

SEACAP 27

MIDTERM PAVEMENT CONDITION MONITORING OF THE RURAL ROAD SURFACE TRIAL (RRST)

APPLICATION FOR MAINTENANCE AND UPDATING THE
COST MODEL

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PRESENTATION SUMMARY

- SEACAP 27 objectives
- SEACAP 27 key activities
- Estimating RRST maintenance cost
- General assessment of the maintenance requirements of the RRST group
- General assessment of the performance of the RRST group
- RRST cost model
- Updating RRST cost model
- Conclusions and recommendations



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SEACAP 27 OBJECTIVES

OVERALL OBJECTIVE

- Demonstrate the suitability of the rural road surface options performance with the road environment constraints.
- Identify the deterioration characteristics of the surfacing options in order to establish their Whole Life Costs and also to define the limits of their appropriate usage.



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KEY ACTIVITIES OF SEACAP 27

- Sites survey, collecting the data of the trial sections condition
- Updating the data
- Data analysis:
 - A statistical assessment of pavement and surfacing condition
 - An interpretation of the trials assessment
- Estimating necessary maintenance costs of the RRST options



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ESTIMATING TRIAL PAVEMENT MAINTENANCE COST

THE IMPORTANCE OF ESTIMATING TRIAL PAVEMENT MAINTENANCE COST

- Maintenance cost is a function of pavement deterioration speed and nature. Therefore:
- Estimating the performance of the RRST options will allow us to assess their maintenance costs in a limited road environment
- Actual maintenance cost associated with the result of interpretation of trial data will make an essential base to update cost model



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ESTIMATING TRIAL PAVEMENT MAINTENANCE COST

BASE FOR ESTIMATING MAINTENANCE COST

- Existing circulars, decrees of the Government regarding the cost estimation for capital construction.
- Procedures and norms of maintenance of rural road trials established by TRL-OtB Consultant.
- Key maintenance factors for each trial group included in the interpretation of trials assessments of SEACAP27
- Deterioration condition data of trial sections collected from the field survey in July – August 2008.
- Unit cost of material, labour and equipment work shift in the provinces that the trial sections running through.

Trial Group	Maintenance Indicative Factors
Concrete	Joint condition Crack extent Surface condition Potholes
Sealed Flexible	Crack extent Ruts Potholes
Blocks	Block condition Joint Condition Ruts Potholes
Unsealed	Corrugations Erosion Ruts Potholes

Key maintenance factors



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GENERAL ASSESSMENT OF THE MAINTENANCE REQUIREMENTS

- For the same option, there is a significant difference in maintenance cost . This confirms that, their performance are very difference and depend on a number of causes.
- Maintenance costs of cement concrete sections after 2 to 3 years of operation are rather low and mainly comprise of maintenance cost for joints.
- On the some poorly performed cement concrete sections, maintenance costs of them are also very low. It shows that the severity of defects is not serious and the defects deteriorate slowly.
- The maintenance cost of penmac is also very low.
- Apart from poorly performing sand seals the maintenance cost of emulsion sealing sections is generally lower that of hot bitumen sealing sections



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GENERAL ASSESSMENT OF THE MAINTENANCE REQUIREMENTS *(continued)*

- If the unsealed flexible pavements are left unmaintained, the maintenance cost after 24 to 30 months of operation is very high which is more than 50% or equal to 100% of the new construction cost.
- Although the performance is classified as poor, the maintenance costs of mortared joints block pavements are very low.
- The maintenance costs for sand emulsion seals block pavements are very high of which most of the costs are spent for restoring of the seals. Whereas:
- The maintenance cost for the same type of pavement without the seal is only at moderate level.



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RELATION BETWEEN MAINTENANCE COST AND ROAD DAMAGE CONDITION INDEX OF CEMENT CONCRETE PAVEMENT

Trial sections	Province	Age (month)	Traffic up to 8/2008 (esa)	Maintenance cost of 1km of road up to 8/2008 (USD)	Road Damage Condition Index (RDCI)		Damage Extend Index (DEI)
					Pavement	Joint	
DL(3)-1	Dak Lak	24	203,955	1212	25	69	70
TQ(1)-2	Tuyen Quang	24	116,152	624	28	28	68
DN(1)-5	Đak Nông	24	257,528	608	17	100	53
D2	Đông Thap	36	5,249	563	1	73	3
D3	Đông Thap	36	5,249	537	2	76	9
DaN2	Đà Nẵng	24	9	530	3	81	11
GL(1)-2	Gia lai	24	209,796	516	36	21	85
HT(1)-2	Ha Tinh	24	100,371	491	3	86	5
HT(1)-1	Ha Tinh	24	100,371	488	3	95	7.5
HT(2)-2	Ha Tinh	24	195,847	470	10	50	23
T2	Tien Giang	36	0	460	24	63	53



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GENERAL ASSESSMENT OF THE PERFORMANCE OF THE RRST GROUP AFTER 24-36 MONTHS

- Penetration macadam is the best performance option. Evidence shows that after 2 to 3 years of operation, more than 85% of the trial sections still perform well
- Cement concrete pavement also perform well with 75% of the trial sections in good condition . Furthermore, the defects on concrete roads deteriorate slowly and they can still perform well for a long period.
- The performance of hot bitumen sealing and emulsion sealing pavements is much worse than the two pavements above although there is evidence that emulsion chip seals are performing better than hot bitumen chip seals
- Among the emulsion sealing options, the sand emulsion sealing has the worst performance. The evidence shows that there is more than 85% of poor to very poor performance sections.



