

Disaster Preparedness in the Transport Sector

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Katmandu, Nepal

**Geohazard
Risk Management**
in Transport Sector



GFDRR
Global Facility for Disaster Reduction and Recovery



WORLD BANK GROUP

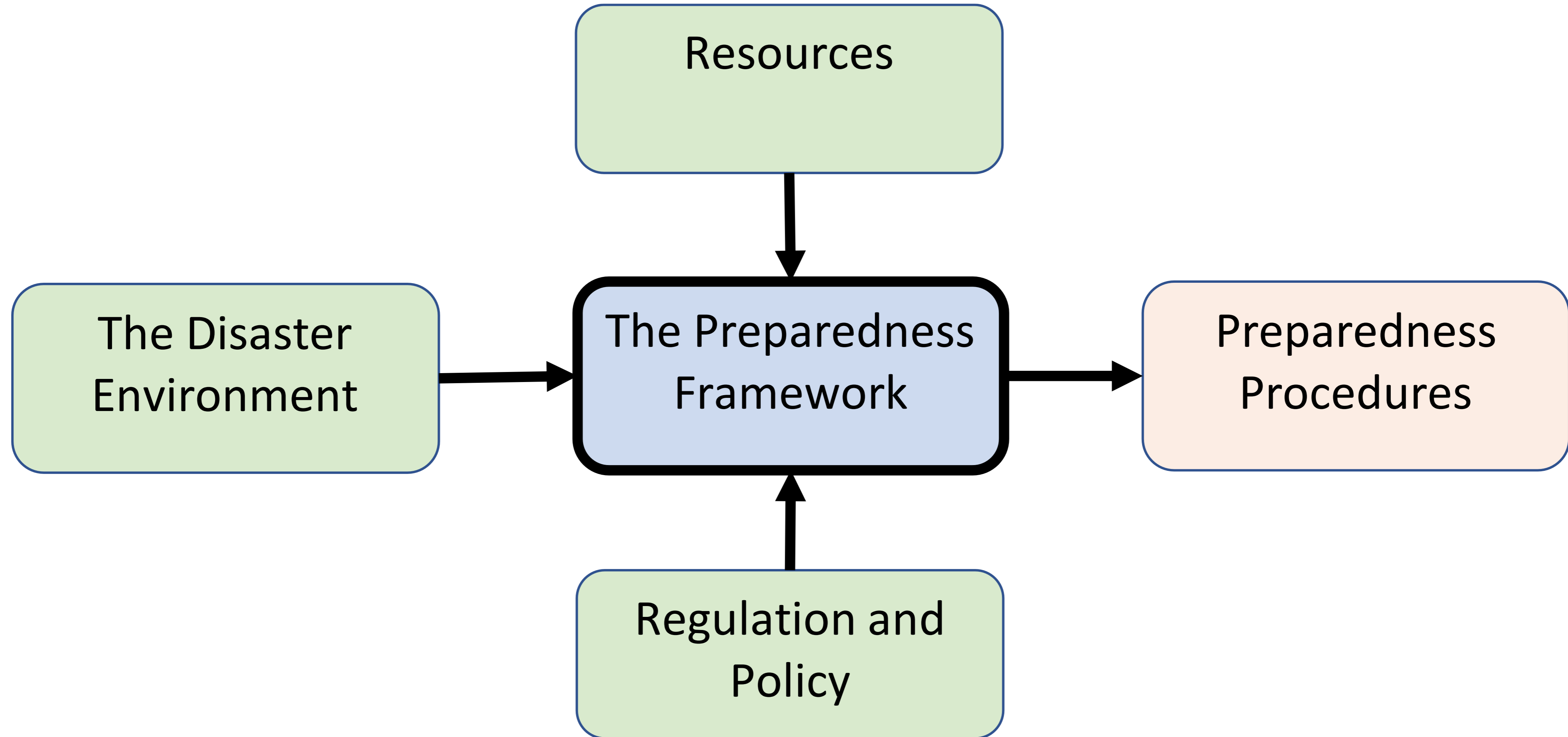
Presentation Focus

Natural disaster preparedness and its integration into road management.

There is no detailed 'one-size fits all' approach to Disaster Preparedness (DP), but there is an overall approach within an overall Disaster Risk Management (DRM) umbrella which can be effectively implemented to reduce disaster impacts.



A Working Framework

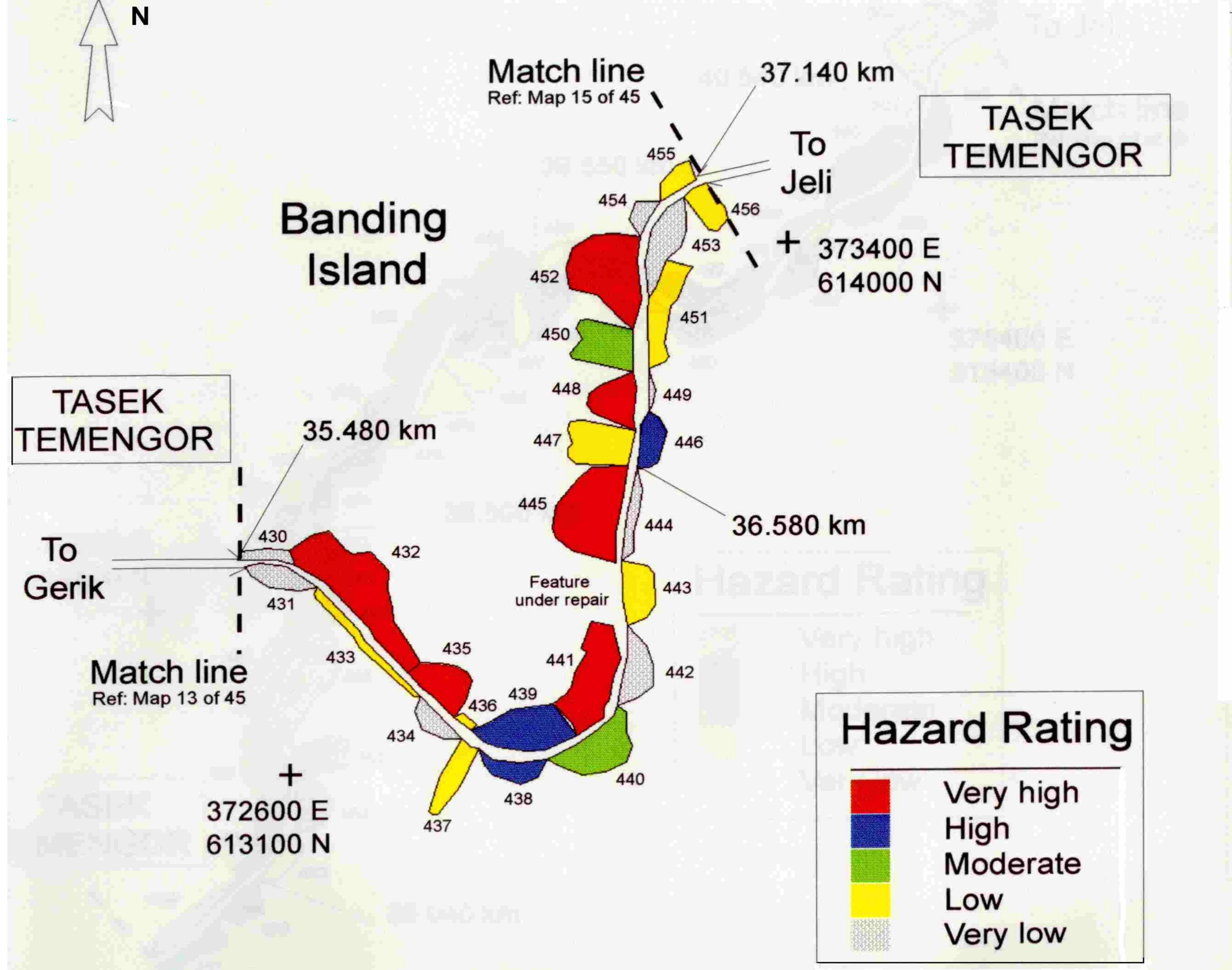


The Natural Disaster Environment: Some key elements

- The hazard – potential or actual
- The road asset (s)
- Natural environment
- Contractual environment
- Social Environment



