor's degree in civil engineering from Michigan State University and is a licensed professional engineer in Florida. As director of planning and engineering with METRO Consulting Group, Howe performs preliminary engineering studies for state and local governments and develops public involvement plans for engineering studies. He is an active leader within ASCE and has served as the ASCE Region 5 governor and led the development of the 2008 report card on Florida's infrastructure.

Brad Iarossi, P.E., M.ASCE
U.S. Fish and Wildlife Service
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Brad Iarossi, P.E., M.ASCE, is the chief of the Dam, Bridge, and Safety Branch of the U.S. Fish and Wildlife Service, where he manages the Dam Safety Program, which includes 300 dams. Previously, he served as the chief of the Dam Safety Program for Maryland's Department of the Environment for more than 16 years. With expertise in environmental regulation and water projects, Iarossi served as the chair of ASCE's National Water Policy Committee and served on the Committee on Government Affairs. He is also a past president of the Association of State Dam Safety Officials (ASDSO) and was the chairman of ASDSO's Legislative Committee for 19 years.

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Short Elliott Hendrickson
Omaha, Nebraska

Dale Jacobson, P.E., BCEE, D.WRF, F.ASCE, is a senior professional engineer with the consulting engineering firm Short Elliott Hendrickson (SEH). He is a professional engineer with 40 years of experience in municipal and industrial wastewater, drinking water, groundwater, solid waste, hazardous waste, and low-level radioactive waste. He has served as the project principal, project manager, or project engineer on numerous projects. He is a past president of the Environmental and Water Resources Institute of ASCE and currently serves on the board of the American Academy of Water Resources Engineers.

Sam Kito, P.E., M.ASCE
Juneau, Alaska

Sam Kito, P.E., M.ASCE, worked as the school facilities engineer for the State of Alaska Department of Education and Early Development for over five years. In that role, Kito was responsible for the state grant and debt funding programs for school facility construction and renovation in Alaska. He has 25 years of experience in the areas of planning, design, inspection, project management, and policy development. He has served as president of the local Juneau chapter of ASCE, and is past chair of the Legislative Liaison Committee for the Alaska Professional Design Council.

Maria Lehman, P.E., F.ASCE
New York State Thruway Authority
Buffalo, New York

Maria Lehman, P.E., F.ASCE, is the project director for risk and project controls for the new Tappan Zee Bridge at the New York State Thruway Authority. She has over 31 years of experience in both the private and public sectors, including commissioner of public works for Erie County, New York, and corporate director for quality assurance at URS Corporation. She has been responsible for planning, design, construction, operations, and maintenance for bridges, highways, railroads, transit, and facilities, including a public safety campus, convention center, office space, court buildings, botanical gardens, hospitals, higher education, prisons, stadiums, and zoo facilities. Lehman was a past member of ASCE's Board of Directors as a director in 1992–95 and as a vice president in 2001–03.

Otto J. Lynch, P.E., M.ASCE
Power Line Systems, Inc.
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Otto J. Lynch, P.E., M.ASCE, is the vice president of Power Line Systems, Inc., where among his responsibilities are product engineering, direction of technical development, support, and implementation of PLS-CADD with corporate users in more than 100 countries. For more than 25 years he has participated in the design and construction of numerous high-voltage transmission line projects around the world and was the pioneer in the use of LiDAR in the transmission line industry. Lynch is currently a member of the National Electric Safety Code and virtually all overhead transmission line industry-related ASCE and IEEE standards and committees.

Sarah Matin, P.E., M.ASCE
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Sarah Matin, P.E., M.ASCE, is a project engineer with Horizon Engineering Group, Inc. in Maitland, Florida. Matin has been the utility manager for many large roadway design/build projects and has also been involved with the roadway, drainage, and utility design for major transportation projects. She is the current president of the ASCE East Central Branch.

Jeffrey May, P.E., M.ASCE
Denver, Colorado

Jeffrey May, P.E., M.ASCE, has over 35 years of experience, including work for two transportation planning consulting firms, the Minnesota Highway Department, and the United Nations. During his career he worked on transportation plans and programs for highway and transit projects. He retired from the Denver Regional Council of Governments, where he was in charge of geographic information systems, aerial photography and mapping, socioeconomic forecasts, transportation and air quality modeling, water quality, and comprehensive planning.

Brian McKeehan, P.E., M.ASCE
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Brian McKeehan, P.E., M.ASCE, is currently a senior aviation manager with Delta Airport Consultants, Inc., headquartered in Richmond, Virginia. Over his 25-year career, McKeehan has held construction engineering positions in all three project roles (airport facilities engineer, consulting engineer, and contractor) and brings all three perspectives to each

project. He has managed over $250 million in construction, including aviation, healthcare, industrial, manufacturing, and commercial projects. He is serving on the Board of Governors of the ASCE Transportation and Development Institute, and is also active in the T&DI Airport Planning and Operations Committee.

Peter Merfeld, P.E, M.ASCE

Maine Turnpike Authority

Portland, Maine

Peter Merfeld, P.E, M.ASCE, is a licensed professional engineer in Maine with 23 years' experience, including 15 years with the Maine Turnpike Authority (MTA). Since 2000, as chief operations officer for the MTA, he is responsible for all maintenance, engineering, capital construction, public safety, and service plaza operations for the 110-mile Interstate toll road in southern Maine. Merfeld is the chair of the Committee on Maine's Infrastructure for the Maine section of ASCE, which is responsible for producing Maine's infrastructure report card. He is a past president for the Maine Section of ASCE, and from 2005 to 2010 served on ASCE's Construction Institute's Claims Avoidance and Resolution Committee. Merfeld recently finished nine years as a board director for the Maine Chapter of the Associated General Contractors of America (AGC) and is currently serving as a board director for the International Bridge, Tunnel and Turnpike Association (IBTTA).

Roger M. Millar Jr., P.E., F.ASCE, AICP, CFM

Smart Growth America

Missoula, Montana

Roger M. Millar Jr., P.E., F.ASCE, AICP, CFM, is a vice president of Smart Growth America (SGA) and director of SGA's Leadership Institute and the National Complete Streets Coalition. Over the past 30 years, Millar has held leadership positions in the public and private sectors, most recently as director of the Missoula, Montana City/County Office of Planning and Grants. Projects in which he played a leadership role—in particular, the Portland River District Development Plan and the Portland Streetcar—are seen as national models. Millar is a member of ASCE's Transportation Policy Committee, a past chair of ASCE's National Infrastructure and Research Policy Committee, and past chair of the Pacific Northwest Council of ASCE.

Paul F. Mlakar, Ph.D., P.E., Dist.M.ASCE

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John P. Sullivan, P.E., M.ASCE, is chief engineer of the Boston Water and Sewer Commission responsible for the design, rehabilitation, and construction management of over 2,500 miles of water, wastewater, and storm systems. During his 40 years with Boston, he has overseen the transformation of an aging piping system dating to 1848 to a vibrant, life-sustaining, water distribution and wastewater and storm drainage collection system.

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