

CONSTRUCTION

Towards greener infrastructure



It is globally acknowledged that there is a growing need for the coordination of design, sustainability, economic and environmental requirements on infrastructure projects.

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THE PROVISION of civil infrastructure has a major effect on the natural environment and on quality of life. Improvement in the awareness of eco-efficiency concepts is urgently needed among policy makers, planners and decision makers. However, the criteria applicable to, and measures for developing, eco-efficient and sustainable infrastructure are yet to be fully identified (United Nations Economic and Social Commission for Asia and the Pacific, 2006).

The lack of appropriate tools and skills for sustainable infrastructure design is often seen as a barrier to sustainable design. Infrastructure development has been focused mainly on financing issues and engineering aspects in the region. Mainstreaming environmental aspects and incorporating the eco-efficiency concept into various stages of infrastructure development have not been

considered as much as they should have been. Engineers need to look at greener technologies, rather than simply using traditional engineering solutions.

This paper focuses on the concept of eco-efficiency in infrastructure design that promotes the use of the greener engineering options, to enable a choice of the one likely to yield the best performance with the least environmental impact. It looks at a number of recommended green practices in infrastructure services design that are environmentally sound, placing fewer burdens on the environment.

By using this green approach, the sustainable design of township infrastructure services can be achieved by enforcing the consideration of resources, environmental impacts of design decisions, innovation, maintenance and materials at the design stage of a project.

Consulting engineers have a responsibility to explore 'green' options

The need to implement green technology

As the custodians of existing infrastructure and the developers of future infrastructure, consulting engineers recognise a responsibility to innovate, improve the products of their efforts and understand the importance of instituting a dialogue with the rest of society on these subjects (FIDIC, 2009: p.12).

In the area of sustainability, there is an urgent need to apply technologies and methods that deliver better and more sustainable performance in a way that is cost-effective. Sustainability and adaptive and mitigative approaches to climate change in the design of infrastructure are therefore important steering elements (FIDIC, 2009: p.44). Relatively few designers have as yet explored the transformative potential of ecological design and have preferred to remain apolitical and unconcerned with the distributional impacts of design as they affect the health of humans and ecosystems (Van Wyk, 2009).

Infrastructure elements such as roads, water and sewage and stormwater can result in the loss of critical ecosystems and biodiversity. There is a need to create an eco-sensitive infrastructure design that encourages and promotes the use of 'softer' design solutions.

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In terms of utilising improved environmentally friendly design methods, this study aims to introduce environmentally friendly design decisions prior to the infrastructure design approval process. This increases overall competitiveness by bringing a whole new class of productive solutions to problems, while at the same time adding a fresh perspective to the traditional infrastructure design process.

Objectives

In view of the inadequacy of tools to assess the environmental impacts of infrastructure design decisions, the aims of this paper are as follows:

- to ensure greener infrastructure with minimal impact on the environment
- to incorporate environmentally friendly, ecologically sensitive, innovative design at the design stage of township infrastructure projects
- to define green infrastructure solutions among engineers by establishing a common language and standard of measurement
- to raise awareness of green engineering benefits and the environmental impact of consultants' design decisions, in order to reduce the environmental impact of development
- to introduce environmentally conscious

Ecological design has yet to be fully explored

design decisions at the inception stage, where they are influenced the most.

The influence of early design decisions

A sustainable project is managed by taking control of the client's decision-making processes as early as possible to provide the certainty of decision-making. This should be done by involving clients completely in the process. Diligent attention to greener infrastructure solutions from the very earliest phases of a project will help guarantee that quality design environmental solutions are 'built in' from the beginning.

It is essential that the environmental issues be integrated into achieving the most appropriate solutions. It is important to implement the environmental management from the early stages of the process, since the 'freedom' to make decisions that are of importance for the environment decreases with the progress of the project.

Green design elements

Innovative approaches to planning and design can greatly mitigate the negative impacts of

Infrastructure services on the environment. Various green technology concepts were researched and modified to suit township infrastructure projects, with the aim of reducing the impact of civil engineering infrastructure on residential developments.

Green technology that can be used on infrastructure projects may include the utilisation of natural or engineered systems that mimic natural landscapes in order to capture, cleanse and reduce stormwater runoff. Greener stormwater infrastructure solutions can include rain gardens, rain barrels, green roofs, wetlands, permeable pavements and other methods intended to reduce the amount of stormwater runoff entering the sewer system and our waterways significantly.

Roads present many opportunities for green infrastructure application that incorporates a wide variety of design elements, including street trees, permeable pavements, bioretention and swales. Eco-efficient water infrastructure opportunities include a reticulated recycled water supply, water-efficient fittings, intermediate storage, etc.

Advantages of the eco approach to infrastructure design
Green township infrastructure technologies will contribute to greenways and green corridors and provide linkages between habitats and wetlands. Green technologies have a number of environmental, economic and community benefits. The benefits of this approach are:

- conserving natural resources
- reducing the ecological footprints of roads, sewer, stormwater and water, allowing ecosystems to function more naturally
- using energy-efficiency systems and materials
- minimising impervious surfaces, reducing soil erosion
- enhancing and protecting ecosystems and biodiversity
- conserving and reusing water and treating stormwater runoff on site
- recharging groundwater flow for streams, conserving water supplies.

Conclusions

As can be seen in this paper, there are numerous opportunities for improving eco-efficiency in infrastructure design. A new paradigm for infrastructure design is required in order to maintain environmental sustainability and mitigate flooding or drought. Green techniques provide adaptation benefits for a wide array of circumstances, by conserving and reusing water, promoting groundwater recharge and reducing surface water discharges that could lead to flooding.

Taking a greener approach to infrastructure development not only mitigates the potential environmental impacts of development, but makes economic sense as well. By softening the environmental footprint, avoiding waste and finding efficiencies, clients and local governments can increase their long-term sustainability. **35**

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