Road Infrastructure Asset Management Course

UNIVERSITY OF TRANSPORT AND COMMUNICATIONS
HANOI, VIETNAM

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Chaired by Prof. Kiyoshi Kobayashi, Kyoto University
INTRODUCTION

ROAD INFRASTRUCTURE ASSET MANAGEMENT AND MAINTENANCE IN VIETNAM

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Problems of M&M; Tentative Solutions
Vietnam Road Network

Total length: 224,483 km
The total number of bridges were 34,933 with the total length of approximately 606,915m.
Classes of roads are defined according to Highway Specification for Design, code TCVN 4054-1998.

Shares of different Roads in term of percentage (Total length 224,482km):

- Class I and II - Roads: 30.80%
- Class III-Roads: 20.30%
- Class IV-Roads: 16.30%
- Class V-Roads: 2.20%
- Class VI-Roads: 30.40%

Shares of different Roads in term of length (Total length 224,482km):

- Class I and II - Roads: 4,939
- Class III-Roads: 68,243
- Class IV-Roads: 45,570
- Class V-Roads: 69,140
- Class VI-Roads: 36,591

(Classes of roads are defined according to Highway Specification for Design, code TCVN 4054-1998)
Shares of different Roads in the networks based on types of pavement

Shares of different Roads (Total length 224,482km)

- Cement Concrete: 49.37%
- Asphalt Concrete: 12.48%
- Bituminous Surface Treatment: 27.76%
- Macadam Stone: 9.89%
- Soil: 0.50%

Length of different Roads, km

- Cement Concrete: 1,113 km
- Asphalt Concrete: 22,194 km
- Bituminous Surface Treatment: 28,017 km
- Macadam Stone: 62,324 km
- Soil: 110,835 km

High Performance
National Road

Total Length: 17,295 km

No.1, HoChi Minh Route
No.2, No.3, No.5, No.6, No.10,...

4.78km/100km²
0.2km/1000 inhabitants
Share of different National roads in term of percentage
(Total length 17,295km)

Class I-Roads: 23.80%
Class II-Roads: 19.60%
Class III-Roads: 15.00%
Class IV-Roads: 16.20%
Class V-Roads: 6.80%
Class VI-Roads: 18.60%

Share of different National roads in term of length
(Total length 17,295km)

<table>
<thead>
<tr>
<th>Class I-Roads</th>
<th>Class II-Roads</th>
<th>Class III-Roads</th>
<th>Class IV-Roads</th>
<th>Class V-Roads</th>
<th>Class VI-Roads</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,116</td>
<td>3,217</td>
<td>3,390</td>
<td>2,594</td>
<td>2,802</td>
<td>1,176</td>
</tr>
</tbody>
</table>
**International Roads in Vietnam**

**ASEAN routes**

Total length: 4237 km

There are eight routes:

- **AH-1**: 1786 km (QL:1+22)
- **AH-13**: 504 km (QL:6+279)
- **AH-14**: 428 km (QL:5+1+3+2+70)
- **AH-15**: 82 km (QL:8)
- **AH-16**: 82 km (QL:9)
- **AH-17**: 1018 km (QL:51+13+14+14b)
- **AH-131**: 147 km (QL:12A)
- **AH-132**: 190 km (QL:24+40)
International Roads in Vietnam

Asian routes

Total length: 2570 km

There are five routes:

- **AH-1**: 1905 km (QL:1+22)
- **AH-14**: 428 km (QL:5+1+3+2+70)
- **AH-15**: 82 km (QL:8)
- **AH-16**: 82 km (QL:9)
- **AH-17**: 73 km (QL:51)
Conclusion about the road system ...

and traffic demand ?
INCREASE IN PASSENGER NUMBER AND MOVEMENT

Increase in Passenger Number and Movement

Increase rate in comparison with values in 1991 (%)

Year

1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004

Figure showing the increase in passenger number and movement from 1991 to 2004. The bars represent the increase rate in comparison with values in 1991 (%) for each year. The chart is color-coded, with red bars indicating passenger number and green bars indicating passenger movement.
Increase in Goods Transportation and Movement

Year


Increase rate in comparison with values in 1991 (%)
Increase in Number of Vehicles, Accident Rate as well as GDP

Increase in Number of Vehicles, Accident Rate as well as GDP

- Numbers of Motorbikes & Vehicles
- Accident Rate
- GDP

Year

2001
Part 2-1. Definition for Road Maintenance

* Road maintenance comprises “activities to keep pavement, shoulders, slopes, drainage facilities and all other structures and property within the road margins as near as possible to their as-constructed or renewed condition” (PIARC 1994).

