

# ***A Partnership for the Advancement of Infrastructure and its Renewal through Innovative Products and Practices***

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## **PREFACE**

This paper describes a national, broad-based initiative to change fundamentally the way we repair and renew our built environment. The nation's infrastructure is critical to sustained economic development and an improved quality of life. One need not be a professional engineer to recognize the high costs associated with a national physical infrastructure that is functionally obsolete, structurally deficient, or physically unsafe. The needs of a 21st century citizenry cannot be met by using generations-old products and strategies to repair and construct our nation's critical physical facilities. A piecemeal and reactive approach to infrastructure policy will only allow us to navigate from crisis to crisis.

The **Partnership for the Advancement of Infrastructure and its Renewal**, or PAIR, aims to put an end to the management-by-crisis approach to infrastructure repair and renewal. PAIR will work with leaders from both the private and public sectors to form collaborative partnerships that bring the very best construction technologies and processes to the market place. The Partnership will try to shorten the unconscionably long timeframe currently needed to take state-of-the-art construction technologies and deploy them on a broad scale.

PAIR is designed to supplement – not supplant - the many initiatives in both the private and public sectors that are addressing the need for proactive infrastructure repair and renewal. PAIR will identify and build on those programs that share the same strategic mission of creatively revitalizing the infrastructure through innovative products and processes. Implementation of the plan described herein will be a function of the ability of a united coalition of industry, government, associations, and individuals to work together to achieve a common goal. The ability to carry out the plan will depend on the resources committed to the enterprise and a passion for the vision it represents.

The Civil Engineering Research Foundation (CERF), a not-for-profit organization dedicated to speeding the delivery of innovation to the engineering and construction marketplace, has developed the implementation plan for PAIR. In this effort, CERF has received guidance and support from a host of infrastructure stakeholders from the private and public sectors. In particular, CERF is pleased to recognize the technical advice and financial support of the agencies represented on the National Science and Technology Council's Construction and Building Subcommittee and the Committee on Technology.

## **PAIR: A CONCEPT WHOSE TIME HAS COME**

The PAIR will fill a critical technology gap in our nation's approach to the care, maintenance, and renewal of the physical infrastructure. PAIR is a response to a traditionally fragmented, reactive approach to infrastructure renewal. PAIR will combine efforts of the private sector, government, professional associations, and academia to identify and implement the innovative products and practices needed to meet the nation's 21st century requirements for physical infrastructure, enabling economic development and improved quality of life. Research and innovation in many fields provide a firm technical basis for PAIR. Political and social scientists support innovations in planning, financing, delivering, operating, and maintaining infrastructure systems that meet public and private needs and receive public and private support. The engineering and physical sciences have produced safe, environmentally friendly, durable and

economical materials and systems. Information sciences provide revolutionary capabilities for access to the information needed for infrastructure decisions and for cost-effective automation in design, construction, operation, and maintenance.

The goal of the PAIR initiative is to forge partnerships in an environment of unprecedented collaboration, providing the focal point for a nationally coordinated program. The Partnership will complement programs such as the Rebuild America Coalition, which seeks public and private support for the investments needed to revitalize the nation's infrastructure. PAIR will facilitate collaborations among different infrastructure stakeholders. The initiative will supplement, rather than supplant, important and effective programs for research and innovation in specific sectors and disciplines. PAIR's synthesis of private and public resources will provide opportunities to influence the research, development, testing, and evaluation process (RDT&E) and improve enabling codes, standards, and practices. PAIR will also showcase innovative products and processes for design and construction; methods to facilitate their acceptance by investors and regulators; and methods to encourage research to reduce knowledge gaps and other barriers to innovation.

The "physical infrastructure" may be described generally as *the physical systems used by firms, the public, and the government to sustain and improve community and commerce*. These systems include all the materials, components, subsystems, and controls that go into the built environment. Broadly, the infrastructure comprises all forms of:

- Transportation systems and transport corridors
- Water supply and distribution systems
- Waste management and sewerage systems
- Schools and other public facilities
- Energy generation and distribution systems
- Communications and information management systems

While there have been important private and public sector initiatives to improve the national infrastructure, to date there is no well-coordinated and accepted national infrastructure policy. In its 1991 study of the national infrastructure, the Congressional Office of Technology Assessment (OTA) noted that historically research, development, testing, and evaluation of infrastructure technology "always targeted specific problems identified by the funding agency; consequently, research in federally funded laboratories and institutions is oriented toward the concerns of the sponsor and usually involves numerous, disparate projects." Accordingly, the study noted, "no agency has focused on R&D programs to make public works services more cost-effective and productive." Not surprisingly, the nation currently suffers from a fragmented approach to infrastructure research and implementation. Our approach to infrastructure repair and renewal has been reactive and shortsighted.

