SEACAP 24

CASE STUDY OF DAK LAK RRST PAVEMENT AND SURFACE DETERIORATION

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The Project

This presentation is concerned primarily with research into the premature failure of Buon Ho trial road in Dak Lak province.

The objective as defined in the ToR is, "…. *to understand the causes of the unexpected deterioration ….. in order to reduce the risk of recurrence in the future*".

Background

The Buon Ho road was constructed as part of the RRST-II programme between March and the end of June 2006.

By the end December 2006 the road was showing signs of very significant deterioration.

Summary of Research Work

Preliminary site visits:	December 2007
Detailed site examination:	Jan-Feb 2008
Laboratory Testing	Feb-March 2008
Interim Report	**March 2008**
Axle load survey	March 2008
Final reporting	June 2008.

Presentation

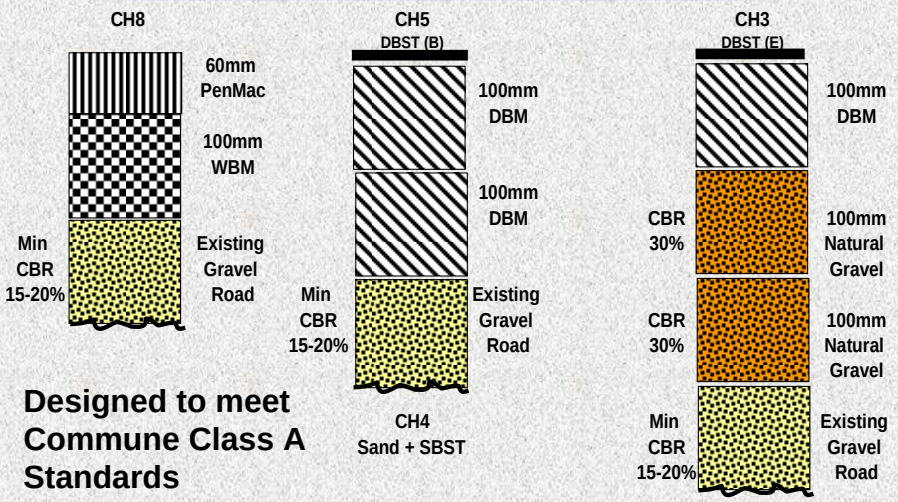
Design and Construction

Condition

Key Questions

Conclusions

Buon Ho Designs



Designed to meet Commune Class A Standards

Contracts

Section	Contract Package	Chainage	Design
BH1	I	3.700 – 4.166	CH 8
BH2	I	5.100 – 5.316	CH 8
BH3	I	8.600 – 9.100	CH 5
BH4	I	9.100 – 10.100	CH 4
BH5	II	10.100 – 12.600	CH 3
BH6	III	12.600 – 14.980	CH 3

Comments on Construction - 2

Submitted construction materials test results indicated a general compliance with specifications and no adverse comments were received from the supervision team on the delivered materials

Following a site visit during construction Intech-TRL requested replacement of existing gravel sources with an improved material – only verbal confirmation of this action received.

A significant number of test results and site information was not received until after construction was complete.

Comments on Construction - 2

Intech-TRL QA inspected the completed road and concluded on the evidence then available that it generally complied with the specifications– but that :

Crossfalls were not as specified

Sand seal was not satisfactory (CH4)

There was a lack of some DCP test results

Some low CBR lab test results from as-delivered material

Some poor particle size distribution of fine stone and 4x6cm stone chippings (WBM, DBM)

There was insufficient site and lab data from section 4

SEACAP 24 Investigations

Visual inspection of whole trial road lengths

Excavation of inspection pits in the trial pavements

In situ testing (DCP)

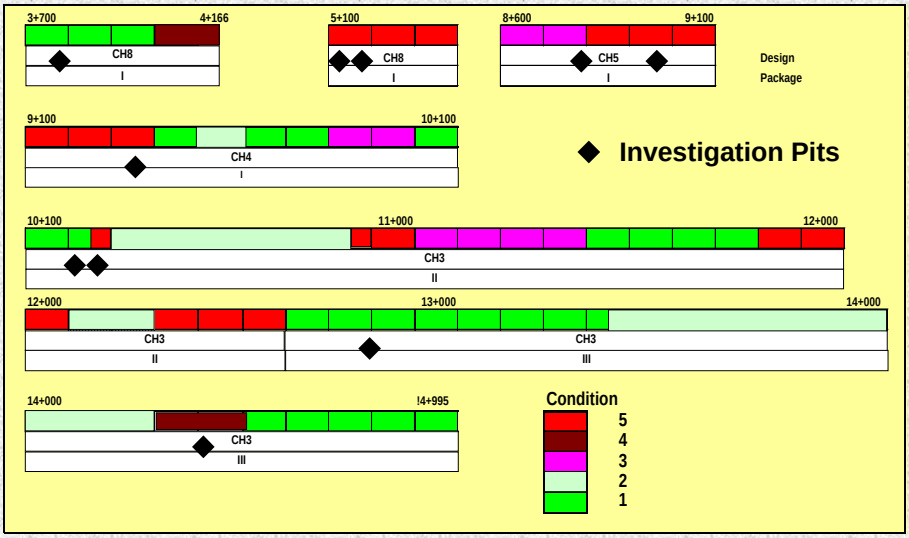
Sampling and testing of as-constructed materials

