

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



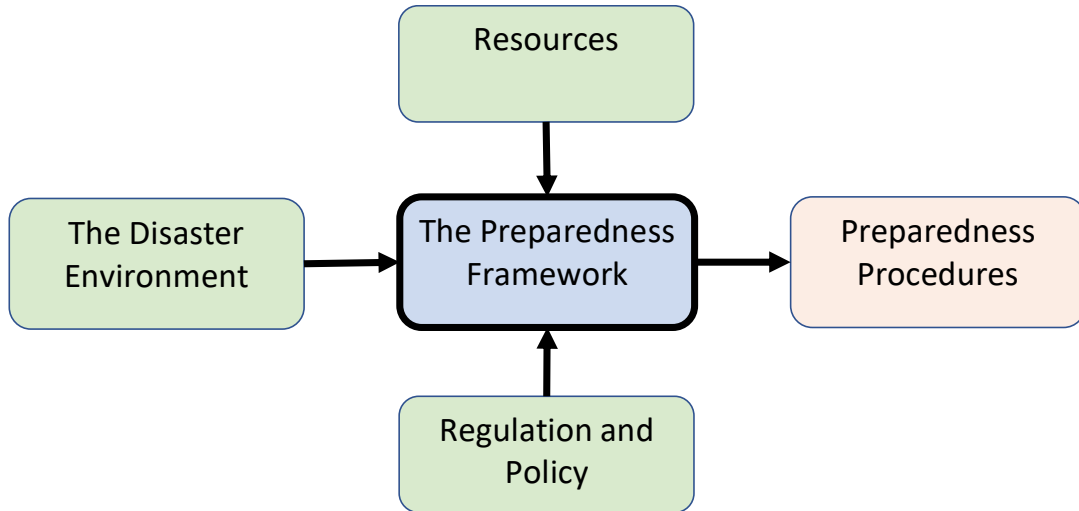
Presentation Focus

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.

