APPENDICES

APPENDICES

APPENDIX A ★ Previous *Report Card* Grades

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

APPENDIX B

Take Action Now

The problems facing our nation's infrastructure may seem daunting and their solutions beyond the ability of the average person to devise, but these problems are in fact solvable. It is true that improving the quality of infrastructure means that we have to make changes in technology, planning, and the political process, but it all begins with you.

Americans must demand that their leaders support a first-class infrastructure that can meet the challenges of today and tomorrow. Public involvement in solving the nation's infrastructure problems is critical to our future success. Two of the most important things you can do are to become educated about the problems we face and to speak out about this critical issue to your community and political leaders, friends, and neighbors.

Web Site

You can learn more about the state of the nation's infrastructure on the *Report Card for America's Infrastructure* web site (www.asce.org/reportcard), where you will find detailed information on the condition of America's various public works systems and what must be done to restore them, as well as ideas for how you as an individual can help. You will be able to participate in discussions on various aspects of the nation's infrastructure, including the issues in your own region, and share what you have learned with others. Perhaps most importantly, you will be able to send letters directly to your elected officials informing them of your support for this critical issue and requesting their attention and action.

Online Community

You can also keep up on day-to-day infrastructure news on ASCE's *Our Failing Infrastructure* blog (www.asce.org/govrel/blog). In addition, you can join the online community of infrastructure supporters on Facebook by searching for the group "Save America's Infrastructure" and inviting your friends to join. ★

APPENDIX C

2009 *Report Card for America's Infrastructure* Advisory Council

Andrew Herrmann, P.E., SECB, F.ASCE, ***Chairman***, is a partner of Hardesty & Hanover, LLP, Consulting Engineers, headquartered in New York City, and serves as partner-in-charge of many of the firm's bridge projects. During his 35 years with the firm, 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. He is ASCE's Assistant Treasurer and a past member of the Board of Direction.

Donald L. Basham, P.E., M.ASCE, is the former Chief of Engineering and Construction for the U.S. Army Corps of Engineers. His career in engineering, construction, and program and project management spans more than 40 years. He was most recently a member of the National Commission on Levee Safety.

John Bennett, P.E., M.ASCE, leads policy development with Amtrak's Strategic Partnerships unit. He has more than three decades of experience in rail and public transportation strategy, policy, planning, and management, including extensive experience in capital program development and management. His collaborative planning experience includes multi-year 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 the definition of capacity enhancement projects for the I-95 Corridor Coalition's Mid-Atlantic Rail Operations study.

Jeanette A. Brown, P.E., BCEE, F.ASCE, D.WRE, is the Executive Director of the Stamford Water Pollution Control Authority. She is also an adjunct professor of environmental engineering at Manhattan College. Brown has 30 years of experience in wastewater treatment. She is considered an authority on operations of biological nitrogen removal processes and sludge management. She is currently the Vice President of the ASCE Environmental and Water Resources Institute.

Charles C. Calhoun, JR., P.E., F.ASCE, is a consultant in private practice. He retired as the Deputy Director of the U.S. Army Corps of Engineers' Research and Development Center, Coastal and Hydraulics Laboratory, after more than 35 years of distinguished service. Calhoun is a past president of the Board of Governors of the ASCE Coasts, Oceans, Ports, and Rivers Institute and has served as the chairman of ASCE's Waterway Committee. He is also a past commissioner and a past vice president of the U.S. Section of the International Navigation Association.

J. 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.

Robert A. Dalrymple, PH.D., P.E., F.ASCE, is the Willard and Lillian Hackerman Professor of Civil Engineering at Johns Hopkins University, specializing in coastal engineering. He is a past chair of ASCE's Coasts, Oceans, Ports, and Rivers Institute; the chair of ASCE's Coastal Engineering Research Council; and a member of the Transportation Research Board of the National Academy of Science's Marine Board. He was elected to the National Academy of Engineering in 2006.

Michael DeVoy, P.E., M.ASCE, is the Director of Airports and Navaids for RW Armstrong. His specialty is developing and overseeing the design process from the concept stages to construction documents. He is the immediate past chairman of the Airport Consultants Council (ACC) Board of Governors.

David Gehr, M.ASCE, is the Senior Vice President for the Americas Highway Market of Parsons Brinckerhoff. Previously, he served in several senior management positions with the Virginia Department of Transportation, including six years as the Chief Administrative Officer of the agency. Gehr has 40 years of professional experience in transportation engineering and policy and is active in several professional organizations.

Henry J. Hatch, P.E., 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 and the Federal Facilities Council. He is a past national president of the Society of American Military Engineers and currently chairs the Natural Sciences and Engineering Committee of the U.S. National Commission for UNESCO. He is a registered professional engineer in the District of Columbia, a Distinguished Member of ASCE, and a member of the National Academy of Engineering.

