global Transport Knowledge Partnership

Transport Power Points:
10-minute briefing series

Eco-roads for Emerging Economies

Rural Transport

The Problem

The Road Transport sector is 'hooked' on cement and bitumen for road infrastructure construction.

Cement and bitumen (mainly made from crude oil) are capital, energy and transport intensive products contributing substantially to the global greenhouse gas problem. Globally, >100million tons of bitumen are used each year, mostly in the road sector.

World Bank estimates that globally over a billion poor people lack all-weather basic access. We need to find alternative low-cost, local resource-based, environmentally friendly, sustainable ways to connect these people and develop the national road networks.

The Urgency

The price of oil has recently dropped from about US$147 per barrel to about US$50 per barrel.

This is a temporary respite. The International Energy Agency warns that the natural output from the world's oilfields is declining faster than previously thought. The temporary downturn in demand due to the current widespread recession will give way to renewed pressure on global fossil fuel resources and 're-ignite' energy prices in the medium term future.

We **urgently** need to tackle both the challenges of global warming and basic access for the rural poor.

Current Technologies

Current bitumen & cement based binders-sealers have serious disadvantages for emerging countries:

- Fossil fuel based
- Capital-intensive centralised production
- Energy-intensive production
- Long transport distances
- Hence large carbon footprint
- Hence high and increasing costs
- Strain on scarce foreign exchange resources
- No benefit for local economy

Is Agriculture the Answer?

Many agro-industry products and waste streams have potential to replace imported Bitumen and Cement without affecting food production:

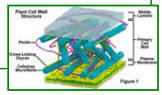
- Forestry and Paper Industry waste streams
- Vegetable oils and vegetable oil residues
- Non edible oils from new biofuel industries
- Residues from staple food production e.g. rice, maize and cereals
- Fibrous wastes e.g. sugarcane bagasse, seed oil and palm oil residues
- Lignocellulosic fibres such as sisal and coir
- Ash from combustion of high silica wastes

We could 'lock' free carbon into the road works!

Potential bitumen substitutes

Wood or Palm Lignin

- The second most abundant organic polymer on Earth
- About 50 million tons is produced annually as residue in paper production
- Solubilised Lignin waste from the paper pulp industry used to control road dust on unpaved roads for a 100 years
- Biofuels industry is expected to deliver abundant fibrous lignin from palm oil extraction.



Potential bitumen substitutes

Pine Resin or Tall Oil

- A viscous yellow-black odorous liquid from the Kraft paper process separated into Tall oil Rosin & Tall oil Pitch
- Used as a tar/bitumen substitute often in combination with other bio materials.

Potential bitumen substitutes

Drying oils and Semi drying oils

- The basis of paint technology, these oils harden to a tough film on exposure to air
- There are new non-food oils like Jatropha being grown for biofuels
- Add strength and water resistance to bitumen substitutes

Potential bitumen substitutes

Oil, Resin and Biomaterial blends

- Mixtures of biomaterials have the greatest potential
- Ecopave[tm] and Vegecol [tm] are real world examples
- Copolymerisation technology seems important and probably achievable for small scale production

Pozzolanas as Cement replacers

Rice Husk Ash (RHA)

- With lime Acts as a cement substitute
- Potentially 26 million tonnes of Rice Husk Ash annually
- By-product of lime or brick kilning
- Potential new 'cottage' industry

Other Agricultural wastes

- Ash from any other high silica residues

Fly Ash

- Pozzolinic ash from power generation, kilns and metal working are suitable

Next Steps?

- Identify potential industrial and research partners
- Run a series of workshops to select the technologies with the greatest potential in region
- Quantify the potential benefits: social, economic, technical, environmental, sustainability
- Identify the potential barriers e.g. development of appropriate small scale technologies, demonstration of performance in the field
- Propose an Innovation & Development plan for funding

Further Information

The following important dissemination forums are supporting Low Traffic Volume Rural Roads (LVRR) knowledge:

global Transport Knowledge Partnership: www.gtkp.com

SEACAP **Southeast Asia Community Access Programme**: www.seacap-info.org

AFCAP **Africa Community Access Programme** jeffreymturner@hotmail.com & rgeddes@africaonline.co.zw

Further information on Eco-roads may be obtained from the above websites and the gTKP Rural Transport Theme Champion: rob.petts@gtkp.com

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