Hazard Rating: E-W Highway Malaysia



Preparedness Procedures

Dealing with a Disaster

- What is it?
- Initial Actions?
- Restore access ?

Disaster Reduction

Avoidance – Engineering resilience

- Design
- Maintenance

Avoidance – Non-engineering issues

- Early warning
- Community resilience
- Evacuation

Dealing with a Disaster

A Logical Pathway: Disaster is the Driver

A practical decision making process - firmly based on field evidence.



- Basic Data acquisition
- Post-disaster risk
- Immediate Access
- Initial repair/stabilisation
- (Long term solutions)

Lao PDR. Tropical Storms

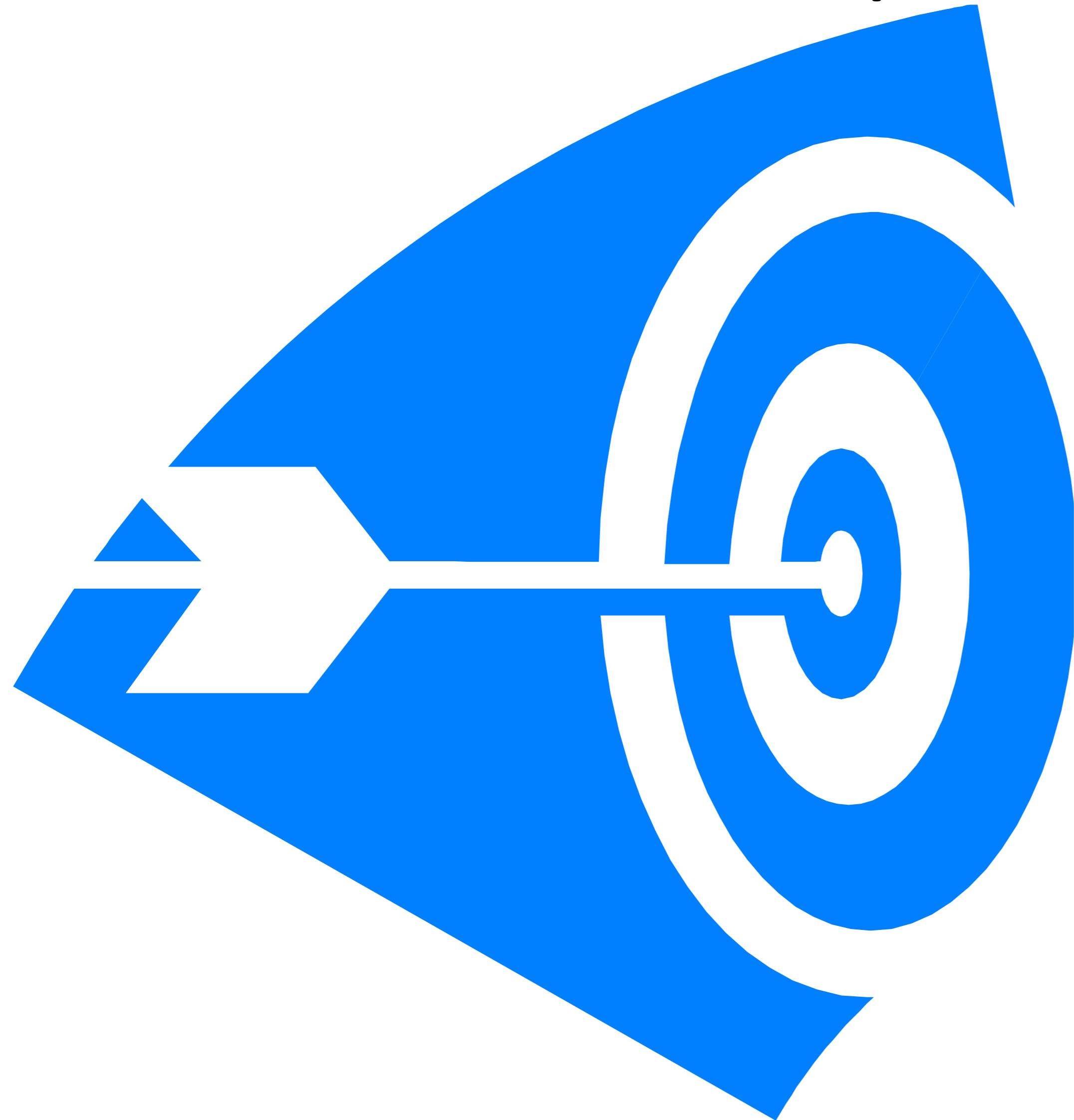
Tropical storms Ketsana and Haima (2009, 2011) brought sharply into focus the impacts of natural disaster on vulnerable rural infrastructure.

The vulnerability of community access routes was particular cause for concern.

Recognised need for system to acquire basic data for preparedness and prioritisation.



Targeted Disaster Interventions at a Transport Network Level



Priority Road
Sections and
Structures



PRF Initial Impact Identification

1. Province 2. District

3. Kumban 4. Village

5. Road

6. Impacted Section
From To

7. Existing Road type: unformed track, earth road, gravel road, stone road

8. Terrain: flat, rolling, mountainous

9. Normal Traffic: typical vehicles, Likely traffic numbers/day

10. Principal Road Task

Problem	Blocked Lengths	
	Total	Partial
Slope failure		
Embankment erosion		
Road washout		
Bridge washout		
Flood		
Total Lengths		

Causes	Y/N
Rain Storm	
Flash Flood	
Secondary Flood	
Earthquake	
Landslide	

Village Level Basic Data

Drafting basic data collection procedures for disaster impact evaluation through the World Bank supported Poverty Reduction Fund (PRF) programme.