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GENERAL ASSESSMENT OF THE PERFORMANCE OF THE RRST GROUP AFTER 24-36 MONTHS

- With most of trial sections performing very poorly, it is possible to confirm that the performance of unsealed flexible pavements is very poor in the majority of road environments in Vietnam.
- With more than 70% of trial sections performing poorly, the performance of block pavements in general appears much worse than the penetration macadam, cement concrete and sealed flexible pavements
- However although overall classified as poor performing, some block pavement sections are still in good condition as the defects on this type of pavement are not serious.



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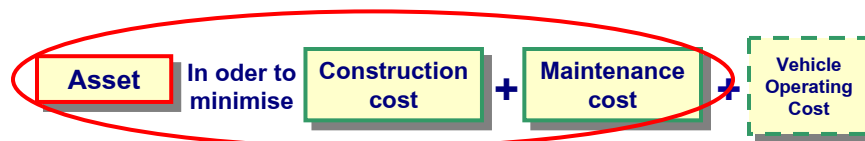


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THE RURAL ROAD SURFACE TRIAL COST MODEL

INTRODUCTION

- The RRST cost model are set up by Intech-TRL in the Rural Road Surfacing Trial Programme
- In this stage, the model has just been set up with the function of estimating whole life asset cost



- The model capable of develoment to incorporate local VoC knowledge.



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THE RURAL ROAD SURFACE TRIAL COST MODEL

FUNCTION OF THE MODEL

CONSTRUCTION COST

- Was set up base on RRST trial option' detailed design and construction cost estimate

MAINTENANCE COST

- Routine maintenance cost adapted from available limited Norm of Vietnam
- Periodic maintenance cost of gravel road base on RRGAP findings
- Preliminary assessment of maintenance of other paving types, pending RRSR long term monitoring
- As to unseal pavements (excluding gravel/laterite), Periodic maintenance cost will be calculated equivalent to 7% of construction cost and applied every 6 years



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THE RURAL ROAD SURFACE TRIAL COST MODEL

RESIDUAL VALUE OF THE PAVEMENT

For Gravel/laterite pavements

Residual value = (residual gravel thickness/initial constructed thickness) x value (cost) of the initial construction thickness

For other pavements

Residual value will be calculated as the following percentage of the initial constructed value of the full pavement layer



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UPDATING RRST COST MODEL

THE NECESSARY TO UPDATE THE COST MODEL

- The rural road surfacing trial cost model was developed in SEACAP1, based on outdated decrees and regulations of the Government on the cost estimation of capital construction.
- The cost and frequency of periodic maintenance applied in the model are based on Vietnam and international experience and it need to be verified and adjusted.
- The assessment results of trials after 2 – 3 year monitoring should be used for the adjustment of the model.



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UPDATING RRST COST MODEL

THE NECESSARY TO UPDATE THE COST MODEL

- Method of calculating other costs in the model
- Periodic maintenance cost
- Frequency to carry out Periodic maintenance
- Residual value of all surfacing options at the end of the analysis period.



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UPDATING RRST COST MODEL

SUMMARY OF THE REQUIRED ADJUSTMENT

Type of pavements		Periodic maintenance cost (year)		Maintenance cost (% of construction cost)		Residual value after 15 years (% of construction cost)	
		Former	current	Former	current	Former	current
Cement concrete							
Block	Mortared joint	10	10	5	4	70	70
	sand joint/fine chipping	6	5	7	7	60	60
	Sand sealed on sand joint	7	6	15	22	60	60
Penetration macadam		10	10	5	5	60	50
Sealed flexible pavement	Hot bitumen	7	7	25	25	40-50	50
	Emulsion sealed	7	7	25	25	40-50	50
Water bound macadam		6	2	7	10	50	40
Natural gravel		Calculated base on Gravel loss matrix from the Rural Road Surfacing Trial Research (RRSR) - (SEACAP 4)					



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CONCLUSIONS AND RECOMMENDATIONS

- The estimation of maintenance cost and interpretation of trial data is an important base to assess the performance of pavement options and update cost model
- Maintenance cost is a function of speed and nature of road deterioration. It depends not only on the Road Deterioration Condition Index and Deterioration Extent Index (RDCI and DEI) but also on the types of defects
- Therefore the assessment of pavement performance should take into account many other road environment factors such as traffic, construction quality, natural environment, costs and types of maintenance...
- In general, cement concrete and penetration macadam pavements still perform well to date. However the joints of concrete pavements need to be constructed in better quality and maintained timely.
- For cement concrete pavement, the threshold for medium repair is assumed on the basis of RDCI and is thus adjusted from 20% to 30%.



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CONCLUSIONS AND RECOMMENDATIONS

- The efficiency of the bitumen seals on top of the sand joints block pavements is very low compared with the cost for building and maintaining them .
- For block pavements, mortared joints should be used to replace for sand and sand emulsion joints
- The block pavements surfaced with sand emulsion seals need to be resealed every 2 years as part of the periodic maintenance



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