Collection of relevant traffic volume data

Axle load survey

General Pavement Condition

1. **Good** condition, occasional minor cracking & rutting
2. **Fair** condition, slight stripping of seals leading to occasional shallow potholes, occasional rutting (<20mm) & occasional interconnected or crocodile cracking
3. **Moderately poor** condition, with significant crocodile cracking and scattered potholes, rutting up to 70-80mm
4. **Bad** condition, extensive crocodile cracking and potholes with rutting up to 200mm
5. **Very bad** condition – essentially pavement has lost integrity with severe ruts and loosening of base material



Key Lab and in situ Testing Issues

Section	% Oversize
1	19
2	11
2	6
3	8
4	31
5	10
5	11
6	17
6	5

1. Oversize and poor grading macadam

2. Poor quality natural gravel – low soaked CBR – out of specification grading and plasticity in key areas

3. Low strength sub-base as measured in situ by DCP in most sections

Inspection Pits: Evident Problems

Poor grading and segregation in macadam

Large oversize in macadam

Poor gravel in placed in 1 layer? (specified 2)

Pavement Deterioration

Comparison of Package II and Package III would support the view that construction procedure, quality control and/or construction materials may be a contributing factor in the rate of deterioration.

However it is important to note the **likely over-riding influence of the reported traffic overloading** on the road – in order to assess this some important assumptions and extrapolations have been made based both on the available dta and surveys

Traffic Summary

The current Vietnamese Rural Road Standard (22TCN210-92), although not absolutely definitive, indicates an ADT of 50 motor vehicles per day and a maximum 6 Tonne axle load, which at most is likely to be around **150,000 esa for a 10 year design life.**

Analysis of available data in conjunction with the axle load survey indicates that the Buon Ho road had been subjected to around **250,000 esa in less than 1 year of road life** with a significant number of vehicles well over the 6T axle limit.

1. Were the pavement designs suitable for Commune road A traffic?

Taking into account the surveyed strength of the existing gravel road; the current local standard designs and recent studies (SEACAP 3) the conclusion may be drawn that the Buon Ho pavement designs were adequate for their intended purpose

2. Was the road constructed as per specification?

It is clear from investigations undertaken that some sections of the road were constructed with out-of-specification materials and there is a possibility that construction procedures were not fully compliant with those specified.

3. Was the as-built road suitable for Commune road A traffic ?

From assessments of as built strength it is likely that some sections of the as built road would have required attention during a 10 year design life.

4. Was the design suitable for actual traffic ?

The pavement designs were not suitable for actual traffic and this would have inevitably resulted in early pavement failure.

5. Was the as built road suitable for actual traffic?

It follows from (2) and (4) above that the as built road was totally inadequate for the actual traffic.

6.What are the key factors causing early deterioration in the Buon Ho road?

Within 6-7 months the traffic carried by the road is almost double the 10-year design figure and hence the volume of traffic and its axle loading have far exceeded the design objectives of the road.

In our opinion it is clear that this is the primary cause of road failure and that if traffic had continued at this volume the whole road is likely to have been destroyed. .

However, it is also clear that the rate of this deterioration was aided to some extent by marginal or poor construction in some areas.

Asset Management

Rural roads are a **valuable asset** that require effective management in terms of ensuring that they **not subjected to tasks beyond their design capacity**.

Light or Low Volume Rural roads are designed and constructed at reduced cost to undertake specific tasks in terms of vehicle type,axle load and traffic capacity and hence a **6t Commune 'A' road cannot be expected to undertake the functions of a district or provincial road**

Design Standards & Procedures

Vietnam has a rapidly developing economy – and this is reflected in the variable tasks required of Rural Infrastructure networks in different regions and provinces.

There is a clear need for a re-assessment of rural road design standards based on the **actual and anticipated tasks** they will be asked to perform in terms of vehicles, axle loads and traffic volumes – **not based on administrative classification.**

For example many 'Commune Roads' may indeed be 'Low Volume' but others in some regions certainly are not.

Supervision and Quality Control

The SEACAP 24 investigations have reinforced the conclusions reached in the SEACAP 1 Final Report that

The role of site supervisors in controlling the contractors' procedures & material usage is not yet generally accepted.

Supervisors had a general problem in being able to exert influence on the contractors to abide by specifications

There is a lack of appreciation of the importance of as-used materials testing, in situ testing and daily records

There is a need to introduce independent check-testing of materials testing as some provincial laboratories exhibited weak data management control.

Overall Conclusions

Research in many ways benefits as much from apparent failures as from success and SEACAP 24 has been a valuable research exercise in further defining key problem areas within the rural road sector, in particular in terms of asset management, appropriate design and quality control in construction.

The important issue now is to take forward the results from this project into projects such as RT3.

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