## **PAIR WILL SUPPORT THE IDENTIFICATION AND IMPLEMENTATION OF HIGH-IMPACT PROJECTS**

Demonstration projects that clearly show the application of innovative and appropriate technologies are the key to making the public aware that the physical infrastructure is a national asset that requires attention. Schools, roads, and bridges are targeted as high-priority focus areas in the near term.

The promotion of high-visibility demonstration projects is essential to increasing the public's awareness of the benefits of innovative technologies to the nation's infrastructure revitalization efforts. PAIR demonstration projects will utilize available innovative technology. Initial demonstrations will focus on (1) schools and (2) highways and bridges. PAIR will aggressively pursue private sector in-kind and cash

contributions to directly support demonstration projects. Public sector support will be essential in identifying and securing appropriate demonstration sites.

### **The Rebuilding of Our Nation's Schools is Vital to an Educated and Well-Trained Citizenry**

According to a 1998 ASCE study, schools are in worse shape than the rest of the infrastructure. In established cities and neighborhoods, many school buildings are showing their age. Many inner-city schools, due to scarce resources for maintenance and repair, are subject to frequent failure of building systems, leaking roofs, poor climate control, and other problems. Some studies have directly linked the physical and cosmetic state of school buildings to adverse effects on not only student performance, but also teacher morale and effectiveness. Further, changes in the approach to teaching, including the incorporation of computers into the classroom, have rendered many classrooms obsolete. Many of the existing school buildings are still quite serviceable if appropriately renovated. Benefits in the area of building automation and control will include the development and demonstration of measurements and standards that will enable open, integrated, and automatic environmental, safety, and security control systems for the nation's schools. The NIBS clearinghouse for education could be a major resource in this effort. Appropriate use of existing technologies can make our older school buildings comfortable, safe, and inviting spaces where our children will thrive. A strong effective K-12 education system is a critical element to maintaining continued U.S. economic success. Innovations demonstrated on schools will have broad applicability to other types of buildings.

### **The Condition of the Nation's Roads and Bridges is Directly Related to Economic Development and Quality of Life**

There are several reasons for targeting roads and bridges. They are the most visible and heavily used element of the physical infrastructure, and the public is immediately affected when roads and bridges fail to "work." Moreover, congestion, road conditions, construction delays and other factors directly affect the cost of transportation for manufactured goods. In addition, an effective road system also reduces the costs of lost loads, penalties, and idle time associated with late deliveries. Finally, the importance of the transportation system in the United States was identified by the President's Commission on Critical Infrastructure Protection as essential to our national security.

While many technologies exist and have been demonstrated to be effective in improving the performance of the nation's roads and bridges, the typically higher first cost for implementing these technologies is often a deterrent to widespread use. Clear demonstration of the effectiveness of using appropriate technology to meet the needs of the driving public as well as the transportation industry in a cost-effective manner is necessary.

### **AS PAIR SECRETARIAT, CERF WILL SUPPORT THE ESTABLISHMENT OF A PARTNERSHIP STRUCTURE AND NATIONAL IDENTITY**

While it is important that PAIR identify and undertake demonstration projects to highlight the impact that technology can make in revitalizing the nation's infrastructure, PAIR must also undertake those activities that will ensure its acceptance and growth as a coordinating force to bring innovative technology into widespread use.

To accomplish this, PAIR will undertake the following critical tasks concurrently with demonstration projects, funding permitting:

- **Preparing and adopting the PAIR Implementation Plan.** As noted above, the development of the PAIR Implementation Plan is already underway. Formal presentation and ratification of the Implementation Plan is scheduled for a workshop to be held in 2000.
- **Preparing and adopting a PAIR policy-level position paper.** PAIR will develop a policy document for use by policy makers, public administrators, and industry practitioners. PAIR will develop a needs

assessment, utilizing both primary and secondary sources. The policy document should be of significant use to the US Congress in developing solutions to pressing infrastructure problems. It will also serve as a vision for the collaboration that is at the core of PAIR. The policy document will be designed to attract and focus attention on pressing infrastructure problems through RDT&E.

