Engineering with the Environment

working with the environment to improve access

Mike James, Peter O'Neill and David Salter

Access and the poor

Roads are important for poor rural communities and play a vital role in pro-poor growth and poverty alleviation policies by providing access to:

- Economic opportunities
- Health services
- Education services
- Markets
- Employment
- Social activities

Modes of transport

Travel in rural areas is typically undertaken by:

Foot
Bicycle
Motor cycle
Tractor and trailer
Public transport

Poor roads particularly impairs access for non-motorised road users


AMADILS
SCANIA

Engineering Access Issues

- On many soils, an engineered earth road is sufficient to provide basic access
- Investments in “spot” improvements to sections recurrently restricting access yield high benefits
- Alternative engineering solutions required for increased sustainability
- Labour-based construction and maintenance provide employment opportunities and low-cost investment opportunities for small contractors

Gravel Loss

Recent research under SEACAP indicates that gravel may not be appropriate for use where any of the following conditions apply:

- Gravel quality is poor
- Compaction & thickness cannot be assured
- Haul distances are long.
- Rainfall is very high
- Dust problems in the dry season
- Traffic levels are high
- Longitudinal Gradients > 6% (or 4% in medium rainfall areas 1,000 – 2,000 mm/year)
- Adequate maintenance cannot be provided
- Gravel deposits are limited/environmentally sensitive

Environmental Issues

Providing access to rural communities can have adverse environmental consequences

- Rural access roads require large quantities of gravel
- Long haulage damage rural roads and increase village traffic
- Adverse impacts on the environment, health and road safety.
- Large scale quarry operations
- erosion on steep grades and to adjacent land
- landslips caused by road construction


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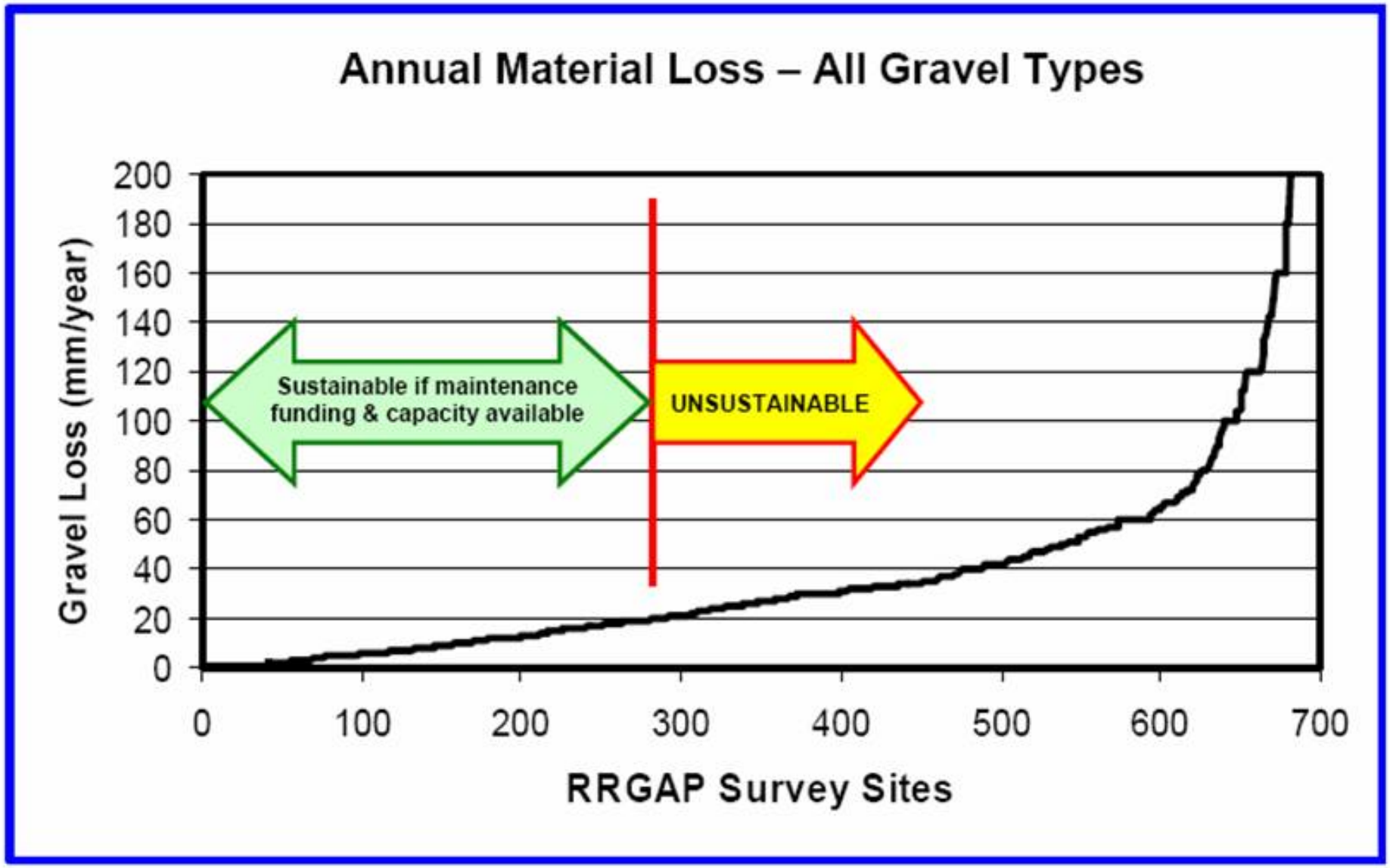
Rural Road Gravel Assessment Programme

