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Statement for the Record of

The American Society of Civil Engineers

on

**National Science Foundation: Advancing Research for the Future of U.S.
Innovation**

**Subcommittee on Research and Technology
Committee on Science, Space, and Technology
U.S. House of Representatives**

April 28, 2021

Introduction

The American Society of Civil Engineers (ASCE)¹ appreciates the opportunity to submit a statement to the House Science Committee's Subcommittee on Science and Technology for the hearing "National Science Foundation: Advancing Research for the Future of U.S. Innovation."

ASCE would like to commend full Committee Chair, Eddie Bernice Johnson and Ranking Member, Frank Lucas for their leadership and support of federal "the National Science Foundation (NSF) for the Future Act." ASCE supports the legislation and urges members of the Science Committee and the House to work with the Senate to enact legislation to strengthen our nation's research enterprise, and NSF in particular.

Civil engineers are responsible for the planning, design, construction, operations, and maintenance of physical infrastructure, including communication facilities, energy generation and distribution facilities, industrial buildings, transportation networks, water supply and sanitation systems, and flood control structures. Most infrastructure is built to provide long service lives (50 - 100 years), and are expected to remain functional, durable, and safe. However, the increasing frequency and intensity of natural disasters, combined with increasing population densities, and system interdependencies have demonstrated vulnerabilities in the nation's infrastructure. This, coupled with the fiscal challenges of rebuilding, highlights the importance of research to develop new materials and innovative processes that can increase efficiencies in infrastructure renewal.

ASCE and NSF share common interests and objectives. Broadly speaking, both promote progress in engineering and recognize the importance of engineering research and education for advancing national prosperity, welfare, and quality of life. Maintaining strong and steadily increasing support for research and education in civil engineering is critical to train an innovative and creative workforce capable of serving the increasingly complex needs of society.

ASCE supports the mission of the NSF and its research across all disciplines of basic scientific research to promote the progress of science; to advance the national health, prosperity, and welfare; and to secure national defense. ASCE supports making the research and education activities of NSF a national priority for funding. Additionally, ASCE urges that the current system of support for basic research based upon excellence, competitive scientific merit and peer review be preserved.

¹ ASCE was founded in 1852 and is the country's oldest national civil engineering organization. It represents more than 150,000 civil engineers individually in private practice, government, industry, and academia who are dedicated to the advancement of the science and profession of civil engineering. ASCE is a non-profit educational and professional society organized under Part 1.501(c) (3) of the Internal Revenue Code. www.asce.org,

To ensure the nation's infrastructure systems continue to provide critical services and acceptably low risks of failures over time, engineers, designers, planners, and policymakers must incorporate system resilience and innovation into the decision-making process. A steady stream of research and innovation growing out of NSF and other federal programs is essential to continue making progress and building smarter.

Our nation's infrastructure system is only as strong as its weakest link—if our roadways become too rough or flooded to travel, if our bridges close to heavier traffic like ambulances, if a region's energy grid is devastated by high winds, or if our levees protect one community at the expense of another, the economy grinds to a halt. Therefore, the foundational step in building smarter and improving resilience is first in assessing the nation's existing infrastructure needs and conditions.

Challenge

The U.S. science and engineering (S&E) enterprise continues to perform the largest share of global research and development (R&D), generates the largest share of research and development intensive industry output globally, awards the largest number of S&E doctoral degrees, and accounts for significant shares of S&E research articles and citations worldwide. However, other nations, are rapidly developing their science and technology (S&T) capacity and this affects the position of the United States relative to the other major global players.

Since 2000, the rise in U.S. R&D was driven mainly by the industry, which continues to perform and fund most of the overall R&D in the United States. During this period, the share of U.S. R&D funded by the federal government has declined. This decline is notable as federally funded R&D is an important source of support, particularly for the higher education sector and for the nation's basic research enterprise.

The U.S. has seen its relative share of global S&T activity remain unchanged or shrink. As more countries around the world develop R&D and human capital infrastructure to sustain and compete in a knowledge-oriented economy, the U.S. is playing a less dominant role in many areas of S&E activity.

ASCE's 2021 Report Card for America's Infrastructure

Every four years, ASCE publishes the *Report Card for America's Infrastructure*, which grades the nation's major infrastructure categories using a simple A to F school report card format. The Report Card examines the current infrastructure needs and conditions by assigning grades and making recommendations to raise them. The 2021 *Report Card for America's Infrastructure*¹ was released on March 3, 2021 and graded 17

¹ <https://infrastructurereportcard.org/>

categories with the cumulative grade of “C-.” This grade represents the first time in 20 years that our infrastructure is out of the “D” range. The 2021 Report Card demonstrates that we have made some incremental progress toward restoring our nation’s infrastructure, however much work is left to be done.