Village Level Check List




Ref.	Issues	Check
1.1	Has all data on form 1 been collected and checked	Yes No
1.2	Actions taken	
	Close road	Yes No Action
	Advise I communities on safety issues	Yes No Action
	Opened diversion track	Yes No Action
	None of these required	Yes No
1.3	Work completed or underway by community action	
	Clear debris from road	Yes No Action
	Clear debris from side ditches	Yes No Action
	Clear debris from culverts/bridges	Yes No Action
	Emergency flood water diversion	Yes No Action
	Emergency slope/earthwork drainage	Yes No Action
	Other	Yes No Action
1.4	Impacts are affecting the following tasks:	
	Access to health centre	Yes No
	Access to school	Yes No
	Produce from farm to village	Yes No
	Produce form village to market	Yes No
	Traders to village/market	Yes No
	Other	Yes No

1.5	Impacts are having a particular adverse impact on:	
	Ethnic groups	Yes No
	Women	Yes No
	Children	Yes No
1.6	Is the impacted road/track associated with an existing or proposed subproject	Yes No
1.7	Is there a local community maintenance system operational?	Yes No
1.8	A Disaster Impact Survey is requested	Yes No
Comments		
Signature		Date

DoR: Nepal

ROADSIDE GEOTECHNICAL
PROBLEMS:
A PRACTICAL GUIDE TO
THEIR SOLUTION.

Initial ID.

Road name:				Site Ref ID:		
Road link:				 hill	 road	 valley
Chainage (km + m):						
Geographical coordinates: Lat ° Long °				Side of road: left <input type="checkbox"/> right <input type="checkbox"/>		
				Size: L= m B= m H= m		
Traffic disruption: high <input type="checkbox"/> low <input type="checkbox"/> no <input type="checkbox"/>				Rainfall		
Traffic blockage duration: days/yr				No rain for ___ days		
Average daily traffic (ADT): vpd				Raining for ___ days Recent heavy rain <input type="checkbox"/>		
Preliminary Problem Identification				Impacts		
Routine(R); Moderate(M); Severe (S)				On Road	Actual	Risk
	R	M	S	None		
Soil-rock fall				Road edge only		
Earth-debris flow				1 lane		
Shallow slide				Most of 2 lanes		
Deep-seated slide				Whole road		
Surface/gully erosion				Earthworks		
River erosion/undercutting				Culverts		
Pavement failure				Bridge		
Structure failure						
Drainage blocked					Above Rd	Below Rd
				Risk to Life		
				Risk to Buildings		

Actions Required

FormA1.2: Problem Identification Decisions 1/1

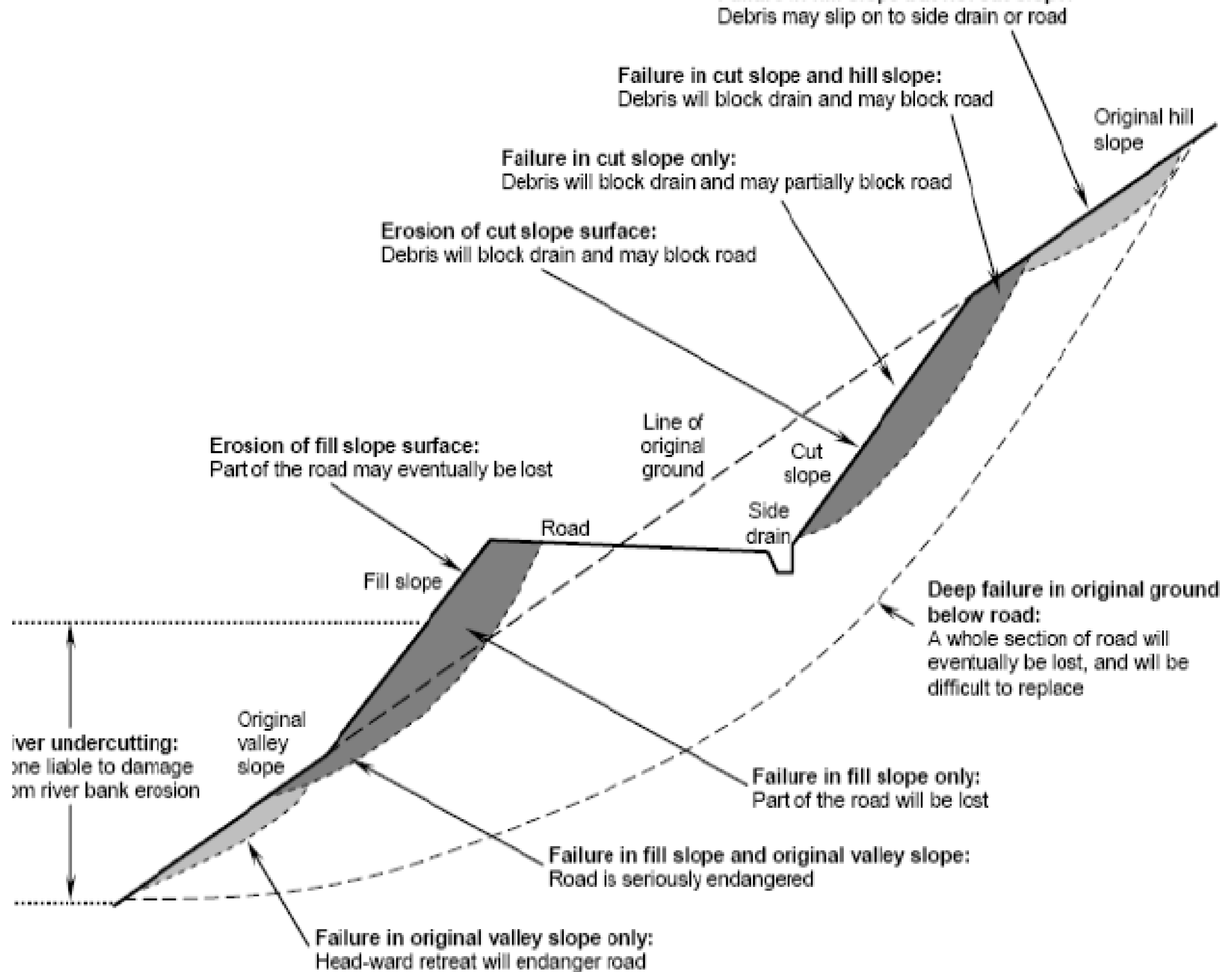
Road name	Site Ref ID
Issue	Decisions
A. Immediate or Emergency Engineering Control	1. Clear debris off the road <input type="checkbox"/> 2. Remove loose or overhanging material <input type="checkbox"/> 3. Divert water off road <input type="checkbox"/> 4. Divert water away from the problem area <input type="checkbox"/> 5. Place stabilising earth works <input type="checkbox"/> 6. Place temporary control structures (gabions, masonry walls) <input type="checkbox"/> 7. Others (specify)
B Short Term Engineering	1. Not required <input type="checkbox"/> 2. Repair existing structures <input type="checkbox"/> 3. Reconstruct the damaged works <input type="checkbox"/> 4. Construct new works (use Annex C) <input type="checkbox"/> 5. Others (specify)
C Long Term Engineering	Engineering response requires design input. Engineering Definition Surveys 1. Topographic Survey <input type="checkbox"/> 2. Engineering Geological Survey <input type="checkbox"/> 3. Failure Assessment <input type="checkbox"/> 4. Engineering Design <input type="checkbox"/> 6. Others (specify)

