

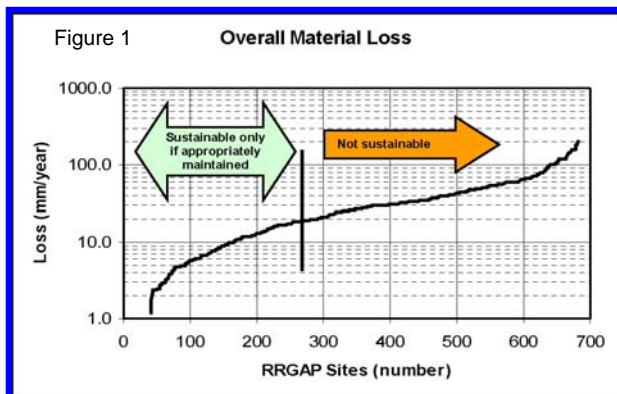
Financed by World Bank and DFID under the South East Asia Community Access Programme (SEACAP)

New cost-effective ways of using locally available materials in rural road construction have been researched by Intech-TRL for the Vietnam Government, World Bank and DFID through the South East Asia Community Access Programme (SEACAP) for the second Rural Transport Project (RT2).

The Limitations of Gravel

Laterite, and other forms of naturally occurring gravel, has been widely adopted as a surfacing material for low cost rural roads, as it has been relatively cheap and until recently reasonably available in many locations. This is an intermediate initial cost solution between a basic earth road construction and the more robust, but costly, bituminous or other types of paving.

The **SEACAP 4** investigations studied road deterioration at 766 road sites. It found serious constraints to the use of gravel in most of the studied 16 program provinces due to factors relating to material quality, material availability, climate, terrain, drainage provision and maintenance. Overall gravel loss figures indicate that around **58%** of the surveyed sites were suffering unsustainable deterioration (<20mm/year), while **28%** were losing material at twice the sustainable rate; refer to Figure 1.



In addition, the necessary regular maintenance and renewal requirements of gravel surfaces have substantial funding and logistical implications and can put a significant strain on non-renewable natural reserves, as well as having significant environmental degradation consequences.

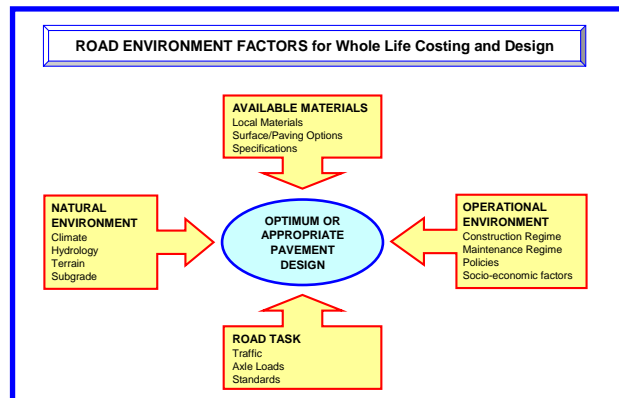
The RRSR has developed detailed guidance on the parameters for appropriate use of gravel as a surfacing. Recommendations have also been made for using gravel as a non-wearing layer within a pavement option, or as a component of a spot improvement road link strategy.

The complementary **SEACAP 1** research project, has been investigating the effective use of alternative surfacing and paving options. These include the use of stone, cement, lime, emulsion and brick in innovative and traditional ways to build low-cost, sustainable roads in Vietnam. Using local resources will enhance affordability of the roads, and could provide a useful income for local enterprises and

benefit communities. 168 trial pavement/surfacing sections have been constructed in 12 provinces of Vietnam with diverse characteristics.

Innovative Approach

The project takes a realistic approach to road design, taking into account local conditions and the road environment, traffic characteristics and loading, maintenance resources, technical and implementation options, environmental and whole life cost considerations.



The effectiveness of a range of alternative surfacing and paving technologies using local materials was assessed. Although these options may have a higher initial investment cost, over the whole life cycle of the road they would prove more durable, needing less maintenance and repair, and therefore they are potentially more cost effective. Options range from the low cost 'hardening' of earth roads where these are only used by non-motorised transport or motorcycles, up to robust paving which could cope with heavily loaded trucks. The emphasis is on appropriate use of local material resources.

For example, Southern Vietnam has a thriving brick making industry and very few hard stone deposits for road building. Clay is locally available and the established small local brick kilns make use of rice husk as a renewable energy source to fire the bricks. These traditional bricks have been shown to be ideal material for road building. The bricks are as strong and regular as factory made coal-fired products. They are generally 10cm x 20cm and 7-10cm thick, and laid



by hand on a thin, 3-5cm, sand bed over a prepared and compacted road base. The joints are then filled with sand-cement mortar and the surface is then lightly compacted.

Other trialed techniques include stone chip and sand seals, bamboo reinforced, steel reinforced and un-reinforced concrete, concrete bricks, dressed stone, cobble stone, stone macadam and stabilization by cement, lime or emulsion. Appropriate shoulder arrangements have also been trialed. Long term monitoring of the trials has commenced to enable deterioration, maintenance and whole life cost attributes to be determined.

An important element of these surface options is that many of them have a high labour and local resource input, leading to increased rural employment and income diversification. In addition, many of them require no special equipment beyond what would be available to a local general contractor. Hence they open up opportunities for more enterprises to compete and participate in the works. Both of these effects will potentially have substantial benefits for the local poor and the rural economies.

Results

The initial trial phase of this project in Vietnam has come to an end. The technical results are being assessed and documented for website and other distribution, but the results so far have been very encouraging.

SEACAP 1 outputs include:

- **Trials database for range of environments**
- **Range of proven surface options and specifications**
- **Improved design approach based on road environment factors**
- **Recommended practice improvements**
- **Cost model for surfacing options**

- **Construction and Maintenance Cost Norms**
- **MoT Vietnamese Website pages**

Local people confirm the impact of the project, saying that they now have improved access to social and economic opportunities. Improvements in road links have resulted in private investments along the roads. Young people are able to find work because of better links to the district roads and main highways, and local people are enjoying shorter journey times to markets because of improved commune roads.

The Government of Vietnam is eager to mainstream these new approaches. They are already being incorporated in new World Bank (RT3) and Asian Development Bank projects worth over US\$250 million.

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