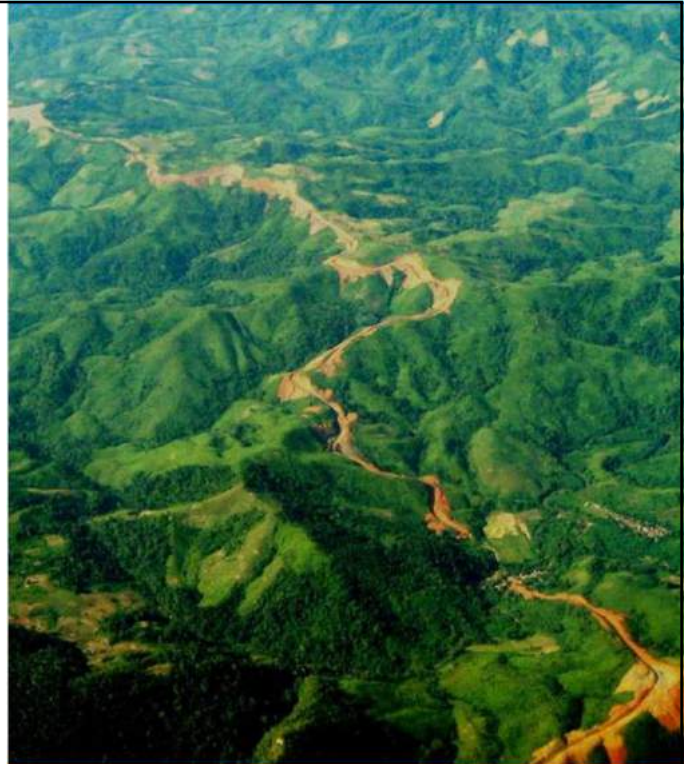


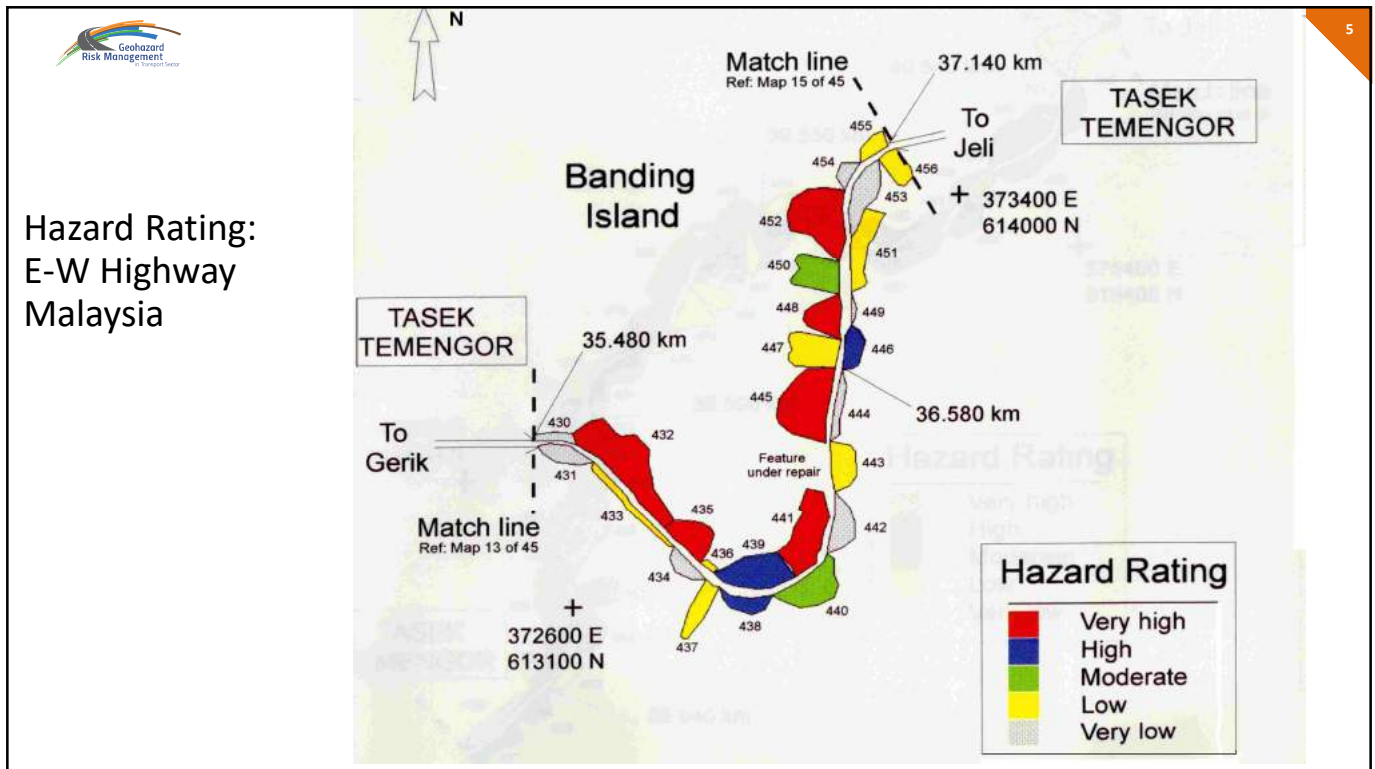
A Working Framework



The Natural Disaster Environment: Some key elements

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





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.