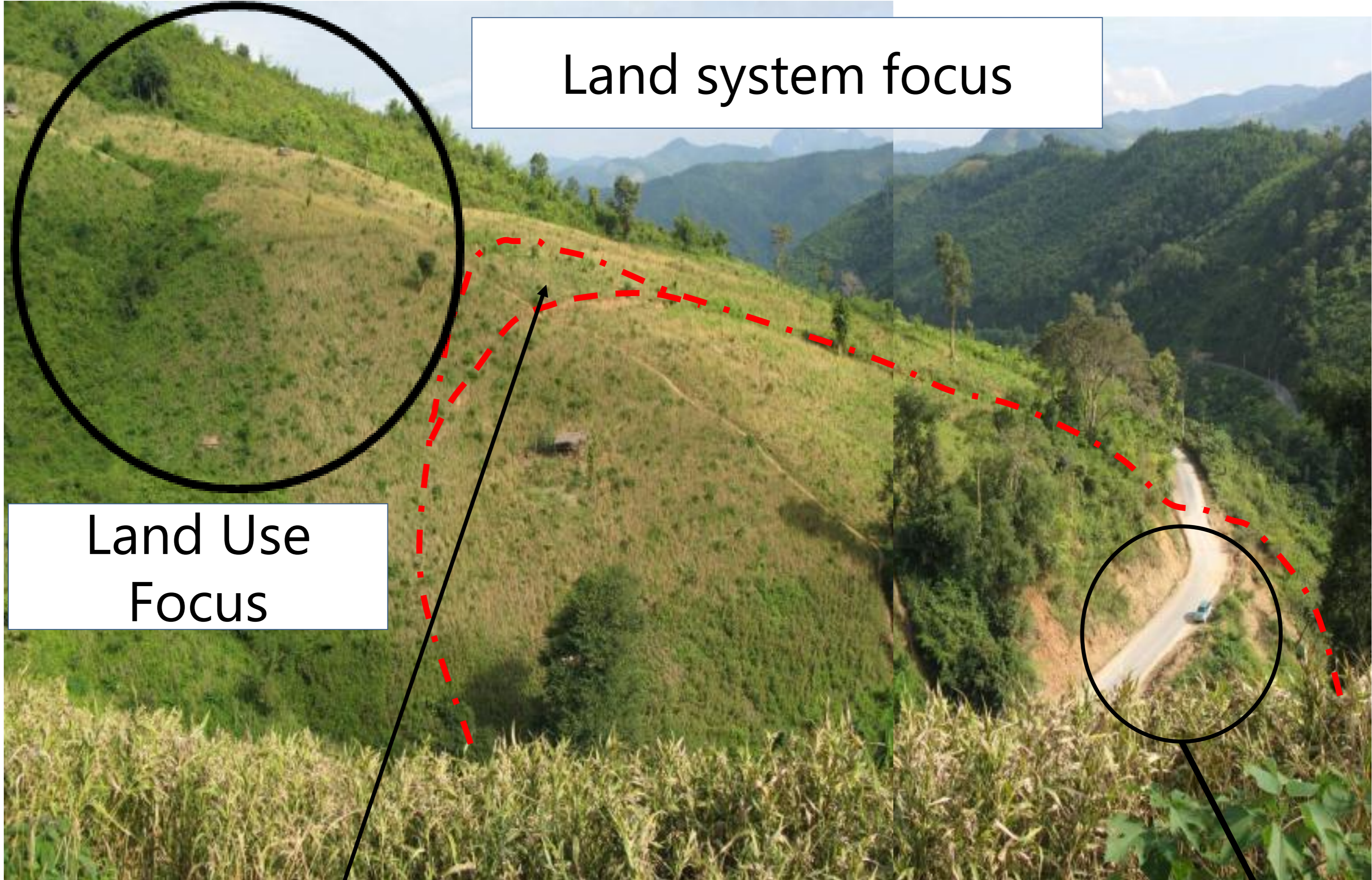
Check List

Issue	Decisions
A Immediate Action Review	1. Road clearance – further action required <input type="checkbox"/> 2. Further emergency control required <input type="checkbox"/> 3. Immediate risk control actions required <input type="checkbox"/> 4. Short term engineering actions – revision required <input type="checkbox"/>
B Geotechnical Assessment	1. Geological/Geotechnical model established <input type="checkbox"/> 2. Erosion mode established <input type="checkbox"/> 3. Failure and erosion boundaries defined <input type="checkbox"/> 4. Erosion cause identified <input type="checkbox"/> 5. Erosion active <input type="checkbox"/> moderately active <input type="checkbox"/> dormant <input type="checkbox"/> 6. Erosion likely to reactivate during next monsoon <input type="checkbox"/>
C Preliminary Risk Assessment	1. Hazard: 1. High <input type="checkbox"/> II. Medium <input type="checkbox"/> III. Low <input type="checkbox"/> 2. Consequence a. Major <input type="checkbox"/> b. Medium <input type="checkbox"/> c. Slight <input type="checkbox"/> 3 Risk High <input type="checkbox"/> Moderate <input type="checkbox"/> Slight <input type="checkbox"/> (Refer Procedure Sheet B2.1 in Annex B) 4. Hazard-risk assessment satisfactory <input type="checkbox"/>
D Strategic Options	1. Problem Avoidance <input type="checkbox"/> 2. Slope protection <input type="checkbox"/> 3. Debris control <input type="checkbox"/> 4. Bank Protection <input type="checkbox"/>

Need to look carefully at initial clearance and access to ensure further failures are not initiated