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

The Report Card also clearly illustrates that we are still only paying about half of our infrastructure bill, as the total investment gap has gone from \$2.1 trillion over 10 years to nearly \$2.59 trillion over 10 years. As ASCE discovered in its 2021 study, *Failure to Act: Economic Impacts of Status Quo Investment Across Infrastructure Systems*¹, failing to close this infrastructure investment gap brings serious economic consequences. Poor roads and airports mean travel times increase. An aging electric grid and inadequate water distribution make utilities unreliable. Problems like these translate into higher costs for businesses to manufacture and distribute goods and provide services. These higher costs, in turn, get passed along to workers and families. By 2039, America’s overdue infrastructure bill will cost the average American household \$3,300 a year, or \$63 a week. When we fail to invest in our infrastructure, we pay the price.

Solutions

ASCE’s Report Card does not just define the challenges we face, but makes recommendations to address our infrastructure problems, improve our quality of life, and strengthen our international competitiveness. The solutions include bold **leadership and action**, sustained **investment including investment in research and development**, and a **focus on resilience** to raise the national infrastructure grade over the next four years, so that every American family, community, and business can thrive.

Strong leadership and decisive action require a clear understanding of what the United States needs to achieve an infrastructure system fit for the future. To close the nearly \$2.59 trillion 10-year investment gap identified in the 2021 Report Card, meet future needs, and restore our global competitive advantage, we must increase investment from all levels of government and the private sector from 2.5% to 3.5% of U.S. Gross Domestic Product (GDP) by 2025.

¹ <https://infrastructurereportcard.org/resources/failure-to-act-economic-reports/>

As we consider these long-term investments, it must be through the lens of ensuring that our nation's infrastructure is resilient - using new approaches, materials, and technologies to ensure infrastructure systems can withstand or quickly recover from natural or man-made hazards. We must leverage proven and emerging technology to make use of limited available resources.

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

Advancements in resilience across all infrastructure sectors can be made by:

- Enabling communities to develop and institute their own resilience pathway for all infrastructure portfolios by streamlining asset management, implementing **life cycle cost analysis** into routine planning processes, and **integrating climate change projections** into long-term goal setting and capital improvement plans.
- Incentivizing and enforcing the use of **codes and standards**, which can mitigate risks of major climate or manmade events.
- Understanding that our infrastructure is a system of systems and encourage a dynamic "big picture" perspective that weighs tradeoffs across infrastructure sectors while keeping resilience as the chief goal.
- Prioritizing projects that improve the safety and security of systems and communities, to ensure continued reliability and enhanced resilience.
- Improving land use planning across all levels of decision-making to strike a balance between built and natural environments, while meeting community needs, now and into the future.
- Enhancing the resilience of various infrastructure sectors by including or enhancing natural or "green" infrastructure.

Building on Progress

ASCE applauds Congress for the attention and focus on infrastructure and the role that scientific and engineering research plays. The NSF is an independent federal agency created by Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense..." NSF is vital because of its support for basic research and the researchers who create knowledge that transforms the future. Independent basic research is a primary driver of the U.S. economy; has enhanced the nation's security; and advanced knowledge to sustain global leadership.

The U.S. research enterprise has been tremendously successful over the decades. This success has been guided by the scientific and engineering communities through a strong system of merit review and advisory committees, trust, and respect. ASCE supports efforts to enhance and revitalize NSF and the nation's research enterprise.

Conclusion

ASCE once again thanks the Subcommittee on Research and Technology for holding this hearing and highlighting the importance of the NSF and its role in the nation's prosperity and national well-being.

ASCE urges Congress to move forward to increase the investment in research and development that recognizes its importance to the national economy and security. ASCE supports the mission of the NSF and its research across all disciplines of basic scientific research to promote the progress of science; to advance the national health, prosperity, and welfare; and to secure national defense. ASCE supports making the research and education activities of NSF a national priority for funding. Additionally, ASCE urges that the current system of support for basic research based upon excellence, competitive scientific merit and peer review be preserved.

If you need more information or ASCE can be of further assistance, please do not hesitate to contact [Martin Hight](mailto:mhight@asce.org), ASCE's Senior Manager for Government Relations at mhight@asce.org or 202-789-7843.