Brad Iarossi, P.E., M.ASCE, is the Chief of the Dam, Bridge, and Safety Branch of the U.S. Fish and Wildlife Service. 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 has been the chairman of ASDSO's Legislative Committee since 1992.

Dale Jacobson, P.E., BCEE, F.ASCE, is the President of Jacobson Satchell Consultants, a consulting engineering firm. 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 the President of the ASCE Environmental & Water Resources Institute and serves on the Board of Civil Engineering Certification, Inc.

Leon Kempner, JR., PH.D., P.E., M.ASCE, has more than three decades of experience as a structural engineer for the Bonneville Power Administration. His career assignments have included structural engineering analysis and the design and research of transmission line facilities. Dr. Kempner is active in many national and international electrical transmission engineering professional organizations and has contributed to many technical publications addressing transmission line structural engineering issues.

Otto J. Lynch, P.E., M.ASCE, is the Vice President of Power Line Systems, Inc., the industry standard provider of overhead transmission line design software. For more than 20 years he has designed and built high-voltage transmission lines around the world and is a highly sought-after instructor for transmission line design seminars to share his worldwide perspective. Lynch is currently the chair of several ASCE standards committees, an active member of multiple ASCE and IEEE committees, and is a member of the National Electric Safety Code.

Roger M. Millar, JR., P.E., F.ASCE, AICP, CFM, is the Director of the Missoula City-County Office of Planning and Grants. He has more than 25 years of professional experience in the public and private sectors. 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 for urban livability. 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., F.ASCE, is the Senior Research Scientist in the U. S. Army Corps of Engineers' Research and Development Center at Vicksburg, Mississippi. Dr. Mlakar has 43 years of experience in protective construction and the application of this military technology to civilian practice, including in U. S. embassies and other prominent buildings. He is a past chair of ASCE's Committee on Critical Infrastructure. He also led the ASCE study of the Pentagon building performance during and immediately following the September 11, 2001 terrorist attack and participated in ASCE's investigation of the April 19, 1995 bombing of the Alfred P. Murrah Federal Building in Oklahoma City, Oklahoma.

James K. Murphy, P.E., CFM, M.ASCE, has more than 30 years of experience consulting with the Federal Emergency Management Agency and more recently with the Department of Homeland Security (DHS), including providing levee policy recommendations. He currently represents the Association of State Floodplain Managers as Vice Chairman on the DHS, Office of Infrastructure Protection, Levee Sector Coordinating Subcouncil, and as a project director for the URS Corporation.

Peter G. Nicholson, PH.D., P.E., F.ASCE, is a professor of civil engineering and the graduate chair of the Department of Civil and Environmental Engineering at the University of Hawaii at Manoa. He is a past chair of the Embankments, Dams & Slopes Committee for ASCE's Geo-Institute and a member of ASCE's Inspection of Dam Standards Committee. Dr. Nicholson has been consulting on dam safety, design, and rehabilitation for more than 20 years in Hawaii and California.

Robert E. Nickerson, P.E., M.ASCE, who has more than 30 years of experience in the electrical utility industry, is an independent consulting structural engineer specializing in the design, analysis, and upgrading of electrical transmission systems. This experience includes three key areas: analysis and design of transmission structures; research and full-scale testing of transmission structures; and currently, in development of transmission models for system analyses and upgrades.

Thomas M. Rachford, PH.D., P.E, F.ASCE, is a Vice President of Gannett Fleming, Inc., an engineering and planning firm headquartered in Harrisburg, Pennsylvania. He has been with Gannett Fleming since 1973. He is a past president of the ASCE Environmental and Water Resources Institute and is a current member of the ASCE Board of Direction.

Debra R. Reinhart, PH.D., P.E., BCEE, F.ASCE, is a professor and the interim Director of the NanoScience Technology Center at the University of Central Florida. Dr. Reinhart is the President of the American Academy of Environmental Engineers and a member of 7 national professional and technical organizations and many national committees. She is the author of more than 100 books, papers, and presentations.

Thomas S. Slater, P.E., M.ASCE, is a leading expert, author and lecturer in aviation engineering and management for Reynolds, Smith and Hills, a national airport planning and consulting firm in Raleigh, North Carolina. He is a past member of ASCE's Transportation Policy Committee and chairman of the Annual Air Transport Conference in 2004. Slater has more than 25 years of experience serving the airport and aviation community.

Paul C. Taylor, P.E., M.ASCE, has served as the Deputy Chief Executive Officer of the Orange County Transportation Authority (OCTA) since March 2007. In the previous three years at the OCTA, he had responsibility for planning, engineering, and

constructing all transportation programs and projects in Orange County, including highways, commuter rail, and multimodal corridor improvements. A licensed civil engineer, Taylor has spent more than 30 years managing major public sector capital and operational improvement programs in Southern California.

