

SEACAP 27
**MID TERM PAVEMENT
CONDITION MONITORING OF
RURAL ROAD SURFACES**

INTRODUCTION & KEY ISSUES

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seacap 27 - background

SEACAP 27 was concerned primarily with the collection and analysis of pavement performance data from the **Rural Road Surfacing Research (RRSR) Trial** road sections. This mid-term monitoring was seen an essential link in the ongoing analysis of rural road performance.

SC 27 was undertaken by **TRL** in association with **OtB Engineering (International)** with local support from **TEDI, University of Transport & Communication (Hanoi)** and **ITST** under the guidance of the **RRSR Steering Committee**.



The Presentation: Key Questions

- **WHY** was the project undertaken ?
- **WHERE** was the work done ?
- **HOW** was the research undertaken ?
- **WHAT** has been the impact?



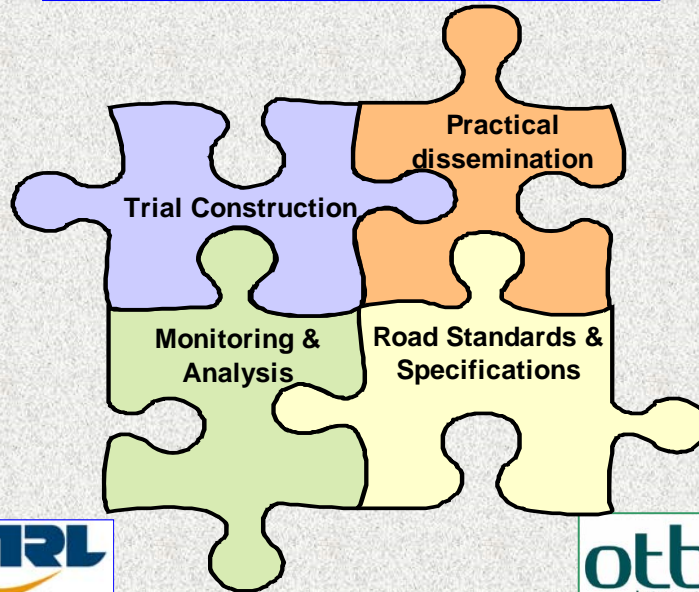
Why ?

To design economically viable and sustainable rural roads it is important to know how and why they deteriorate so that the selection, design and construction procedures can be tailored to minimise this deterioration.

Some options will be better suited to particular conditions. The best available solution will vary with the road environmental conditions



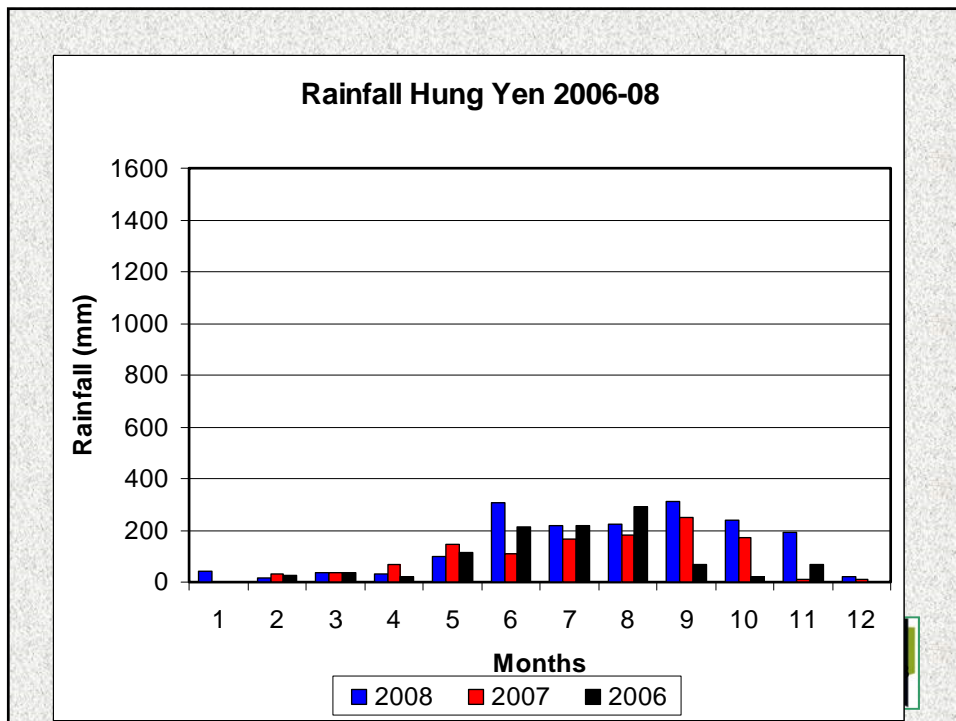
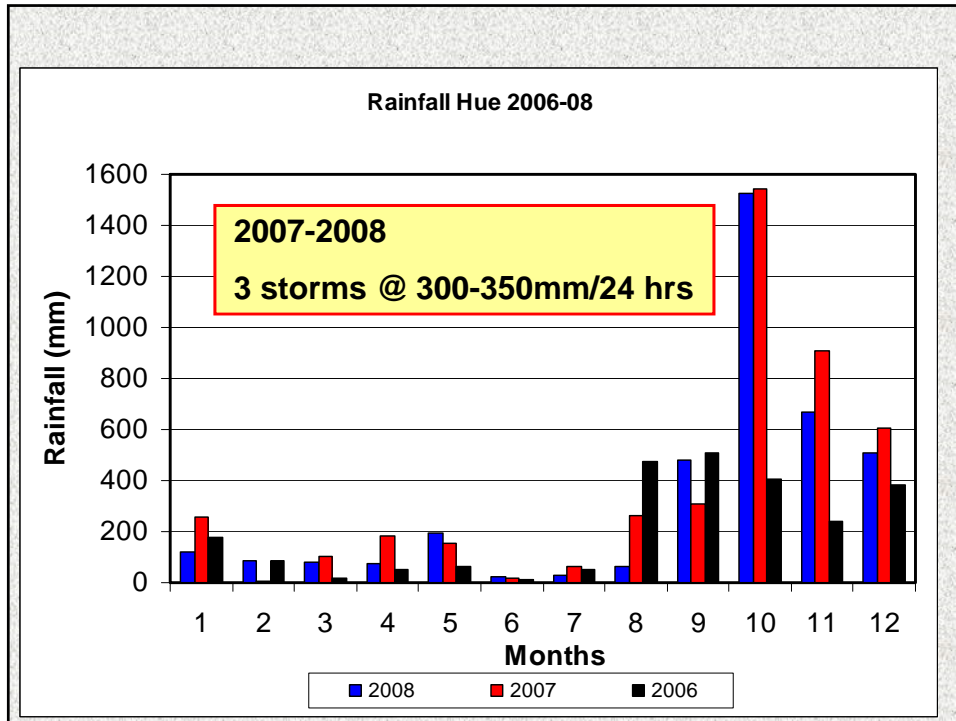
Road Research Delivery