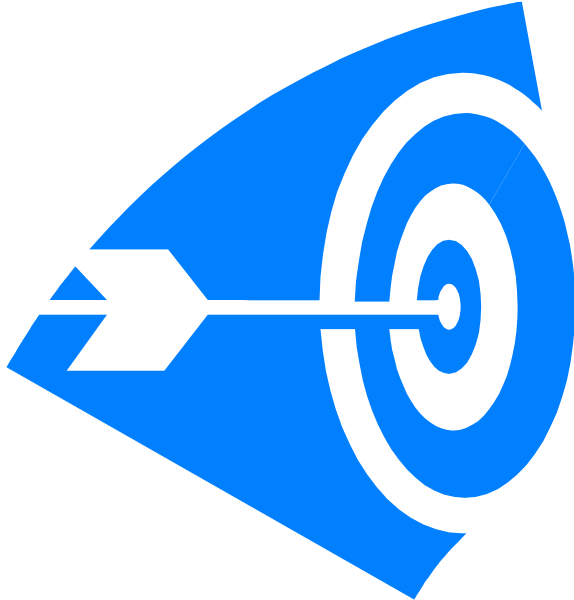
The vulnerability of community access routes was particular cause for concern.

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

11. Disaster Impacts

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

12. Disaster Causes

| 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.

| 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 from village to market | Yes No |
| | Traders to village/market | Yes No |
| | Other | Yes No |

Village Level Check List

| | | |
|-----------|---|--------|
| 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

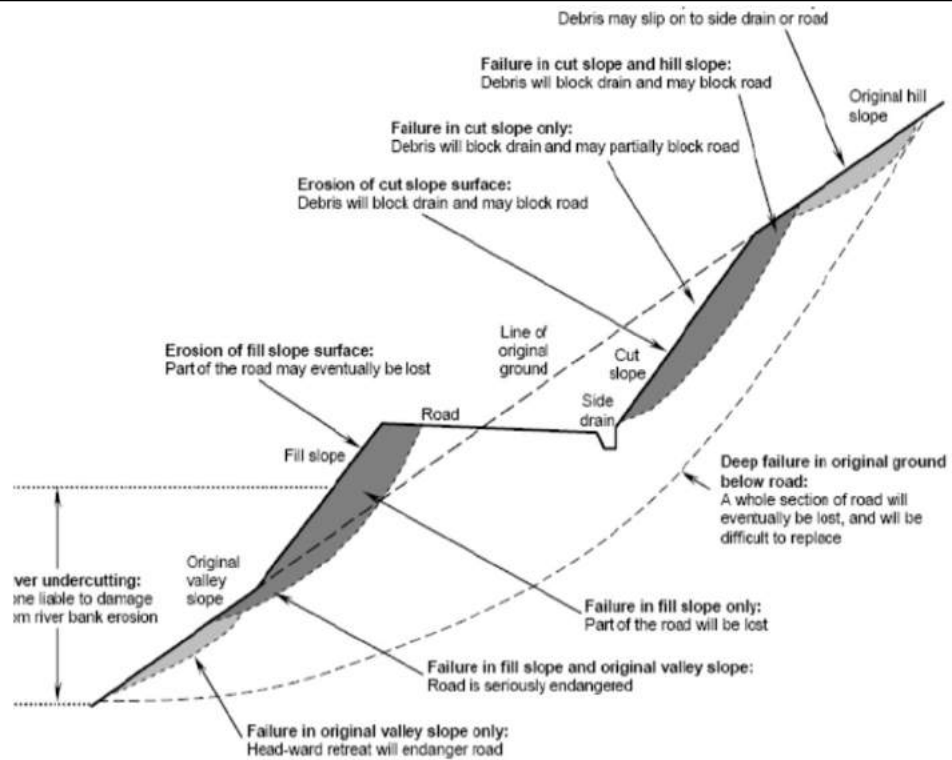
ROADSIDE GEOTECHNICAL PROBLEMS: A PRACTICAL GUIDE TO THEIR SOLUTION.