Paulo Valerio, P.E., A.M.ASCE, is the Engineering Designer for the Maryland National Capital Park and Planning Commission in Prince George's County, Maryland. He oversees design and construction management for park and recreation facilities.

C. Michael Walton, PH.D., P.E., DIST. M.ASCE, is a professor of civil engineering and holds the Ernest H. Cockrell Centennial Chair in Engineering at the University of Texas at Austin. Walton's distinguished career in transportation policy and engineering analysis spans more than 30 years and is highlighted by his contributions to many transportation professional societies and technical publications.

Thomas R. Warne, P.E., M.ASCE, is the president of Tom Warne and Associates, LLC, a consulting firm assisting public agencies in becoming more effective and private companies in becoming more profitable in the 21st century. Projects and engagements have included large design-build efforts, strategic planning, succession management, legislative initiatives, market analysis, process improvement initiatives, and client interventions. In addition, Warne served as president of the American Association of State Highway and Transportation Officials in 2000.

David L. Westerling, PH.D., P.E., F.ASCE, is a professor of civil engineering at Merrimack College in North Andover, Massachusetts. Dr. Westerling is a former ASCE Congressional Fellow and a past president of the Boston Society of Civil Engineers. He has more than 35 years of engineering experience in the public and private sectors. Dr. Westerling was elected town moderator in Harvard, Massachusetts.

Kevin Womack, PH.D., P.E., M.ASCE, is a professor of Civil and Environmental Engineering at Utah State University and the Director of the Utah Transportation Center, specializing in transportation infrastructure and policy. Womack is a past ASCE Congressional Fellow, working for the Senate Environment and Public Works Committee during the drafting of SAFETEA-LU, and has just completed a term as the chair of the ASCE National Transportation Policy Committee. ★

APPENDIX D

Methodology

In the development of the *Report Card* grades, 7 fundamental components of the infrastructure were considered. The fundamental components were not weighted. The grade for each category was allocated at the discretion of the *2009 Report Card for America's Infrastructure* Advisory Council on the basis of their review and analysis of the data. These experts in the subject areas may have determined grades on the basis of a particular plus or minus in any of the components.

The fundamental components assessed were:

- ★ **CAPACITY:** Evaluate the infrastructure's capacity to meet current and future demands.
- ★ **CONDITION:** Evaluate the infrastructure's existing or near future physical condition.
- ★ **FUNDING:** Identify 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. (For more information on resilience, see below.)

GRADING CRITERIA

The *2009 Report Card for America's Infrastructure* followed a traditional letter grade scale.

A = 90–100%
B = 80–89%
C = 70–79%
D = 51–69%
F = 50% or lower

RESEARCH AND GRADING PROCESS

1. Review available data or surveys for each category. Data collected will be used as follows:

- ★ Assess infrastructure using existing reported grades;
- ★ Identify current amount being spent and dollars needed to replace existing infrastructure, in 2009 dollars;
- ★ Identify dollars needed to upgrade infrastructure to meet future needs;
- ★ Identify percent capacity of problem;

★ Identify quantity of infrastructure, number of bridges, miles of road, pipe, etc.;
★ Assess consequences of doing nothing.

2. Compile and analyze the data, resulting in the development of a summary report. The following criteria will be used in presenting the data:
★ Total need defined by dollars needed;
★ Existing and future needs and current funding levels;
★ Percent of capacity represented by the problem;
★ Quantity that the problem represents;
★ Progress made in category from previous report card, including condition, funding, etc.;
★ Consequences of doing nothing.

3. Determine an initial grade.

4. Analyze, validate, and determine final grade.

RESILIENCE

Infrastructure resilience is the capability of systems to prevent or protect against significant multihazard threats and the ability to recover rapidly and ensure continuity of critical services, with minimal negative impact to public health and safety. In evaluating resiliency for each of the 15 categories, the following criteria were considered:
★ Risk and consequence management (both within each sector and across sectors);
★ Life-cycle maintenance;
★ Sector and system interdependencies;
★ Time, ease and cost of recovery.

As the metrics for evaluating resilience are in their infancy, the *2009 Report Card for America's Infrastructure* includes brief qualitative comments for each category. There is an overarching need to develop multihazard risk assessments for each sector and use them to inform public perceptions and priorities.

As applied to infrastructure, the concept of evaluating resilience embodies a shift from a strategy based on pure protection to one that ensures the continuity of operations in the face of aging as well as man-made and natural hazards. The scope of resilience includes security, disaster preparedness and mitigation, and response and recovery activities. A strong, prosperous, and competitive nation must develop and maintain a resilient infrastructure. ★

APPENDIX E

Sources for Estimated 5-Year Investment Needs

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U.S. Environmental Protection Agency, *The Clean Water and Drinking Water Infrastructure Gap Analysis*, 2002. ★

APPENDIX F

Photography Credits

ASCE would like to thank the following organizations for providing the photos contained in this report.

