

# Improving Vietnam's Sustainability

## *Key priorities for 2014 and beyond*

## Rural Road Pavement and Surfacing Options

### The Rural Road Surfacing Research Programme

The Rural Road Gravel Assessment Programme (RRGAP) comprised the evaluation of a representative selection of 269 WB-funded road links from 16 provinces.

Between 2003 and 2012 three phases of trial road selection, design and construction were undertaken under the RRST programme. The objective was to compare new pavement options in terms of construction and in-service performance against a number of standard Vietnamese "control" sections,

Monitoring of the trial sections commenced as soon as construction was completed. A total of 156 km of

trial roads have been constructed within a range of road environments in 16 provinces, from which a representative 123 sections of between 80m to 200m in length have been selected for ongoing performance monitoring.

The condition monitoring of the Vietnamese trials has resulted in the assembly of a significant amounts of data on the performance of a wide variety of pavement and surfacing types.

## Research Outcomes

### Sustainability of Unsealed Gravel Surfaces

The RRGAP studies showed that unsealed gravel is not a sustainable option in many of Vietnam's road environments. More than 60% of the analysed road sections indicated gravel loss of greater than the 20mm/yr taken as the limit of loss sustainability.

### Pavement and Surfacing Selection and Design

A two-phase pavement selection and design approach has been developed, based on the experience gained with the RRST programme

Phase I comprises the identification of appropriate pavement types compatible with the road environment and may be considered as a progressive screening operation aimed at identifying one or more options that are compatible with the road task and its environment. The second phase is the detailed design of the selected pavement option compatible with engineering requirements; primarily traffic, axle load and sub-grade strength.

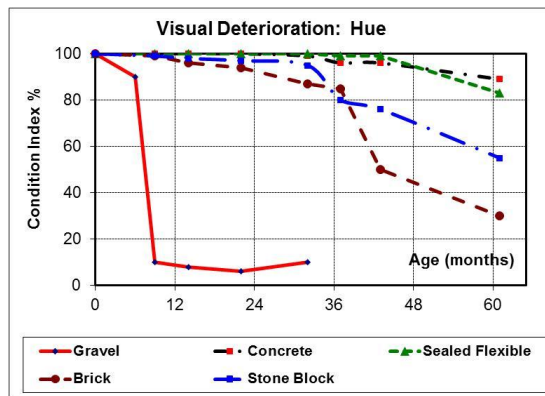
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Phase II of the selection and design process involves the detailed design of the general options identified under Phase I.

### The Comparison of Engineering Performance

The rural road performance data enables comparative analysis to be made of different pavement and surfacing options. Figure 1, for example, compares options in a single very high rainfall environment.

Figure 1 Performance of Different Options on a Single Trial Road: Visual Assessment.



### Environmentally Optimised Design

The principles of Environmentally Optimised Design (EOD) and Spot Improvement allow for the adoption of variable surfacing options along the length of rural road links. The appropriate adoption of this strategy allows a more focussed use of limited construction resources.

## Maintenance

The lack of routine or periodic maintenance undertaken on the RRST roads since 2005 reflects the general position in the rural road sector as a whole in Vietnam. However, by analysing the

### Specifications

The RRSR programme has prepared a library of relevant rural road pavement specifications in English and Vietnamese. These have been updated based on experience gained during RRST construction and monitoring phases.

### Quality Control

Existing supervision arrangements in the rural road sector do not appear to be sufficiently effective.

### Pavement Drainage

Although drainage was not a direct component of the pavement trials its impact on the performance of the pavements was assessed and the following general conclusions arrived at:

- Side drainage was often poorly constructed and frequently omitted altogether.
- Missing or ineffective drainage is directly linked to poorly performing or failing pavements.

### Whole Life Costs

A simplified Whole Life Asset Cost (WLAC) approach, assessing both maintenance and construction costs over road design life period, has been developed for use in the RRSR programme.

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deterioration patterns of the trial options over 6-7 years it has been possible to assess the relative maintenance costs.

# Pavement and Surfacing Performance

## Unsealed Granular Pavements

Analysis of the trial control section data confirmed the conclusions from the separate gravel studies (RRGAP) that even in low traffic environments unsealed gravel wearing course (GWC) or water-bound macadam (WBM) surfacings are not sustainable options in areas of flood, high rainfall, or steep gradient. Monitored trial sections in the lower rainfall, flatter, regions in the Vietnam Central Plateau have shown satisfactory performance in similar traffic environments when well-constructed with appropriate materials.

## Concrete Pavements

The concrete trial roads are generally performing well. Even on the sections exhibiting some cracking, the great majority of the pavement slabs are still performing adequately in a zero-maintenance regime. The exceptions are where significant problems with the quality of concrete were recorded during construction.

## Sealed Flexible Pavements

The combination of emulsion double chip seal on dry-bound macadam base/sub-base is performing as well or better than the Vietnamese standard option of hot bitumen seal over water-bound macadam base/sub-base.

## Stone Block Pavements

The performance of the two stone cobble or stone sett trial pavements is good and they have been shown to be highly resistant to rain-storm and flood erosion.

The pavement is effective in providing a sustainable surface/road-base in mountainous areas, albeit with high roughness consequences.

## Brick Pavements

Although the single sand seals placed over brick options have performed very poorly, the brick pavements themselves have continued to perform satisfactorily with little or no maintenance.

## Carriageway Shoulders

Road shoulders were constructed with a variety of materials. In general the shoulders were very poorly maintained and deteriorated to poor condition. In many cases the erosion of shoulders was impacting on the performance of otherwise sound pavements. Coarse quarry-run materials were clearly the best performing shoulder materials with sealed WBM/DBB a second best. Full-width construction should be considered where the additional costs are justified.

# Key Recommendations

1. The design and construction of rural road networks should be founded on four key principles:
  - Roads must suit their function.
  - Design must be suitable for the local environment.
  - Materials must be locally available.

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- Roads should be constructed with whole life costs that will not place excessive burdens on the local management budgets.
2. It is not possible for local authorities, designers or contractors to accept research outcomes without their being adopted by Ministries for inclusion in official standards and specification.
  3. Suitable rural road classification is a necessary step in providing the context and design control framework.
  4. For rural roads a key initial question should be –“What roads can I build with the locally available materials?”
  5. The use of technical standards and specifications that are focussed on up-to-date regional or national requirements is essential.
  6. The RRSR has shown that unsealed granular roads are not a sustainable option in many of the road environments of Vietnam, especially if no effective maintenance programme is in place.
  7. Spot Improvement solutions may be effectively applied in cases where there is insufficient budget to supply a sustainable whole road link solution.

## Further Discussion

*Phuong Thi Minh Tran is a Senior Transport Specialist in the East Asia and Pacific Sustainable Department of the World Bank in Vietnam.*

*Jasper Cook is a Geotechnical and Road Engineering Short Term Consultant with the World Bank in Vietnam and Lao PDR.*

*Pham Gia Tuan is Vietnam based Road Engineering Short Term Consultant with the World Bank.*

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