- Gravel can only be considered as a serious viable surfacing option for Vietnam where
  - Quality material is locally available in sufficient quantities
  - Road gradients are less than 4% in medium rainfall areas
  - Adequate drainage can be guaranteed
  - Adequate quality assurance controls are in place
  - An appropriate maintenance regime can be guaranteed
  - flooding is only a minor local occurrence
  - Traffic is below 200 motor vpd equivalent



Vietnam Rural Road Gravel Assessment Programme (RRGAP) 2004 – ANNUAL RATE OF GRAVEL LOSS FROM ALL SITES

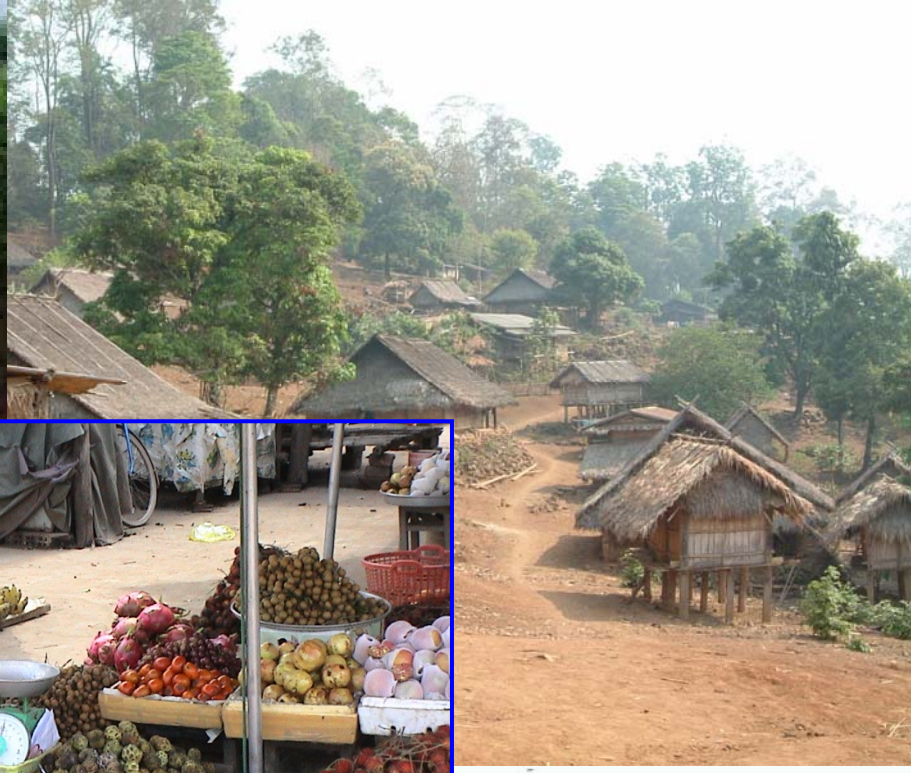
South East Asia Community Access Programme (SEACAP)

