Research on Sustainable Paving/Surfacing for Low Volume Roads in Vietnam

by

Robert Petts, global Transport Knowledge Partnership (gTKP)
Dr Jasper Cook, OtB Engineering Ltd
David Salter, South East Asia Community Access Programme (SEACAP)

rob@intech-consult.demon.co.uk
www.gtkp.com
info@otbeng.com otb_hanoi@fpt.vn
www.otbeng.com
davidsalter@online.com.kh
www.seacap-info.org
The Message

- There has been an unsustainable reliance on low-initial-cost gravel roads to solve the access problems of poor rural communities in Vietnam. Surface material losses are high and proper maintenance has rarely been achieved.
- A new approach is required, using a ‘menu’ of more durable, low cost, low maintenance, local-resource-based surfaces, using gravel only where appropriate.
- The paper presents the findings of recent LVRR research in Vietnam.
The Presentation

- Poverty is linked to Poor Road Access
- The Limitations of traditional ‘Gravel’ use
- Alternative Surface Options ➔ Reduced Maintenance & more sustainable
- Trials outcomes & recommendations
Poverty is linked to poor access.

Figure 1 - Poverty & Accessibility, Vietnam 2002

Accessibility (population within 2km of all-weather road)
Excluding Mekong Delta Provinces
Poverty is linked to poor access

Rural Economic and Social development needs commercial, educational, health and infrastructure initiatives that rely on **GOOD PERMANENT ACCESS**.

Unfortunately, Poor Access for millions in rural communities globally limits the effectiveness of these initiatives, because of:
- unreliable travel or impassability, especially in the rains,
- high unit transport costs for goods, services & people.

*Investment is discouraged by poor access.*
Traditionally Gravel used for rural access roads

They are low (initial) cost and relatively easy to construct.

However, they are expensive to maintain (In SEA, typically up to US$1,600/km/year)

A Km of gravel road typically looses more than 70 cubic metres of material EACH YEAR in South East Asia.

A range of constraints means that maintenance is rarely carried out, leading to impassability, or the need to repeatedly reconstruct.

..........SENSIBLE?
RRGAP – Survey Gravel Loss on 700 sites
Gravel Surface should not be used where:

- Gravel quality is poor *(it should meet local durability, grading and plasticity specifications/recommendations)*
- Gravel deposits are limited/environmentally sensitive
- Haul distances are long *(suggest cost analysis for haulage >10km)*
- Rainfall is very high *(>2m/year)*, or dry season dust problems
- Traffic levels are high *(more than 200 motor vehicles/day)*
- Longitudinal Gradients > 6% *(>4% if rainfall >1 metre/year)*
- Sub-grade is weak or soaked (flood risk)
- Compaction & thickness cannot be assured *(bad quality control)*
- Camber and side Drainage are not provided, or
- **Adequate maintenance is not provided** *(on say >50% of network)*
Proposed new Gravel use guidelines

Natural Gravel is Technically a feasible option. Proceed to Non-technical Assessment (Sheet 2)
There are many PROVEN Alternative Surface Options using:

- Stone
- Bitumen
- Concrete
- Brick

They can have better Whole Life Cost and Local Resource Use attributes, & LESS MAINTENANCE.

Portorož, Slovenia
Range of Material Options trialed

- Hot Bitumen
- Bitumen Emulsion
- Sand Seal
- Stone Chip Seal
- Penetration Macadam
- Bamboo Reinforced Concrete
- Steel Reinforced Concrete
- Non-Reinforced Concrete
- Dry-Bound Macadam
- Water-Bound Macadam
- Sand
- Cement Stabilised Soil
- Lime Stabilised Soil
- Emulsion Stabilised Soil
- Concrete Bricks
- Clay Bricks (sand joints)
- Clay Bricks (mortared)
- Stone Setts
- Cobble Stones
- Graded Crushed Stone
- Natural Gravel
- Quarry Run
Trial Locations

Figure 1.1: RRST-I and RRST-II Provinces
Factors that should influence surface/paving selection

ROAD ENVIRONMENT FACTORS

AVAILABLE MATERIALS
Local Materials
Surface/Paving Options
Specifications

NATURAL ENVIRONMENT
Climate
Hydrology
Terrain
Subgrade

OPTIMUM OR APPROPRIATE DESIGN

OPERATIONAL ENVIRONMENT
Construction Regime
Maintenance Regime
Policies
Socio-economic factors

ROAD TASK
Traffic
Axle Loads
Standards
Factors that should influence surface/paving selection

Final surfacing and paving selection should be based on a **Whole Life Costing** of feasible alternatives that make sustainable and environmentally acceptable use of the locally available resources. Realistic assessment of the likelihood of adequate maintenance should be an essential component of this process.

Local guidelines should be developed based on **Whole Life Costing** to facilitate local decision making.
The Vietnam RRSR has yielded three key outcomes.

- The use of unimproved natural gravel as a universal rural road surfacing material has been proved to be unsustainable in over 60% of the situations in Vietnam.

- There are far more sustainable alternative technologies that can be used instead of gravel. This has led to a substantial change in the technical approaches used by the MoT on rural roads. Outcomes of the RRSR are now being incorporated into the third World Bank funded RTP project (US$ 150 million), as well as other investment programmes in Vietnam.

- Guidelines are being produced for affordable, appropriate, sustainable use of local resources to deliver Rural Road solutions.
There are two important dissemination forums supporting Low Traffic Volume Rural Roads (LVRR) knowledge in SEAsia:

**global Transport Knowledge Partnership:**
www.gtkp.com

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

Further information on the Vietnam and other LVRR research can be obtained from the above websites and the gTKP Rural Transport Theme Champion: rob.petts@gtkp.com, Jasper Cook: info@otbeng.com and David Salter (SEACAP): davidsalter@online.com.kh