



Sustainability Considerations in Bridge Design, Construction, and Maintenance

by M. Myint Lwin



The roadside sign shows what “Green Highways” is all about.

WHAT IS SUSTAINABILITY?

The World Commission on Environment and Development, in their Report on Our Common Future (1987), defines sustainability as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. This implies that the development of highway projects, including pavements and bridges, must consider the rights of future generations to raw materials and ecological support systems, such as the climatic, agriculture, economic, and cultural systems. When designing, building, and maintaining a safe, durable, and efficient highway system, we need to work together to coordinate and integrate environmental protection and enhancement activities in the decision making process. We need to consider recycling of old pavements and bridges, involving the communities in the selection of the best environmentally sensitive designs, protecting watersheds and natural habitats during construction, and conserving resources in the operation and maintenance of the facilities.

The FHWA Initiatives

In 2002, the Federal Highway Administration (FHWA) designated environmental stewardship and streamlining as one of its three “vital few goals,” along with safety and congestion mitigation. Subsequently, FHWA made substantial investments in improving the quality and efficiency of environmental decision-making through initiatives such as context sensitive solutions, the Eco-Logical approach, the Exemplary Ecosystem Initiatives program, the recently announced Human Environment Initiatives program, and efforts to link planning and the environment. Visit the FHWA website at www.fhwa.dot.gov/csd/index.cfm for more information on these and other initiatives.

Context sensitive solution is a collaborative,

interdisciplinary approach that involves stakeholders in developing transportation facilities that complement their physical settings and preserve scenic, aesthetic, historic, and environmental resources while maintaining safety and mobility.

Through the Exemplary Ecosystem Initiatives program, FHWA recognizes best practices in environmental stewardship demonstrated at the state level. Since 2002, FHWA has highlighted more than 20 innovative and forward-thinking initiatives that employ ecosystem-based approaches.

FHWA has hosted more than 20 workshops across the country to promote the linkages between planning and the National Environmental Policy Act. Also, a planning work group, chaired by FHWA and established as part of Executive Order 13274, Environmental Stewardship and Transportation Infrastructure Project Reviews, aims to advance integrated planning by bringing together the necessary agencies and stakeholders early on.

To promote ecosystem approaches to transportation development, FHWA championed a multiagency effort to develop a nonprescriptive approach to making infrastructure more sensitive to wildlife and ecosystems through greater agency cooperative conservation. The effort culminated in May 2006 with release of the publication *Eco-Logical: An Ecosystem Approach to Developing Infrastructure Projects* (FHWA-HEP-06-011).

SAFETEA-LU Section 1805 Use of Debris from Demolished Bridges and Overpasses stipulates that any state that demolishes a bridge or an overpass that is eligible for federal assistance under the highway bridge replacement and rehabilitation program under Section 144 of Title 23, United States Code, is directed to first make the debris from the demolition of such bridge or overpass available for beneficial use by a federal, state,

or local government, unless such use obstructs navigation. The term “beneficial use” means the application of the debris for purposes of shore erosion control or stabilization, ecosystem restoration, and marine habitat creation.

Green Highways

A new multidisciplinary partnership brings together the diverse initiatives and activities that contribute to the “greening” of U.S. highways. The Green Highways Partnership (Green Highways) is a voluntary, collaborative effort aimed at fostering partnerships to improve upon natural, built, social, and environmental conditions, while addressing the functional requirements of transportation infrastructure. Green Highways provides state departments of transportation (DOTs) with the opportunity to highlight the many good environmental practices already underway and encourages additional innovations.

FHWA is one of many partners that include federal and state transportation and regulatory agencies, contractors, industry groups, trade associations, academic institutions, and nongovernmental organizations focused on highways and resource management issues. The partnership engages practitioners who represent an array of disciplines, including engineering, environment, law, safety, operations, maintenance, and real estate.