EXECUTIVE SUMMARY

Montgomery County, Maryland photo courtesy of The Gazette / Gazette.Net.

WATER AND ENVIRONMENT

DAMS Martinez Creek Dam No. 5 photo courtesy of the San Antonio River Authority. Skyline Lake Dam photo courtesy of New Jersey Department of Environmental Protection, Office of Engineering and Construction. NRCS Rehabilitated Dam photo courtesy of the U.S. Natural Resources Conservation Service.

DRINKING WATER Groundwater Replenishment System photos courtesy of Orange County Water District. Downtown Water Main Project photos courtesy of the City of Port Angeles.

HAZARDOUS WASTE Sequim Bay Estuary Restoration photo courtesy of the Jamestown S'Klallam Tribe. Brownfield Cleanup photo courtesy of the U.S. Environmental Protection Agency.

LEVEES Investment in Levees photo courtesy of the California Department of Water Resources, Division of Safety of Dams. Levee Protection photo courtesy of Angelle Bergeron, New Orleans Correspondent, *Engineering News-Record*.

SOLID WASTE Food Scraps Diversion Program photo courtesy of Norcal Waste. Orange County Landfill photos courtesy of Debra R. Reinhart, Ph.D., P.E., BCEE, F.ASCE. Greater Detroit Resource Recovery Facility photos courtesy of the Greater Detroit Resource Recovery Authority.

WASTEWATER North City Water Reclamation Plant photo courtesy of the City of San Diego. Pervious Paving photo courtesy of Mutual Materials and UNI-GROUP U.S.A. Sewer Separation Project photo courtesy of Washington Area Sewer Authority.

TRANSPORTATION

AVIATION Sea-Tac International Airport photo courtesy of Sea-Tac Airport. Chicago-O'Hare International Airport photo courtesy of the City of Chicago. Center Taxiway, Los Angeles International Airport photo courtesy of LAWA-LAX (Los Angeles World Airports/Los Angeles International Airport). Next Generation Ground Based Augmentation System, Newark Liberty International Airport photo courtesy of the Port Authority of New York and New Jersey. Philadelphia International Airport photo courtesy of Matthew Johnson, skyscrapersunset.com

BRIDGES Accelerated Bridge Construction photos courtesy of Utah Department of Transportation. Woodrow Wilson Bridge photo courtesy of the Wilson Bridge Project. The MacArthur Maze Repairs photo courtesy of California Department of Transportation, photographed by John Huseby.

INLAND WATERWAYS McAlpine Lock, Ohio River, photo Courtesy of the U.S. Army Corps of Engineers, Louisville District. Delaware River Channel Deepening Project photos courtesy of the U.S. Army Corps of Engineers, Philadelphia District. Lock 22, Upper Mississippi River System photo courtesy of the U.S. Army Corps of Engineers, Rock Island District.

RAIL Chicago Region Environmental and Transportation Efficiency Program photos courtesy of the CREATE partners. Alameda Corridor photo courtesy of AECOM. Amtrak's Northeast Corridor photo courtesy of Amtrak.

ROADS I-495 Virginia HOT Lanes Project photo courtesy of Transurban. Median Crash Barriers photo courtesy of the Roadway Safety Foundation. The Marquette Interchange Renovation photos courtesy of the Wisconsin Department of Transportation.

TRANSIT Utah Transit Authority Transit Express (TRAX) photos courtesy of Utah Transit Authority Transit Express. Regional Transportation District Transit System photo courtesy of LightRail*Now*, photo by Dave Dobbs. Missoula Urban Transportation District (Mountain Line) photo courtesy of Missoula, Montana Office of Planning and Grants. Orange County Transportation Authority photos courtesy of Orange County Transportation Authority.

PUBLIC FACILITIES

PARKS AND RECREATION The Trust for Public Land photo courtesy of Julieth Rivera, Trust for Public Land. State-Local Government Partnerships photos courtesy of Portland Department of Parks and Recreation.

SCHOOLS Seismic Retrofits photo courtesy of Portland Public Schools. School Modernization Program photo courtesy of Cincinnati Public Schools, photo by Robert Flischel. Improvements to Camden High School photo courtesy of Camden City Public Schools.

ENERGY

ENERGY American Electric Power's (AEP) Jacksons Ferry-Wyoming 765 kV Transmission Line photo courtesy of American Electric Power. Smith to North Clark 345 kV Transmission Line photo courtesy of East Kentucky Power Cooperative. Palo Verde to Pinal West 500 kV Project photo courtesy of Black & Veatch. Arrowhead to Weston 345 kV Transmission Line photo courtesy of the American Transmission Company. ★