* Work that preserves the riding qualities, safety characteristics, functional serviceability, and structural integrity of the facilities that comprise the roadways on the highway system.

Maintenance comprises of only the work necessary to preserve the road asset in an acceptable operating standard. It does not add or extend the asset (SMEC 2002).
Part 2-2. Classification of Road Maintenance

Classification Maintenance Work

Preventive (Proactive) Maintenance

Definition

Requirement ?

A well planned strategy!

- System, retard future deterioration, prolong the service life, and delay the need for rehabilitation.
Routine maintenance, which comprises **small-scale works conducted regularly**, aims “to ensure the daily pass-ability and safety of existing roads in the short-run and to prevent premature deterioration of the roads” *(PIARC 1994)*.

For Pavement, RM covers such activities as:
1. Patch potholes and local failures;
2. Seal cracks in bituminous surfaces;
3. Patch broken pavement edges;
4. Regulate sharp depressions and rutting;
5. Repair spalled concrete;
6. Seal cracks in concrete with grout or bitumen;
7. Pothole patch & restore camber in gravel pavements;
8. Restore shape of shoulder; restore shape and grade of drains
Corrective maintenance/ Periodic maintenance

Activities carried out on a regular basis and relatively long intervals to restore the integrity of the existing road facility, to prolong its service life and/or to ensure the safety of the road users. The activities are cyclic, predictable, the work planned and tend to be large scale, requiring specialized equipment and skilled personnel.

For Pavement, PM covers such activities as:
1. Thin asphalt overlays (usually less than 50mm thick)
2. Surface dressings (SBST, DBST, TBST)
3. Replace joint sealant; grout concrete cracks
4. Replace failed concrete slabs;
5. Re-gravel (up to 100 mm thick)

Lack of application new M&R technologies: Cheaper, more durable, faster,... (VTO, Micro Surfacing, Slurry Surfacing, Fog seal, Chip seal, etc).
Corrective maintenance/ Emergency maintenance

Activities requiring rapid response to restore the asset to keep it open and make safe for the user. Emergency maintenance generally results from crashes, floods and landslides, etc.
Part 2-2. Classification of Road Maintenance

Services and cost distribution for Road maintenance (Data of USA)
Part 2-3. Signification of Road Maintenance

- $T1$ : Pre-investing Period
- $T2$ : Investing Period
- $T3 = T$ : Operating Period = Planned Life Cycle

Different maintenance work during operation

Refund
Part 2-3. Signification of Road Maintenance

Planned and timely maintenance will minimize the deterioration of the road and help to prevent expensive rehabilitation. *(MOT 2003)*

**Vicious Circle of M&M**

1. Borrow money for new construction or Rehabilitation roads.

2. Poor M&M cause fast deterioration of roads and reduce the quality of the whole system.

3. Re-borrow money for repair the critical deteriorated roads.

For the whole Roads network: The more investment, the less effective!
Part 2-3. Signification of Road Maintenance

Retard the deterioration process of the road especially for low capacity roads.

The capacity of Vietnamese roads network: **Low** => The **deterioration rate is high**.

Serviceability Index (S)

\[ S_1 > S_2 > S_c => \alpha_2 > \alpha_1 \]
Delayed and poor maintenance have indirect costs and loose potential benefits for influence area of roads. Resulting in increased Vehicle Operating Costs and a reluctance by transport operators to use the roads. This imposes a heavy burden on the economy: as passenger and freight services are curtailed, there is a consequent loss of economic and social development opportunities.
Part 1. Road Network & Traffic Demand
Part 2. Road M&M: Significant and Classification
Part 3. M&M Work
Part 4. Problems of M&M; Tentative Solutions
Part 3-1. M&M Work

Structural organizations of Road Authorities and Agencies in Vietnam

- Vietnam Government
  - Ministry of Transport (MOT)
  - Provincial Government
  - Other Government's Units
  - Other Ministry's Units
  - Vietnam Road Admin. (VRA)
  - P. Dept. of Transport (PDOT)
  - RRMU II
  - RRMU IV
  - RRMU V
  - RRMU VII
  - S_RRMU IV.X.Y M&M Company
  - Other Units

Central Government

- National Roads
- Local Roads

Local Government
- Government
- MOT
- MOF
- VRA
- RRMUs II, IV, V, and VII
- Road M&M Companies
- Sectional Road M&M Division
- Road M&M Units
- National Roads