Land system focus

Land Use Focus

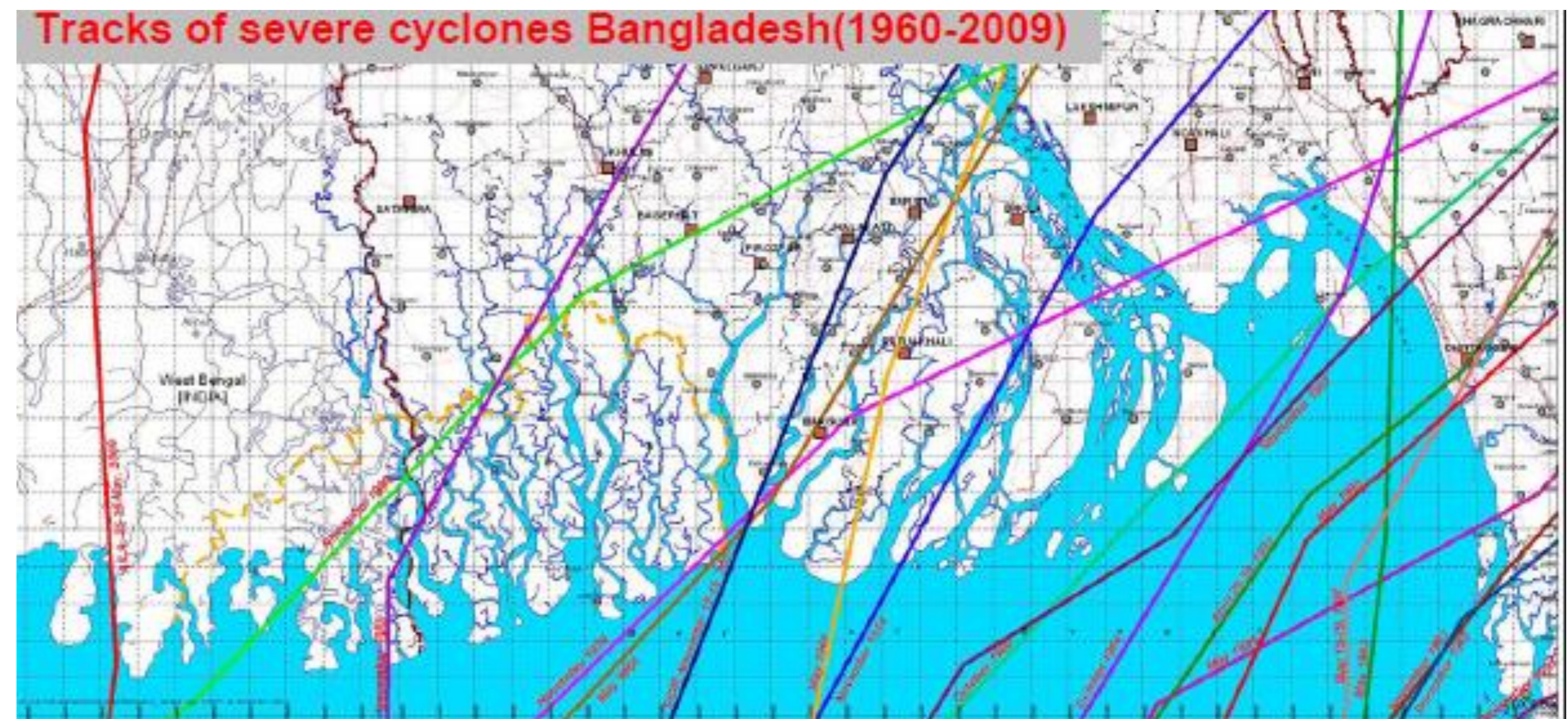
Geotechnical Focus

Engineering Focus

Define the hazard (s) and risk

Preparedness requires a clear understandings of the disaster hazards encountered or likely to be encountered and their associated risks.

- Landslide – upslope/downslope
- Typhoon/tropical storm
- Flash flood
- General flood
- Storm surge/tsunami
- Heat wave





The Vulnerable Asset (s)

The nature of the vulnerable asset is crucial

—

- National highway
- Provincial road
- District road
- Community road

Each will have different expectations in terms of disaster response.

For an existing disaster the additional requirement is to know the current safety and ongoing risk issues.



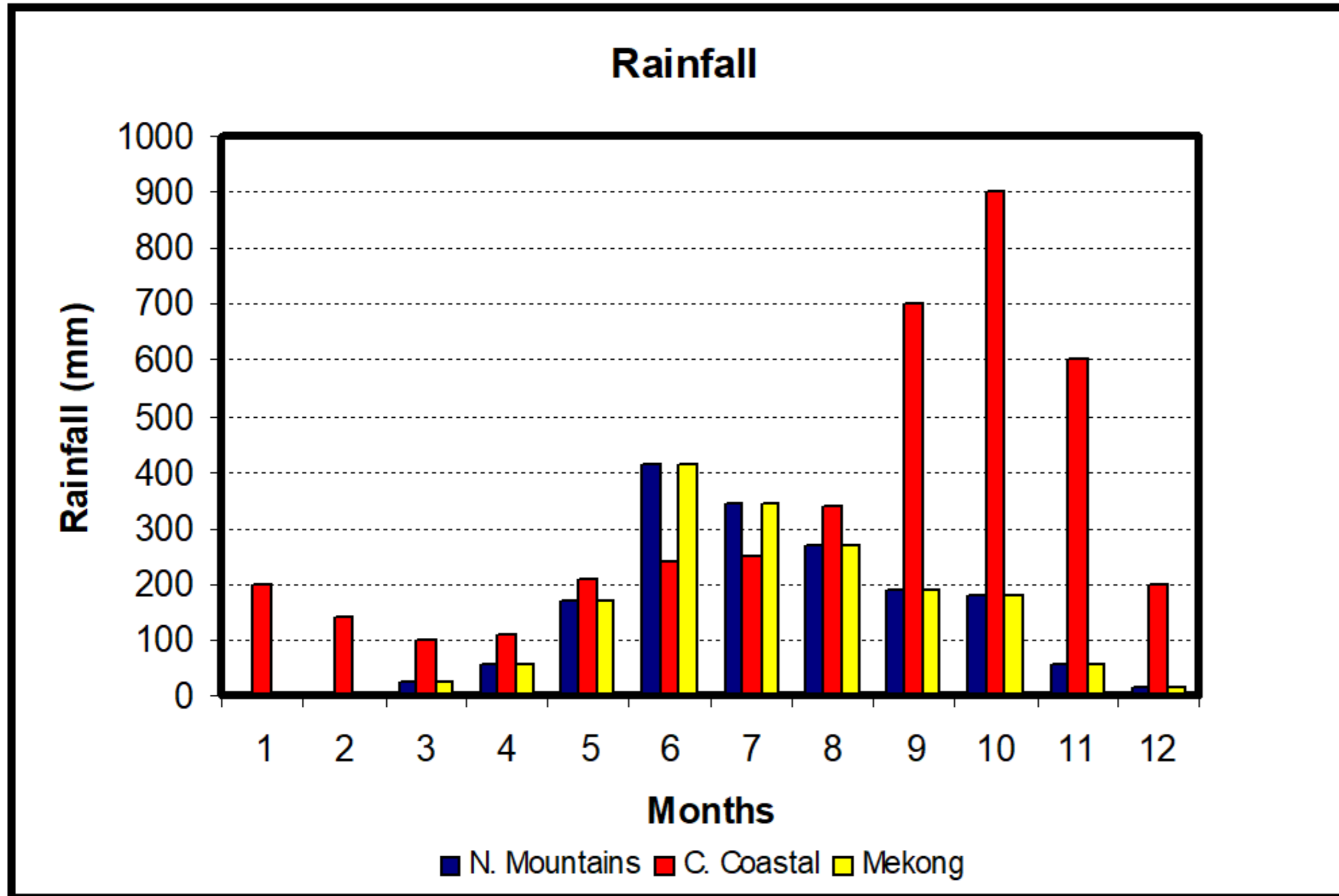
Preparedness must acknowledge expectation on Level of Service

Current draft proposals for levels of Climate Resilience service for roads in Lao PDR in terms of road closure and flood disaster level.

Road Class	Flood Event (Return Period)			
	5yr	10yr	50yr	100yr
National Highway	nil	Nil	<2 hrs	<12hrs
Provincial Highway	nil	<6 hrs	<1 day	<2 days
District Road	<2hrs	<12 hrs	<2 Days	<4 Days
Village Access	<12hrs	<2 Days	<4 Days	<7 Days
Farm Access	<1 Day	<4 Days	< 7 Days	<10 Days

The Natural Environment

The natural environment includes such issues as terrain and rainfall.