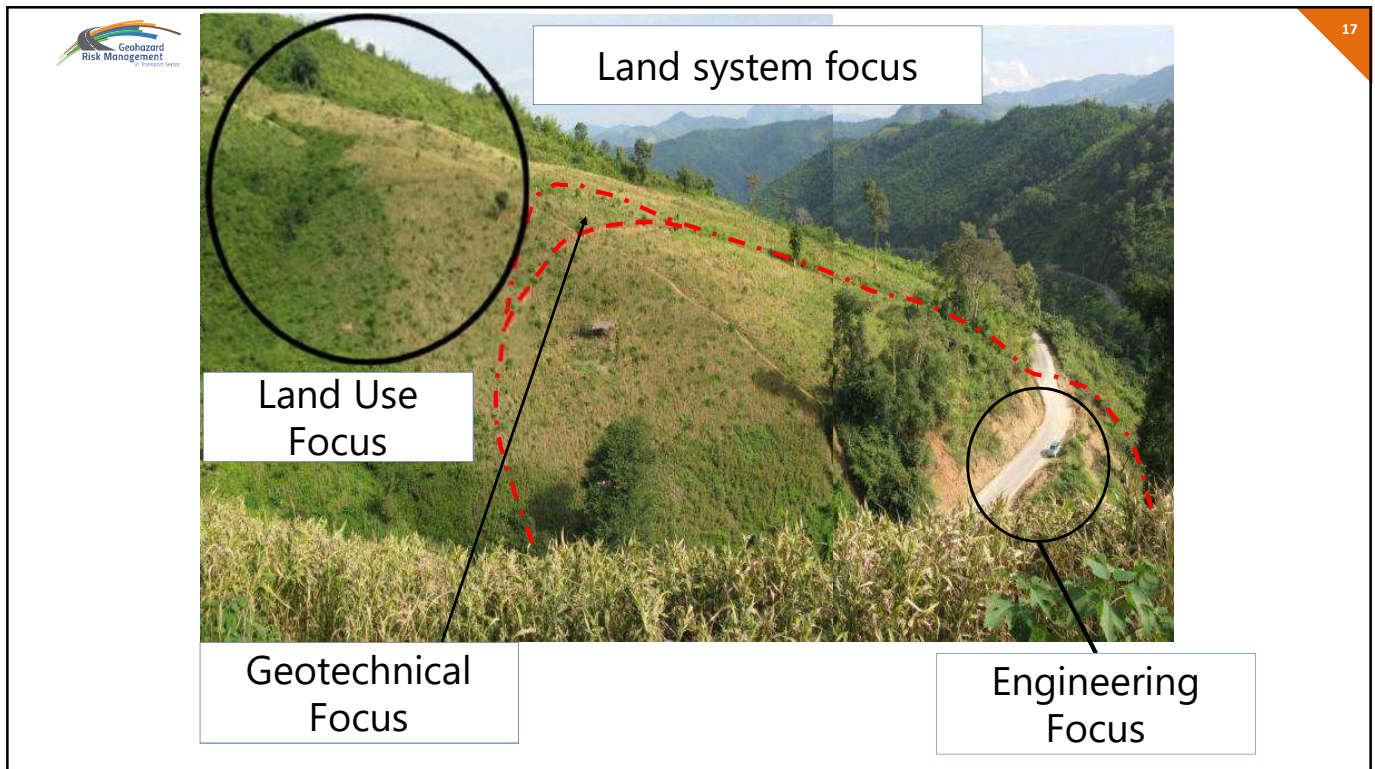
Initial ID.

| | | | | | | |
|--|---|---|---|---|----------|----------|
| Road name: | | | | Site Ref ID: | | |
| Road link: | | | | <input type="checkbox"/> hill <input type="checkbox"/> road <input type="checkbox"/> valley | | |
| Chainage (km + m): | | | | | | |
| Geographical coordinates: | | | | Side of road: left <input type="checkbox"/> right <input type="checkbox"/> | | |
| Lat .° Long .° | | | | 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 | | |