Processes:
- Submit Maintenance Plan
- Submit Budget Plan
- Approve Budget Plan
- Allocate approval Budget
- Assign Tasks/Conduct M
Local Government

Provincial People’s Committees

PDOF

VRA

Submit Maintenance Plan

Submit Budget Plan

Allocate approval Budget

Approve Budget Plan

Assign Tasks/Conduct M

PDOTs

Sectional Road M&M Division

Road M&M Units

Authorized
National Roads

Local Roads
Part 3-1. M&M Work/Produce of maintenance

Maintenance Demands

Routine Maintenance

- Problem treatment? (Yes/No)
  - Yes: End
  - No: Periodic Maintenance

Periodic Maintenance

- Problem treatment? (Yes/No)
  - No: Special Maintenance (Preventive, Major repair)
  - Yes: End

Special Maintenance (Preventive, Major repair)

- Problem treatment? (Yes/No)
  - No: Posting
  - Yes: End

External Contractors_Limited Tendering (Outsourcing works)

Road M&M Agencies (in-house works) Direct Appointment

Others
Example:

**Rao Bridge in HaiPhong Province:** Operated without any maintenance, so collapsed in 1987 with Life Time of 7 years 4 months.

**Railway Tunnels System:** built by French in 1920’s, very poor maintenance for 70 years, so in 1993 Tunnel No.7 through HaiVan Pass collapsed.
Problems:

When, How
Lack of basics of Sciences to determine !!!

Roads Operation with Maintenance
(Remarkable Progress)
Contents

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Part 4. Problems of M&M; Tentative Solutions
Government Budget ! But Insufficient !!!

Vietnam Road Infrastructure Master Plan up to 2010 and Orientation to 2020:

+ Financing in Improving the Road System: 
  $C_1 = 18,942$ bil. VND/year

+ Financing in M&M Existing Road System: 
  $C_2 = 3,800$ bil. VND/year (20% of $C_1$) in need but the actual fund is just above 950 bil. VND in 2005
New Const. N.H: approx. 1 mil. USD/km (Average: 300,000 USD/km)
Maintenance: N.H: approx. 1,300 USD/km.year
L.R: approx. 500 USD/km.year
Actual Budget allocated for Road M&M in comparison with need

- Actual Budget allocated for M&M (Bil. VND)
- Budget needed for M&M (Bil. VND)
2. Establishing “Road Maintenance FUND”

Vietnam Road Administration has submitted the Proposal of “Road Maintenance FUND” to Government for approving.

7 Main Sources for “Road Maintenance FUND” :

1. Fuel charges: 2,500 bil. VND/year.
2. Toll collection for improved Projects: 350 to 600 bil. VND/year.
4. Traffic fees collection through tyres and inner tubes of vehicles (10% of sale price): 400 bil. VND/year
5. Charges for getting driving licences: after deducting all expenses for issuing.
6. Part of the vehicles inspection fees: after deducting all expenses for inspecting.
7. Support from organization, enterprises and individuals, etc.

1. Properly Financing Roads Improving Projects (new const.) and M&M activities
Part 4-1... /Management Tools

Problems:

- When, How
- Lack of basics of Sciences to determine !!!

SI restored after repairing

Elapsed Time

T1

T2

Actual Life Time

Designed Life Time

SI initial

SI critical

Lost of SI

Overview of HDM-4

Henry G. R. Kerali

HIGHWAY DEVELOPMENT & MANAGEMENT

volume one

H D M - 4

So it is necessary to develop the suitable management system and tools with suitable models regards to the actual condition in Vietnam.
Need to transfer maintenance activities from existing mechanism to a purely business mechanism with the participation of private companies.
Insufficient! Need more: Standards and technical Norms of application new technologies for periodical maintenance (VTO, Micro Surfacing, Slurry Surfacing, Fog seal, Chip seal, etc.)
Part 4-1... /Poor relationship between investment period and operating period
Tightly Collaborate!
For a better Road and a better Life

Planning → F/S → D/D → Build

Preliminary Maintenance Plan → Detailed Maintenance Plan

PMUs → Inspection/Monitoring → Update Database

NEED Temporary Countermeasures?
Y → Implement Temp. Countermeasures
N → LCC Calculation

Classification Maintenance Work

NEED Countermeasures this year?
Y → Implement Countermeasures
N → M&M Agencies

Preventive (Proactive) Maintenance
Corrective (Reactive) Maintenance
Periodic M&R
Emergency M&R

Routine Maintenance

Poor Relation

M&M Agencies

Tightly collaborate! For a better Road and a better Life

M&M Agencies
Q&A

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Thank you very much for your attention!