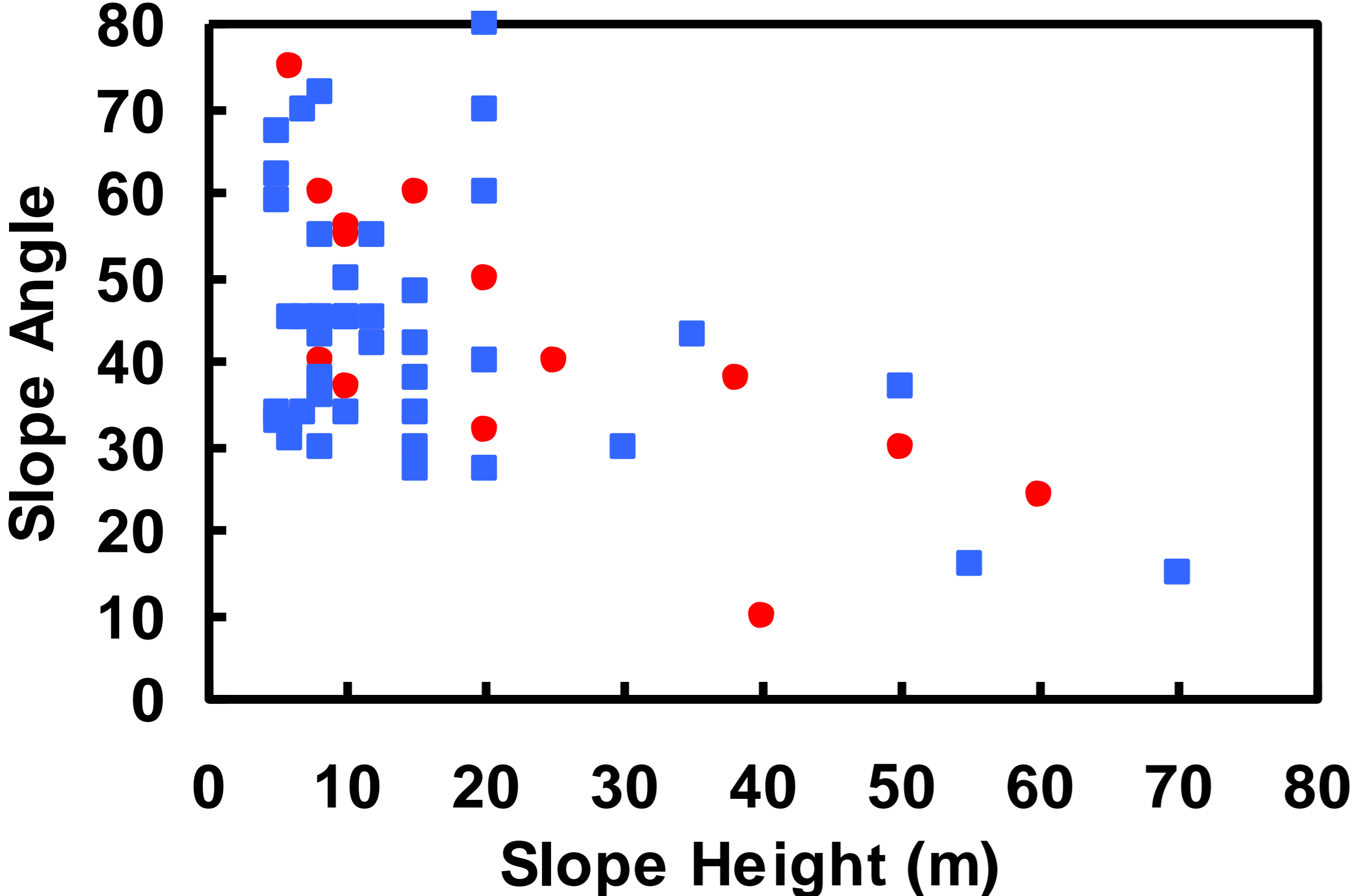




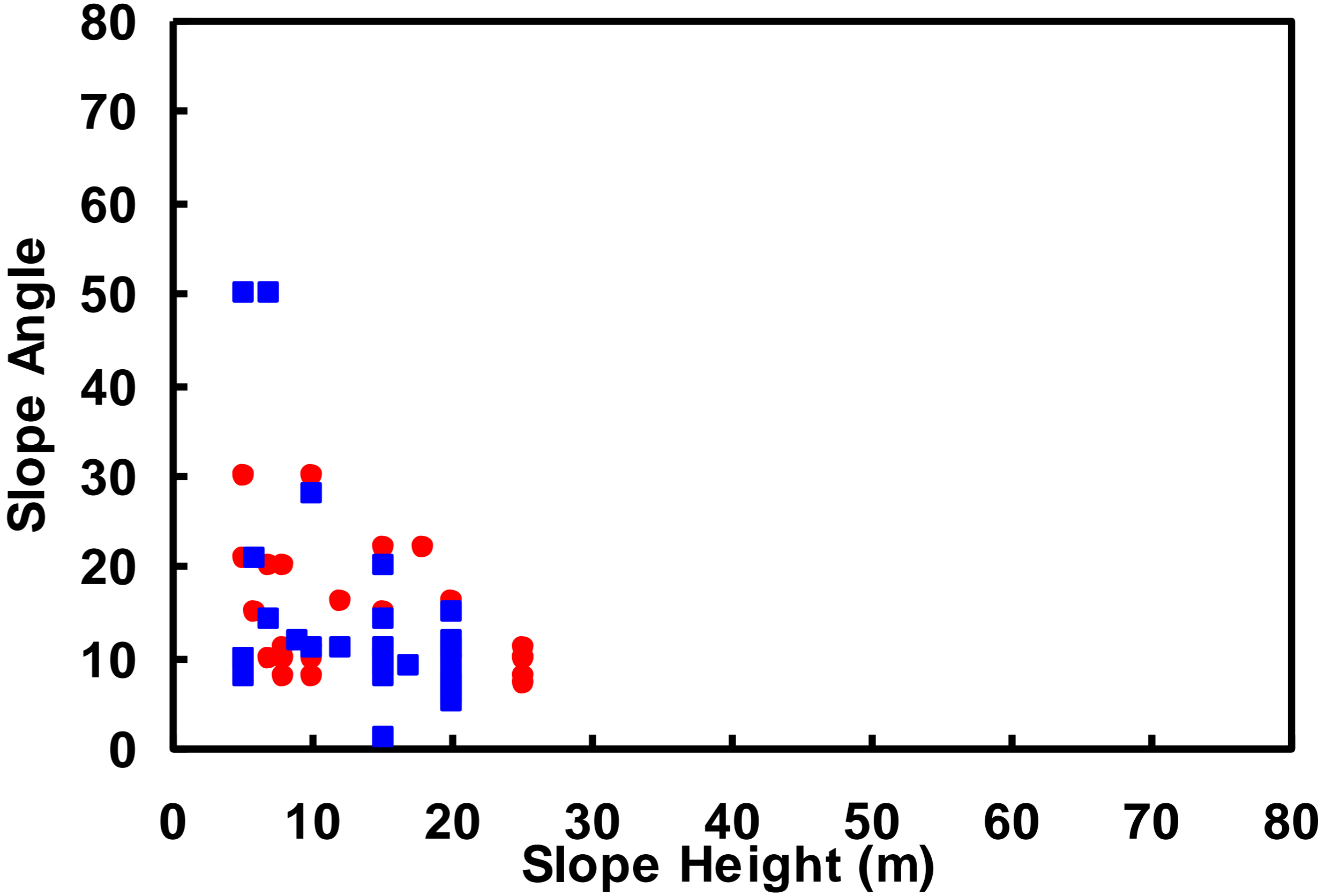
**Marginal Geotechnical
Environment + Land Use
Trigger(+ Rain?)**

**Marginal Geotechnical
Environment + Construction
Trigger (+ Rain?)**

Slope height-angle relationship



volcanic cut-slopes



Mudstone cut-slopes

The Contractual environment

What sort of contracts are in place, or need to be in place.

