

## Section 1

### S1.1: Concepts of Rural Road Maintenance

#### SUMMARY

- Principles of LVRR maintenance
- Tasks of LVRR maintenance
- Types of Rural Road Maintenance
- Routine maintenance 1
- Routine maintenance 2



### Importance of LVRR maintenance

**All components** of the rural road infrastructure, such as pavement surface, shoulders, earthworks, bridges and drainage structures, require maintenance to ensure that they continue to function as designed.



## Tasks of Rural Road Maintenance

Non-maintained roads cause additional costs to the users and community in higher vehicle operating and transport costs, reduced safety and delayed or slower journeys. Government, community, commercial and individual efforts to bring development and services to the rural areas will be hampered by poor road maintenance, and investments will be placed at risk.



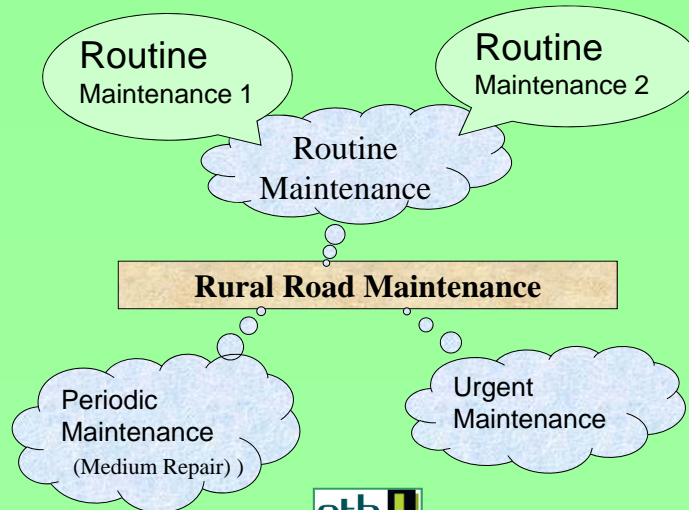
## Key Types of Rural Road Maintenance

**Routine maintenance** (1 and 2) Remediating relatively minor defects on rural roads that occur on a frequent and sometimes recurring basis

**Periodic maintenance:** Comprises more expensive cyclic activities that are required on regular basis eg re-gravelling of unsealed roads on a 3-4 year cycle



## Types of Rural Road Maintenance



## Routine Maintenance

**Routine 1** Maintenance items that require only unskilled labour and simple hand tools for example grass cutting, bush clearing, and ditch cleaning. These items can be carried out using compulsory or voluntary labour.

**Routine 2.** Items requiring material, equipment and specialized skills such as pothole patching, or mechanical grading. They require certain additional resources and specialized skills.

## Routine maintenance 1

M1

Clean ditches/drains



Clean culverts



Lining & repair drains, culverts



Remove small landslides



Refill slope gully



Reshape shoulder



Fill Potholes



Treat soft spots (earth, gravel road)



Grade corrugations



Clean pavement or bridge surface



Remove debris from culverts or bridges



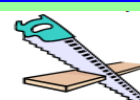
Spray water to reduce dusting



## Routine maintenance 2

M2

Image system



Fill potholes



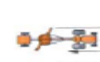
Treat soft spots or rutting (bituminous pavement)



Seal cracking (bituminous pavement)



Reshape road cap (by using equipment)



road face

Remove large landslides



Treat large soft spots



road - ed

Repair retaining walls



Paint & repair traffic signs



her work

## NOTE

- ❑ **There are two types of Routine Maintenance: Routine Maintenance 1 & Routine Maintenance 2**
- ❑ **Undertaking Routine Maintenance does not require high cost and yields extensive benefits, maintains the road quality and extends road service life.**



## Discussion

**Routine 1 and Routine 2 - are these valid definitions in the Cambodian environment ?**



## Section 1

### S1.2: Rural Road Defects and Causes

#### SUMMARY

- Types of defects of road structures, bridges, culverts in Rural Road Network.
- Causes of Rural Road defects and
- Appropriate maintenance activities



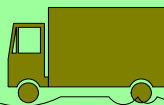
### S1.2: Rural Road Defects and Causes

## Causes of Rural Road defects

Natural conditions (topography, geography, hydrography, vegetation, rain fall, moisture content...)