Region	Trucks >5T		
	% 2 Axle	% 3 Axle	% 4 Axle
N-C Coastal	70	30	0
Central Highlands	44	42	14
Red River Delta	95	5	0
N Highlands	98	2	0
Mekong Delta	100	0	0

Traffic

Typical Road	Daily Traffic			esa (8.4T) to Feb 2009
	2- Wheeled	Trucks <5T	Trucks >5T	
N.C. Coastal	750	6	0	70
C Highlands	1200	53	48	200,000
Red River	1500	15	5	3,700
N Highlands	1300	14	12	17,000
Mekong	1100	7	1	700



Where?

**Survey
Extent**

Province	Roads	Sections	Metres
Da Nang	1	6	725
Dak Lak	3	9	880
Dak Nong	1	11	1100
Dong Thap	1	9	1490
Gia Lai	2	9	1000
Ha Tinh	3	10	1000
Hue	1	7	1175
Hung Yen	4	11	1200
Ninh Binh	5	13	1300
Quang Binh	2	8	800
Tien Giang	1	7	1300
Tuyen Quang	2	7	700
	26	107	12670



RRST I & II



How? - The Work Undertaken

Representative sections of 100m to 200m length were selected for monitoring. Using:

Visual assessment (Standard Form)
 MERLIN (for roughness)
 DCP (for strength)
 Levelling (unsealed roads)

3 Phases of monitoring following on from previous SEACAP 1 work



RRST-Trials Monitoring to Date

Province	Monitoring Phases						
	SEACAP 1			SEACAP 27			
Hue	6- 2005	2- 2006	7- 2006	3- 2007	1- 2008	5/6- 2008	1- 2009
Tien Giang	7- 2005	1- 2006	7- 2006	3- 2007	1- 2008	5/6- 2008	1- 2009
Dong Thap	7- 2005	1- 2006	7- 2006	3- 2007	1- 2008	5/6- 2008	1- 2009
Da Nang			7- 2006	3- 2007	1-2008	5/6- 2008	1- 2009
Tuyen Quang			7- 2006	2- 2007	12- 2007	5/6- 2008	1- 2009
Ha Tinh			7- 2006	3- 2007	1- 2008	5/6- 2008	1- 2009
Quang Binh			7- 2006	3- 2007	1- 2008	5/6- 2008	1- 2009
Ninh Binh			7- 2006	3- 2007	12- 2007	5/6- 2008	1- 2009
Hung Yen			7- 2006	3- 2007	12- 2007	5/6- 2008	1- 2009
Gai Lai			7- 2006	3-h 2007	1- 2008	5/6- 2008	1- 2009
Dak Lak			7- 2006	3- 2007	1- 2008	5/6- 2008	1- 2009
Dak Nong			7- 2006	3- 2007	1- 2008	5/6- 2008	1- 2009