An effective performance based road maintenance contract for example will have access to relevant plant for access clearance and initial repairs.

This contrasts with limited community labour based maintenance in more remote areas of the rural network



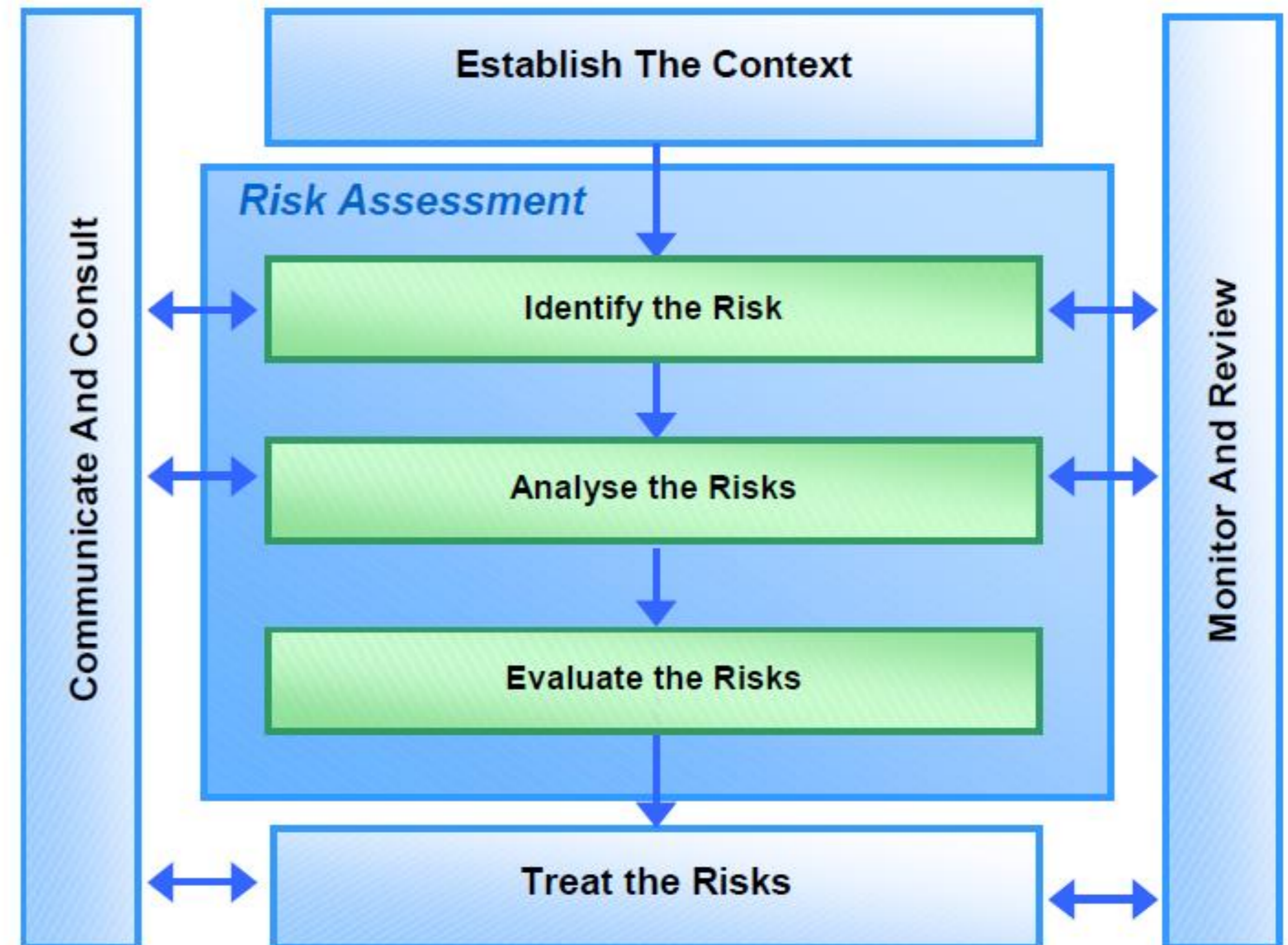
Output and Performance Results Contracts (OPRC) for Road Maintenance

A contract in which payment for maintenance deliverable is explicitly linked to the contractor's successfully meeting or exceeding certain clearly defined performance indicators – essentially the contractor is responsible for maintaining the required level of service consistently over a period of years.

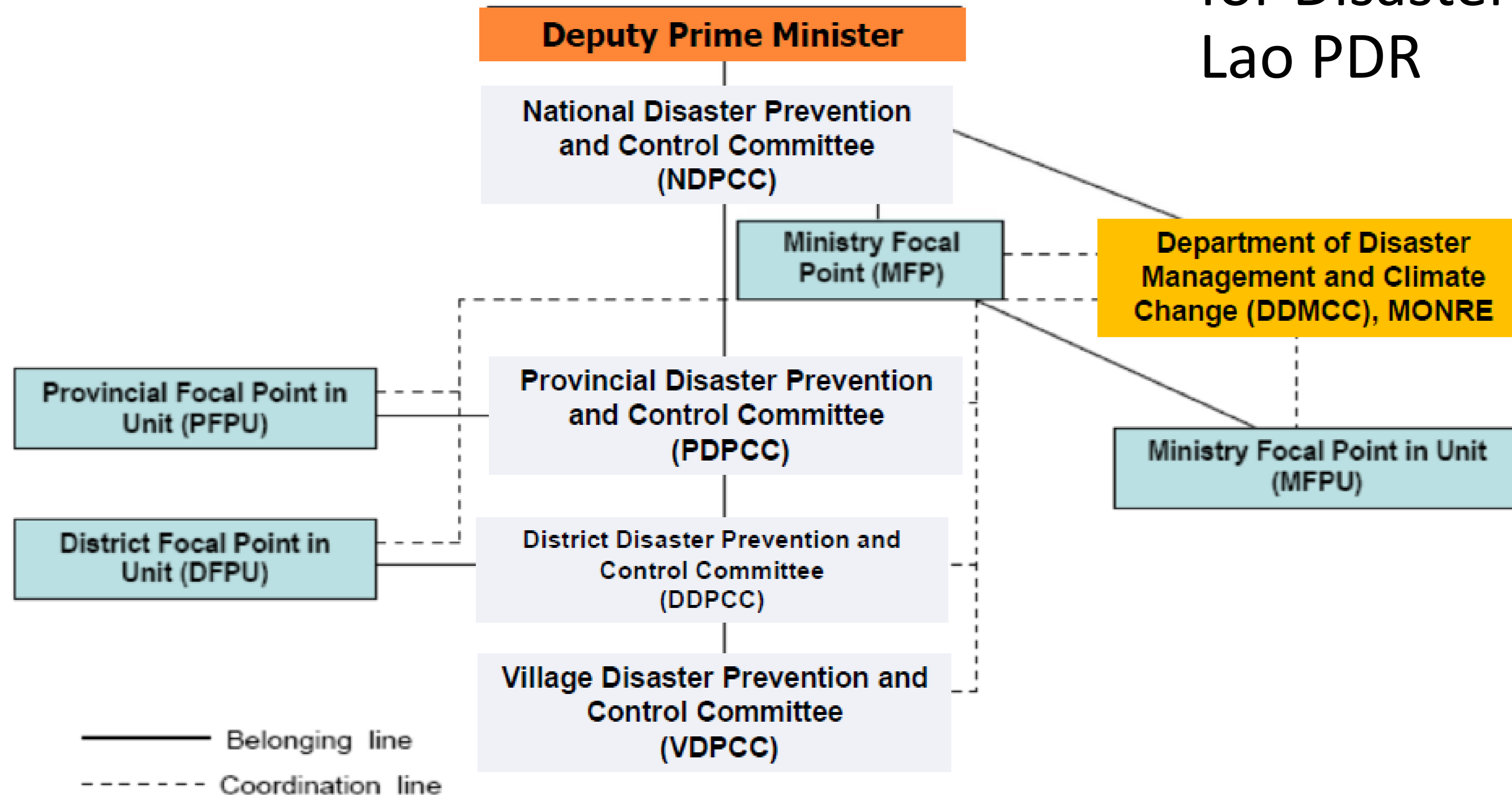
Crucially from a DP viewpoint under OPRC, the Contractor has a strong financial incentive to understand the nature and characteristics of the road asset, and to be both efficient and effective whenever he undertakes and will have plant readily available for initial disaster interventions – usually to be reimbursed under emergency maintenance BoQ items.