Traffic conditions (traffic volume, traffic load,...)



Construction conditions (designing & constructing quality, ...)



Human activities



## Defect identification & Appropriate routine maintenance

**Defect identification:**  
Excessive vegetation growth on road shoulders eliminates the normal vision



**Appropriate routine maintenance:**  
Routine maintenance 1



## Defect identification & Appropriate routine maintenance

Defect identification:.....  
.....

.....



S1.2: Rural Road Defects and Causes  
Defect identification &  
Appropriate routine maintenance

3



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S1.2: Rural Road Defects and Causes  
Defect identification &  
Appropriate routine maintenance

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S1.2: Rural Road Defects and Causes  
Defect identification &  
Appropriate routine maintenance



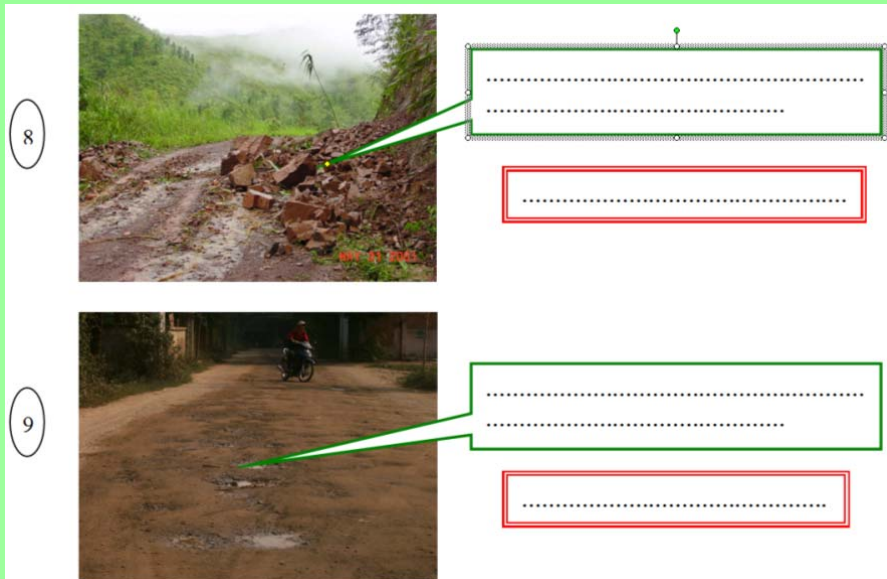
S1.2: Rural Road Defects and Causes  
Defect identification &  
Appropriate routine maintenance



## Defect identification & Appropriate routine maintenance



## Defect identification & Appropriate routine maintenance



## Defect identification & Appropriate routine maintenance



### S1.2: Rural Road Defects and Causes

## Defect identification & Appropriate routine maintenance



**Defect identification & Appropriate routine maintenance**



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**Defect identification & Appropriate routine maintenance**

15



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# Key Notes

- ❑ Water is an enemy of road - Don't let water stagnate on the road surface or road shoulders.



- ❑ It is important to keep the designed shape of the road



## Defects summary

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
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- 12
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- 14
- 15

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## Section 1

### S1.3: Road Defect Survey and Maintenance Demand Determination

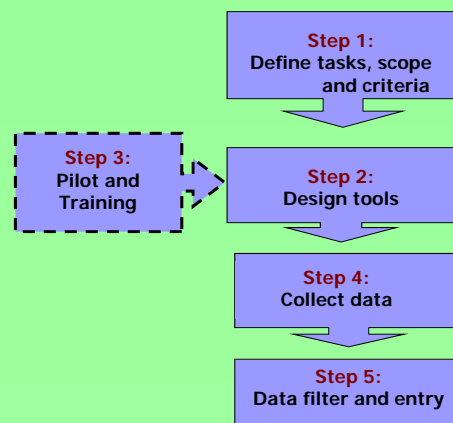
#### SUMMARY

- LVRR survey procedure
- Qualitative and quantitative assessment criteria
- Routine tools and devices for survey
- Collect data at the field
- LVRR survey forms