- **Developing model legislation.** Broad private sector participation and financial support is essential to PAIR's success. The private sector participants will fund and work to develop a legislative agenda, focusing on increasing and targeting public support for infrastructure renewal through innovative technologies. One of the key elements of the activity will be the assessment of the shortcomings of existing legislation. A second key activity will be the formation of a high-level private sector delegation that will be tasked with lobbying for PAIR objectives with specific legislative proposals and improving the dialogue between lawmakers and the private and public sectors.
- **Preparing and publishing infrastructure renewal handbooks.** On behalf of PAIR, CERF plans to produce a series of handbooks that will increase public awareness of the types of technology available and appropriate for infrastructure and renewal. The handbooks would be made available for sale, and over time, may become an important source of exposure for PAIR. Initially, the handbooks will reflect PAIR's experience with the high-visibility demonstration projects, but later handbooks may reflect the insight and practices gleaned from other sources as well. This task is integral to PAIR's outreach and continuing education objectives.
- **Defining a PAIR clearinghouse development strategy.** The goal of a PAIR clearinghouse will be to provide a "portal" to the wealth of information available regarding innovative technology, research, and related activities. The knowledge center/clearinghouse will become a full-service resource center, with a physical location. Access could be both electronic (through the World Wide Web), as well as through telephone or mail. Under the current agreements with NIST and FHWA, CERF has developed a PAIR page that is posted on the CERF Web site. The PAIR clearinghouse activity builds on that accomplishment, but is intended to go far beyond that effort in creating the clearinghouse for infrastructure renewal technologies. This will mark the first time that such a comprehensive clearinghouse becomes available to industry practitioners and the public.
- **Developing the Partnership.** CERF, serving as the Secretariat for PAIR, will begin immediately to recruit and form an Executive Committee (Ex-Com) responsible for overall PAIR operations, membership requirements, and policy initiatives.

## CONCLUSION

When our grandparents and great-grandparents developed marvels such as the vast subway system in New York City, the great water supply and sewer systems in Chicago, and the complex irrigation projects in the Southwest, these remarkable achievements were unprecedented in their scope. The impact on the way we travel, where we live, and how we earn our living was profound. Years later the development of our nation's interstate highway system was equally epochal. In many ways, we are still living off the legacy of those far-sighted engineers and planners who perceived a need to change fundamentally the structure of our built environment.

These achievements are 50, 75, even 100 years old. Deterioration is inevitable, even without the pressures of a larger, more mobile population. Many of these facilities are in desperate need of repair or replacement. They are clearly inadequate for the demands of the 21st century. Ever increasing demands on the infrastructure are causing systems built even 15 or 20 years ago to become obsolete.

As a nation we are ever more dependent on an effective and robust infrastructure for an enhanced quality of life. What legacy shall we leave future generations? PAIR represents a renewed commitment to the built environment. Its far-sighted strategy will become part of that legacy. The key to PAIR's success will be the breadth, vitality, and commitment of its private and public partnerships. The program cannot become a tightly centralized effort, with prescribed "one size fits all" solutions imposed from above.

Rather, PAIR's approach will be to draw on the imagination, expertise, and experience of the many different stakeholders and users of the physical infrastructure. Only by utilizing these diverse resources will we be able to effectively accelerate the technology development process, improve our quality of life, and move towards developing a truly sustainable public infrastructure.

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Richard Belle is currently *Senior Program Manager* for the Civil Engineering Research Foundation (CERF), the research affiliate of the American Society of Civil Engineers. Richard is CERF's senior survey research methodologist, with expertise in survey design and operations, program evaluation, and statistical analysis. He has lead responsibility for design and analysis of all market research efforts, baseline data assessments, benchmarking analyses, and attitude surveys. Richard currently manages CERF's materials programs, notably the high-performance construction materials and systems program (CONMAT). Other recent and current projects focus on developing a national private-public sector partnership to spur infrastructure renewal through the use of innovative technologies (**Partnership for the Advancement of Infrastructure and its Renewal, or PAIR**), operational management of the National Council for Civil Engineering Research (NCCER), industry benchmarking activities, assessment of current technologies in use, outreach to small and medium size design and construction firms, barriers to rapid technology transfer, public/private collaborations, revitalization of the public works infrastructure, enhancement of environmental quality, and improvement of competitiveness.

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**J. Peter Kissinger**  
**Vice President, CERF**  
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J. Peter Kissinger is the Vice President of the Civil Engineering Research Foundation (CERF) with executive level responsibility in a range of programs within CERF's mission. Most notably, Mr. Kissinger oversees the day to day management of the CERF Innovation Centers which provide technology verification (evaluation) services for a wide range of technologies across the spectrum of the design, construction, engineering and environmental markets. Mr. Kissinger joined the CERF staff in January 1993, as the Director of Highway Innovative Research. He was responsible for organizing and implementing the first CERF Innovation Center - HITEC (the Highway Innovative Technology Evaluation Center), which serves the highway and bridge community. In January of 1994 when HITEC became operational, Mr. Kissinger became Center's Director, a position that he still holds. In October of 1994, Mr. Kissinger was named a Vice-President of CERF, assuming executive level responsibilities in several areas. In that capacity, Mr. Kissinger's primary focus has been in expanding and refining the collaborative evaluation center concept developed for HITEC so that it could be applied to other markets. Presently, in addition to HITEC, the CERF Innovation Centers include CeITEC (public works and underground construction technologies), NES-BIC (building systems and technologies) and EvTEC, the Environmental Technology Evaluation Center. Mr. Kissinger is the Director of CeITEC and serves as a member of the NES-BIC Management Board and the EvTEC Advisory Council.

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