Green Highways grew out of efforts by the U.S. Environmental Protection Agency’s (EPA) Region 3, which consists of the mid-Atlantic States of Delaware, Maryland, Pennsylvania, Virginia, and West Virginia and the District of Columbia. “The goal is to achieve transportation and environmental objectives so that both are ‘better than before,’” says Hal Kassoff, Senior Vice President at Parsons Brinckerhoff Inc., a consultant involved in the initiative.

Through a combination of networking events and opportunities, public-private partnerships, and a new website clearinghouse (www.greenhighways.org), Green Highways proponents are pushing the boundaries of traditional highway building practices. "Whether one represents industry or government agency, everyone involved welcomes the opportunity to advance to a more sustainable country and world," says Robb Jolly, Senior Vice President of Market Development for the American Concrete Pavement Association (ACPA).

Green Bridges

The concepts of "Green Bridges" should logically follow the approaches, efforts, and partnerships established for "Green Highways." In "Green Bridges," the design, construction, and maintenance practices should give full consideration to at least the following areas:

- Attention to safety, durability, mobility, and efficiency;
- Compliance with environmental and preservation laws and regulations;
- Application of context sensitive solutions;
- Sustainable site selection and planning;
- Utilization of high performance materials and quality workmanship;
- Safeguarding air and water quality and efficiency;
- Conservation of materials and resources; and
- Avoidance of negative impacts on the ecosystems.



*Eleanor Schonell Bridge project, Brisbane, Australia.
Photo: Rae Allen.*

A good example of a "Green Bridge" is the Green Bridge Project in Brisbane, Australia. It is Australia's first pedestrian, bicycle, and bus bridge. The bridge, now known as the Eleanor Schonell Bridge, is a cable-stayed structure with a 390-m (1280-ft) -long main span, and connects the University of Queensland's St. Lucia campus and Dutton Park (www.brisbane.qld.gov.au and search for "Eleanor Schonell"). The community was involved in the design of the Green Bridge. It has several environmental and cultural features included in the design:

- Bio-retention ponds that collect and filter water runoff from the bridge deck;
- Interactive touch screens featuring bridge information;
- A solar roof at the Dutton Park that is used to power digital signage and lighting on the bridge; and
- Poetry by local writers is permanently etched into the railings and concrete of the pedestrian walkway.

The safety and mobility related benefits of this pedestrian, bicycle, and bus bridge are:

- Improved access to the university campus;
- Enhanced public transportation services;
- Encouragement of walking, bicycling, and other modes of green transportation;
- Reduced congestion on local streets; and
- Reduced traffic going through the city.

Education in Sustainability

At the 2007 PCI Convention and National Bridge Conference, Emily Lorenz, Editor-in-Chief of the *PCI Journal*, conducted an educational seminar on sustainability. The seminar provided an overview of sustainability and explained the importance to those who work in the construction industry.

In their 2007 Design Awards Program, PCI established a new award category: Best Sustainable Design. This award helps to heighten the awareness of the significance of sustainability and promotes the use of "Green Bridges" principles in the design of bridges. The inaugural award went to the 5th Street Pedestrian Plaza Bridge, owned jointly by the Georgia Department of Transportation and the Georgia Institute of Technology. The bridge deck included high planter walls that not only help to control noise and limit visibility of the traffic below but also serve as landscaping areas. (See page 22.)



*PCI Sustainability Award
The new Fifth Street Bridge crosses I-75/I-85
in Midtown, Atlanta. Photo: ARCADIS U.S. Inc.*

Closing Remarks

Sustainability is about cleaner air and water, greener earth, and healthier living for the present and future generations. Let's continue to design sustainable concrete bridges!

In the next few editions of *ASPIRE*™ we will continue to discuss the social, economic, and ecological benefits of sustainable concrete bridges. The author invites readers to share ideas and suggestions, facts and figures, case studies, etc. on these topics by writing to him at myint.lwin@dot.gov.



U.S. Department of Transportation
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