Analysis of performance data

Road pavements should last from 7 to 15 years so this analysis is very much a mid-term or preliminary analysis based on the performance of the roads during the first 2 -3 years of service



WHAT Impacts? - Key Outputs

- An updated RRSR database and manual
- A updated of SEACAP 1 summary of pavement option advantages and disadvantages
- A review of maintenance needs
- A review of the RRST cost model
- Handover of the RRSR database to the DST
- Two final technical reports
- Key documents posted on relevant websites



Impact: Option Summary

Roads divided into 4 categories

Trial Type	Sections	Length (km)
Block	11	1.675
Concrete	24	3.025
Sealed Flexible	56	6.300
Unsealed	16	1.670



SEACAP 27 Trial Sections

Roads divided into 4 categories

Trial Type	Sections
Block	11
Concrete	24
Sealed Flexible	57
Unsealed	8



Summary of Sealed Flexible Pavement Performance

Performance ranking	Number of sections	Surface problem	Structural problem	Indefinite at this stage
Good	26 (46%)	0	0	0
Fair	13 (23%)	3 (+ 2)	2 (+ 2)	6
Poor	6 (11%)	3 (+ 2)	1 (+ 2)	0
Very poor	11 (20%)	5 (+ 6)	(+ 6)	0



Summary of Seal Performance

Surfacing	Number of sections	Very poor	Poor	Fair	Good
Sand seal on SBST	8	5	1	1	1
Penetration Macadam	7	-	-	1	6
DBST (hot)	13	2	2	5	4
DBST (emulsion)	26	4	2	4	16
TBST	2	-	-	1	1



Summary of Block Pavement Performance

Performance ranking	Block condition	Joint condition	Seal condition	Overall performance
Good –	5	0	0	1
Fair –	3	0	0	3
Poor	3	7	0	4
Very poor	0	4	11	3



Summary: Block Pavements

- The single sand seals have performed poorly.
- The minimum strength requirement of 20-25MPa for manufactured engineering quality bricks is important.



Summary: Block Pavements

- Mortared jointed options are probably more appropriate than sand joint options.
- Stone options: robust but rough



Summary: Concrete

The results of the trials of bamboo reinforced concrete in Vietnam (together with results obtained in Cambodia) show conclusively that bamboo reinforcement in pavement slabs has no obvious advantage over well-constructed non-reinforced concrete



BLOCK 03



Summary: Concrete



Two principal causes for poor performance stand out:

Poor quality concrete and poor support for the concrete slabs (sub-base or eroded shoulders).




Surface Failure

Flexible Pavements






Structural Failure



Summary: Flexible Pavements

Evidence indicates that the combination of emulsion DBST over DBM is performing better than the standard option of hot DBST over WBM.

Poor construction is major issue with the flexible pavement sites, particularly with regard to the seals. Less than 50% were satisfactory as-built.



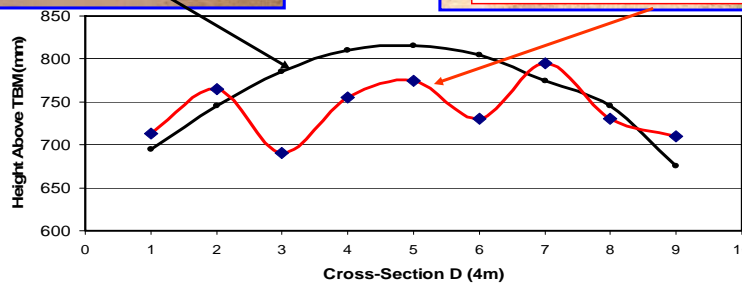
Summary: Unsealed Gravel

The majority of gravel control sites performed poorly- however there are clearly areas where unsealed gravel surfaces are a sustainable LVRR option provided they are constructed correctly and MAINTAINED.

Unsealed WBM is not a realistic option because of loss of cohesive fines and surface loosening.



Hue Gravel Control Section



Summary: Poorly Performing Sites

The review has highlighted key issues with respect the deterioration of poorly performing sites, namely:

Sub-standard construction procedure or poor compliance with specifications

None of the trial roads have had any significant maintenance carried out on them.

Poor road management, either in identifying the road task or in controlling overloading.



RRSR- Work in Progress

The RRSR project is very much work in progress – the monitoring and analysis has only covered less than half of the trial design life .

There is in addition much more practical analysis to be undertaken and **effectively disseminated** at provincial as well as central level.