#### S1.3: Road Defect Survey

### RR survey procedure



## RR assessment criteria

- Two types of RR assessment criteria:
- ❑ **Qualitative criteria** used for quality assessment of RR condition (Good, bad...)
  - ❑ **Quantitative criteria**: used for defining number, size, weight (m,m2, m3, kg...) needed for identifying volume of maintenance works and/or estimating maintenance cost



## RR assessment criteria

- ❑ **Qualitative criteria sample**

**Table 1: quality assessment criteria for an earth road**

Criteria	Unit	Good	Fair	Bad	Very bad
1. Cross fall	percent	4 - 6	2 - 4	1 - 2	<1
2. Pothole area	% of surface area	0	≤ 3.5	> 3.5 and ≤10	>10
3. Corrugation	Height of corrugation (cm)	None	≤ 3 cm	>3 cm & ≤5cm and total length of corrugation greater than 20% of road length	>5 cm and total length of corrugation greater than 20% of road length



# RR assessment criteria

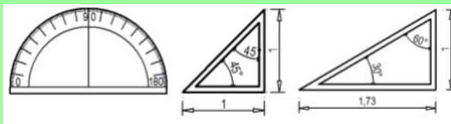
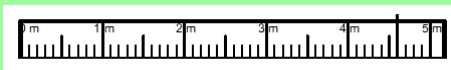
## Quantitative criteria sample

For Earth Road

- The area -  $m^2$  - of pavement need to be cleared
- The area -  $m^2$  - of rutting & corrugation
- The area -  $m^2$  and average depth (m) of pothole
- The volume -  $m^3$  - of soft spot

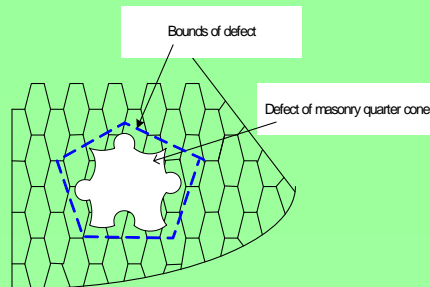


# Tools and devices for survey



## How to identify and measure the defects?

- ❑ **Defect zone should be converted to equivalent simple shape to define maintenance demand**



### S1.3: Road Defect Survey

## LVRD defect survey forms

- ❑ Four main forms can be used for LVRD condition/defects survey:
  1. For pavement defects
  2. for shoulder, side drain & embankment defects
  3. for bridge, culvert, retaining wall... Defects
  4. Defect quantity - field survey result form



# LVRR defect survey forms

## Assessment criteria for Pavement defects

- Items 7, 8, 9 are exclusive for concrete pavement

1	Pavement clearing (length/area) -m/m2-
2	Corrugation (depth/area) -cm/m2-
3	Rutting (depth/area) - cm/m2-
4	Pothole (average depth/area) - cm/m2-
5	Soft spot (volume/area) - m3/m2-
6	Cracking, raveling, fretting (area) - m2
7	Numbers of concrete slab need to be replaced - slab -
8	Concrete pavement cracking (area) - m2 -
9	Crack, joint damage (length) - m -



### S1.3: Road Defect Survey

# LVRR defect survey forms

## Form 1: survey pavement defects

Chainage	Km																		
	m	0	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850
Pavement/Shoulder width (m):.....																			
Pavement type:.....																			
1	Pavement clearing (length/area) -m/m2-																		
2	Corrugation (depth/area) -cm/m2-																		
3	Rutting (depth/area) - cm/m2-																		
4	Pothole (average depth/area) - cm/m2-																		
5	Soft spot (volume/area) - m3/m2-																		
6	Cracking, raveling, fretting (area) - m2																		
7	Numbers of concrete slab need to be replaced - slab -																		