SEACAP is a DFID funded programme with the following GOALS:

- Provide support to developing countries in making optimal decisions on the provision of access to poor rural communities
- Improve sustainability and affordability of access for the rural poor
- Create opportunities for pro-poor growth and poverty alleviation in partnership with participating countries

SEACAP Approach for sustainable access

- Local resource based technologies.
- Spot improvement as a priority investment.
- Interventions based on life cycle costs and benefits.



SEACAP Approach

Through the SEACAP and other initiatives, DfID is exploring solutions to these issues

- Investigation of naturally occurring unimproved gravel as a suitable pavement material
- Low cost alternative surfaces and pavements;
- Spot repairs and improvements
- Exploitation of local gravel sources using mobile crushers
- Combining bioengineering and geotechnical engineering for slope stability

Rural Access

Experience on Lao Swedish Road Sector Project

- strong correlation between access to basic infrastructure services and the incidence of poverty
- villages with road access producing more in general than before
- positive impact on education, health, commerce, agriculture, land use and gender inequalities
- decreased transport costs

Low Cost Surfacing

- DfID has funded research into alternative pavements using local resources and materials
- provide year round access and lower long term (life cycle) costs
- reduce the reliance on increasingly scarce gravel deposits by removing the need for frequent re-gravelling and by reducing erosion

DfID Research

- Cambodia
  - Puok Market Trials
  - DfID funded Knowledge and Research (KaR) programme and subsequent SEACAP 8 Project
- Vietnam
  - Rural Road Surfacing Trials
- Lao PDR
  - Local Resource Solutions to Problematic Rural Roads Access

Surfacing Trial Options

- Bamboo Reinforced Concrete Pavement
- Steel Reinforced Concrete (as a comparison control for BRC)
- Un-reinforced Concrete
- Concrete Paving Blocks
- Geocell
- Armoured Laterite Road-base & Single Bitumen Stone Chip Seal
- Sand-Aggregate Road-base & Single Bitumen Stone Chip Seal
- Bitumen/Emulsion Seals on waterbound or dry bound macadam, or lime/cement/emulsion stabilised soil.
- Otta Seal
- Hand Packed Stone
- Hand-Packed Stone & Laterite Wearing Coarse
- Cobble Stone Paving
- Dressed Stone with Bitumen-Sand Sealed Joint
- Mortared Stone
- Fired Clay Brick Paving.
- Engineered Natural Surface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Bio Engineering

- Living Stabiliation
  - vegetative plantings
  - soil bioengineering
- Vegetation helps to prevent surface erosion by:
  - Binding and restraining soil particles in place;
  - Reducing sediment transport;
  - Intercepting raindrops;
  - Retarding and controlling velocity of the runoff;
  - Enhancing and maintaining infiltration capacity.

Bio Engineering

- Herbaceous species used in con-junction with soil bioengineering to add protection against surface erosion.
- Deeply rooted woody vegetation provides greater protection against shallow mass movement by
  - Mechanically reinforcing the soil with roots
  - Depleting soil-water through transpiration and interception
  - Buttressing and soil arching action from embedded stems

- Good quality gravel is increasingly difficult to locate
  - poor quality substandard material used in road construction
  - Rapid deterioration of the gravel pavements
  - need for even more material to rehabilitate the road in order to maintain access
  - communities and road authorities locked into an unending cycle of repair
  - constant drain on local material resources.

These strategies are being investigated and mainstreamed through the DfID SEACAP programme involving

- the use of robust pavements on problematic sections
- bio-engineering techniques
- spot repairs
- the exploitation of small gravel sources


Thank You