General Preparedness Requirements

Disaster preparedness strategies need to be integrated fully within cross-ministry government processes to be fully effective and sustainable – from Government Policy down to on the ground application.



2. Disaster Prevention and Control Committee (DPCC) Diagram



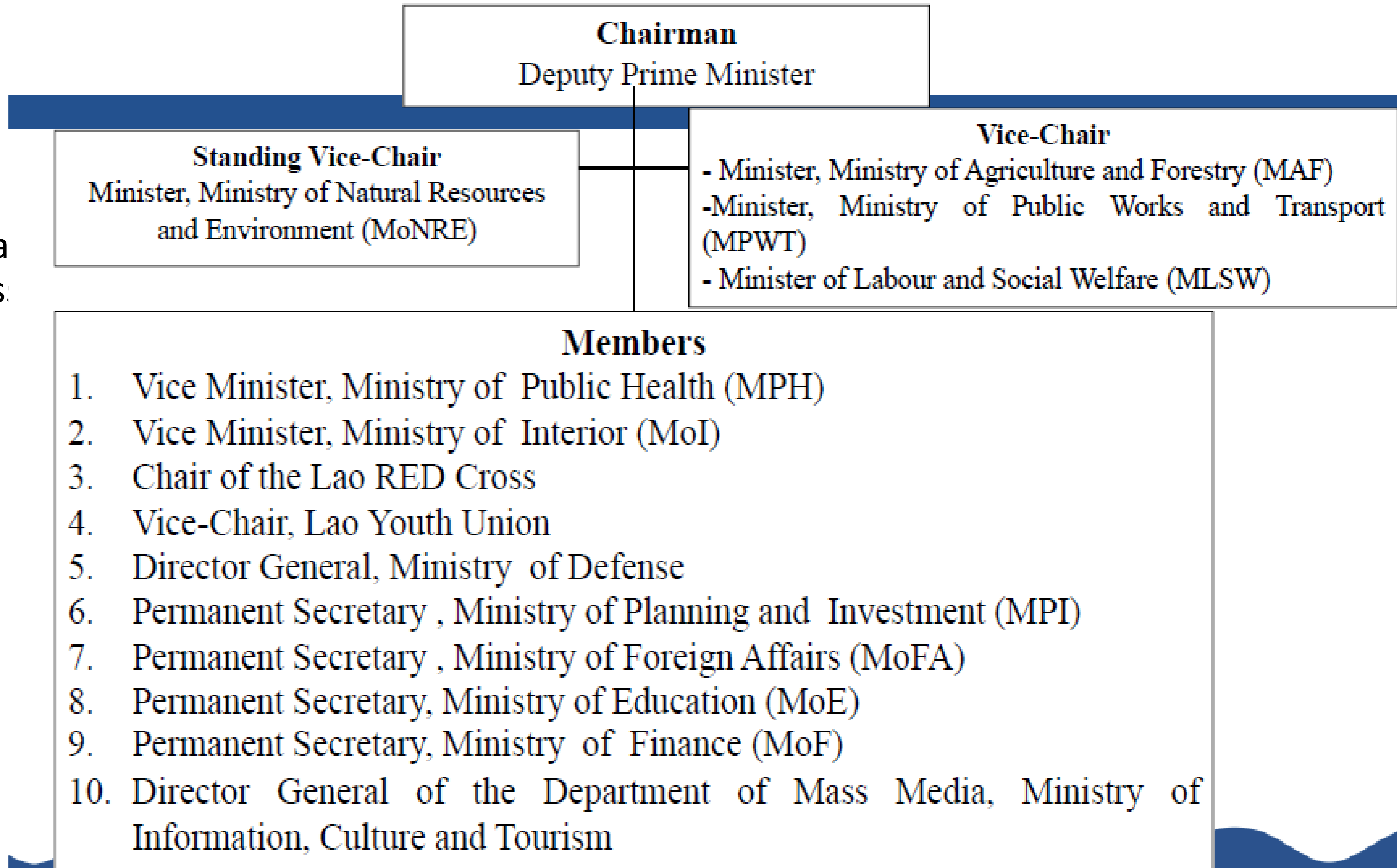
Example of a Framework for Disaster Preparedness: Lao PDR

Disaster preparedness requires an holistic approach, involving route corridors, land use, watersheds and a land systems approach as well as key non engineering social, capacity building and regulation issues .

It is important that any initiatives are cross-sectorial and inter-ministerial.



Organizational Structure of National Disaster Prevention and Control Committee



Example of Cross-Ministerial Inputs to a National Preparedness committee

Preparedness Non-Engineering Key Issues

Warning

Major climate events – local focal points

Known landslide areas – monitoring

Local workshops for rural areas

Definition of risk levels



Preparedness Non-Engineering Key Issues

Remote Sensing – Small Drones

UAVs, or drones, can be useful and flexible tools to assist with many aspects of disaster management - from collecting basic data to assessing immediate safety condition.



Evacuation Preparedness

If advance warnings are possible then evacuation may be desirable – using pre-identified safe and secure routes.

For example strengthened routes to cyclone shelters



Preparedness Non-Engineering Key Issues

Communication:

Do not assume mobile phone or wifi systems will still operational in the disaster area.

Emergency communications ? Landlines?

Fall-back situations set up with armed forces for radio communication?



Preparedness Key Issues Check List

- Be clear about the nature of the hazard threats their impacts and associated risks.
- Understand what to do for specific hazards
- Understand implication of initial clearance
- Have an emergency plan to suit the range of threats
- Be clear on contacts and responsibilities – focal points
- Communications
- Evacuation routes.
- Practice and update preparedness actions.