# LVRR defect survey forms

Assessment criteria for shoulder, side drain & embankment defects

1	Shoulder reshaping (m/m <sup>2</sup> )
2	Grass cutting on shoulder (m/m <sup>2</sup> )
3	Brush clearing on road side (m <sup>2</sup> )
4	Side drain clearing (m)
5	Additional excavation of side drain (m)
6	Minor landslide removing (m <sup>3</sup> )
7	Embankment/ slope refilling (m <sup>3</sup> )
8	Side post/ traffic sign clearing (unit)



# LVRR defect survey forms

Form 2: For shoulder, side drain & embankment defects

RT2 Project						ROAD DEFECTS SURVEYING FORM															Form 2: For shoulder, side drain & embankment defects
Province: .....		District: .....		Commune: .....		Starting Time: .....			Finishing time: .....			Page: .....									
Road Code: .....		Road name: .....		From: ..... To: .....			Surveyor Name: .....			Date: .....											
Location		Km																			
		m		0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000																	
Remarks	Pavement Shoulder width (m): .....																				
	Pavement type: .....																				
Shoulder - road head - side drain	1	Shoulder reshaping (m/m <sup>2</sup> )																			
	2	Grass cutting on shoulder (m/m <sup>2</sup> )																			
	3	Brush clearing on road side (m <sup>2</sup> )																			
	4	Side drain clearing (m)																			
	5	Additional excavation of side drain (m)																			
	6	Minor landslide removing (m <sup>3</sup> )																			
	7	Embankment/ slope refilling (m <sup>3</sup> )																			
	8	Side post/ traffic sign clearing (unit)																			



# LVRR defect survey forms

Assessment  
criteria for  
bridge,  
culvert,  
retaining  
wall... defects

bridge - culvert - other structures	1	Clean debris on bridge surface (m <sup>2</sup> )
	2	Replace bridge wooden plank (m <sup>3</sup> )
	3	Replace bridge wooden nails (unit)
	4	Repair abutment(c,i)
	5	Remove concrete, masonry (m <sup>3</sup> )
	6	Soil excavation (m <sup>3</sup> )
	7	Replace concrete (m <sup>3</sup> )
	8	Replace masonry (m <sup>3</sup> )



# LVRR defect survey forms

Form 3: For bridge, culvert ,  
retaining wall... defects

RT2 Project		<b>ROAD DEFECTS SURVEYING FORM</b>				Form 3: For bridge, culvert, retaining wall... defects	
Province:.....	District:.....	Commune:.....	Starting Time:.....	Finishing time:.....	Page:.....		
Road Code:.....	Road name:.....	From:..... To:.....	Surveyor Name:.....	Date:.....	.....		
Location	Km m	0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000					
Summary	Pavement Shoulder width (m):.....						
	Pavement type:.....						
bridge - culvert - other structures	<ul style="list-style-type: none"> <li>• Clean debris on bridge surface</li> <li>1 (m<sup>2</sup>)</li> <li>Replace bridge wooden plank</li> <li>2 (m<sup>3</sup>)</li> <li>Replace bridge wooden nails</li> <li>3 (unit)</li> <li>4 Repair abutment(c,i)</li> <li>5 Remove concrete, masonry (m<sup>3</sup>)</li> <li>6 Soil excavation (m<sup>3</sup>)</li> <li>7 Replace concrete (m<sup>3</sup>)</li> <li>8 Replace masonry (m<sup>3</sup>)</li> </ul>						



## LVRR defect survey forms

Form 4: Defect quantity - field survey result form

		Road : .....	
		Road code: .....	
- Pavement width/Road width:3.5m/5m			
Location and location of defects			
K0 - K0+500	K0+ 500 - K1		
130	80		
20/6.4	0		
30	42		
.....	.....	.....	.....
2/120	1.5/300		
0	0		
200/70	140/49		
0	0		
80	60		
20/14	30/18		
.....	.....	.....	.....



### S1.3: Road Defect Survey

## Discussion

How to organize LVRR defect survey?

How to collect data at the field? (how to identify and measure the defects)?

How to fill the survey forms?

