

Asia

This is the new hallmark of sustainable infrastructure projects that meet the needs of society today without compromising the ability of future generations to meet their own needs.

Although infrastructure is fundamental to maintain and improve the quality of life, there is still a critical need for basic infrastructure on a global scale. The World Health Organization reports, for instance, that more than 1 billion of the world's nearly 6.5 billion people live in extreme poverty without access to clean drinking water. Roughly half the world's population now lives in urban areas, where services such as water, sanitation, power, transportation, communication, health, and education are inadequate to support the standard of living developed countries have come to expect

Sustaining society through infrastructure means increasing the earth's capacity to support life while decreasing the demands placed on the earth's ecosystems and natural resources. Infrastructure professionals are challenged to meet these often conflicting goals on large-scale, high-profile projects in both developed and developing nations. Two recent highway projects underway exemplify the innovative methods used to address sustainability issues while delivering best-in-class transportation solutions. Technology played a vital role in meeting these goals efficiently and effectively.

Improving Karnataka state highways

Located in the south of India, Karnataka State has a

population of 53 million people, with 30 percent living in urban areas and more than 5 million crowded into the capital city of Bangalore, the fastest-growing city in Asia. Karnataka currently has one of the lowest density road networks in India, where road density relative to population averages just 2.53 kilometers per 1,000 people compared to 22.68 per 1,000 in the United States. The

Government of Karnataka's Public Works Department maintains a 17,075-kilometer state highway system that carries a major portion of the burgeoning traffic generated by economic and

Green Highways

Reducing ecological footprint

Highway improvement programs on two continents often share one objective: to minimize their transportation systems' ecological footprint by reducing carbon emissions, recycling materials, preserving forests, and protecting communities.

population growth. Carrying capacity has become severely compromised, with a whopping 77.5 percent of the system operating inadequate single-lane roads.

The second phase of the Karnataka State Highways Improvement Project (KSHIP-II) is part of an ongoing program to improve the state road network capacity, management and maintenance. The first project, initiated in 2001 with \$360 million in funding from the World Bank, repaired and upgraded 2,985 kilometers of state roads. KSHIP-I was completed in 2007, at a cost of \$474.5 million. The second project, estimated at \$1.1 billion, is improving 3,411 kilometers of highway.

In January 2007, the Public Works Department awarded the project to Scott Wilson India Pvt. Ltd. in joint venture with Scott Wilson Ltd. United Kingdom. Work began in March 2007 with the Phase 1A detailed project reports (DPRs) for 1,447 kilometers of roads, including 443 bridges, six railway crossings, and nine bypasses for major cities. One

of the main objectives was to alleviate the current unsafe and congested conditions by providing better quality roads in a sustainable and environment-friendly manner.

"We have adopted a methodology to assess and predict the potential environmental impacts due to project activity and provide the means for prevention and mitigation of those impacts," said Venkat Sheela, principal engineer with Scott Wilson India in Bangalore. "Thus, we are enhancing the project benefits to the overall socio-economic growth of Karnataka State."

KSHIP-II will remove transportation barriers, improve mobility and safety, and reduce costs.

With shorter travel times and fewer vehicles, the project is expected to lower vehicle operating costs and fuel consumption. The consequent reduction in carbon emissions will reduce the state highway system's impact on global warming. The Government of Karnataka is expected to claim carbon credits from the United Nations Framework Convention on Climate Change valued at \$6 million.

Three additional strategies will minimize the ecological footprint of the improved state highway system. Using Bentley's MXROAD, an advanced modeling tool that enables the rapid and accurate design of all road types, the project team was able to conserve materials by retaining existing pavement in suitable sections, reusing existing soil/pavement as

subgrade for new construction, and reducing overlay quantities. These measures will save an estimated \$3 million in Phase 1A alone.

Extensive modeling of road alignments aided in forest preservation and wildlife protection in the forest reserves. In addition, more than 40,000 trees lining city avenues are impacted by the project. Widening the roads along one side only protected as many trees as possible. These efforts will contribute to the carbon credit balance.

The state highways also pass through towns and villages where population densities vary dramatically. Through public awareness programs and consultation with stakeholders, the project team developed strategies to protect these communities, including improved road geometry and traffic-calming measures, adjusted alignments for bridges and railway crossings, reduced design speeds and adequate traffic signage, and nine major bypasses totaling 125 kilometers to circumvent severely congested urban centers.

Working within a managed environment, where Bentley solutions enabled rapid analysis of multiple alternative alignments, the project team completed Phase 1A alignment DPRs within 10 months. Upon completion, KSHIP-II will help meet the challenge of sustainability through infrastructure by improving the availability of transportation services in Karnataka State.

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3,411

kilometers of highway, with the first of two phases to be completed by 2012.