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

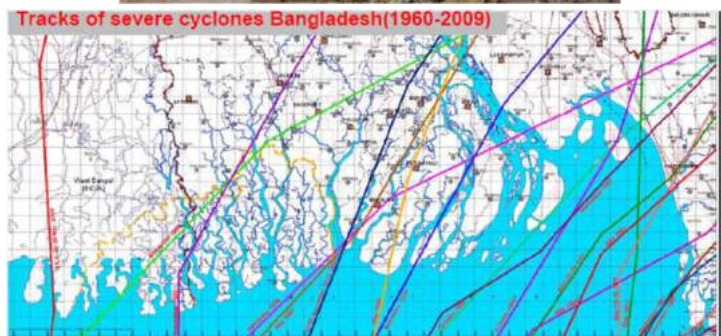


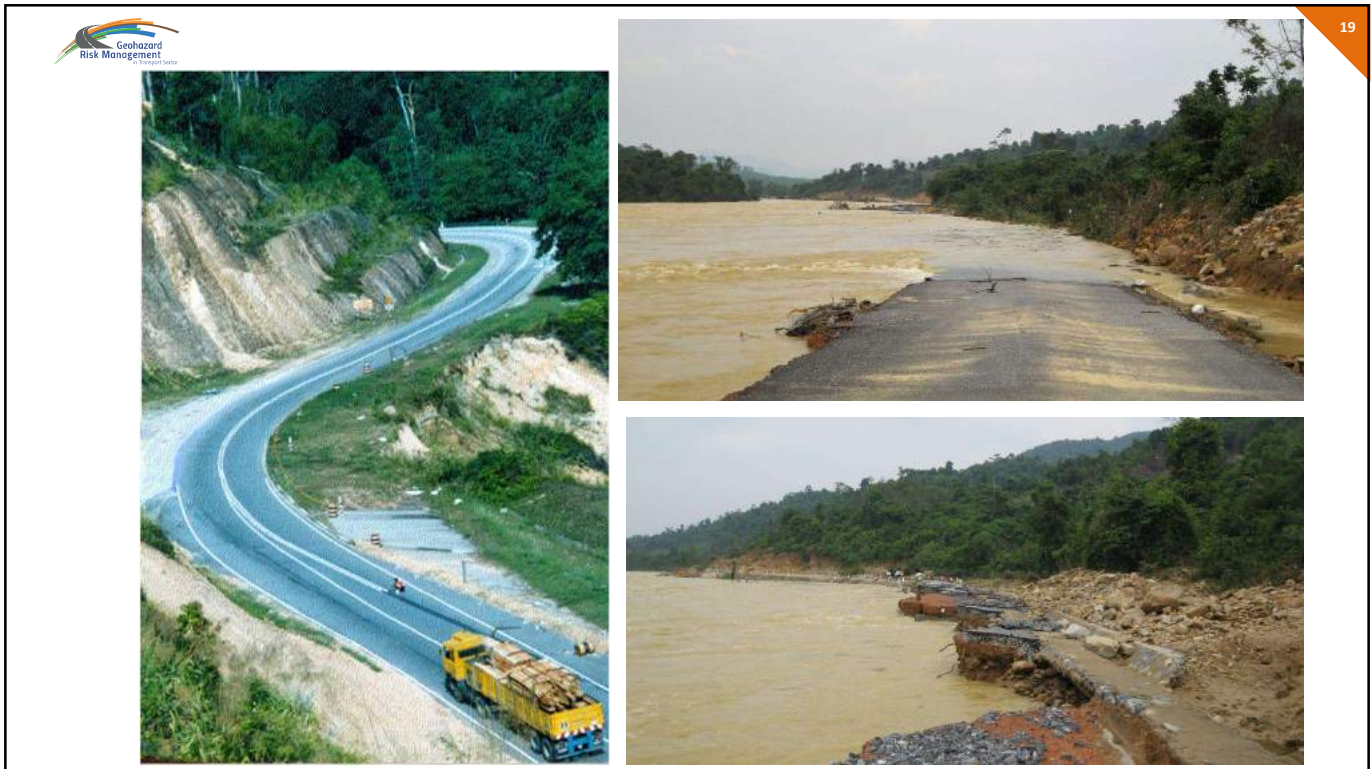


Define the hazard (s) and risk


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





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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.

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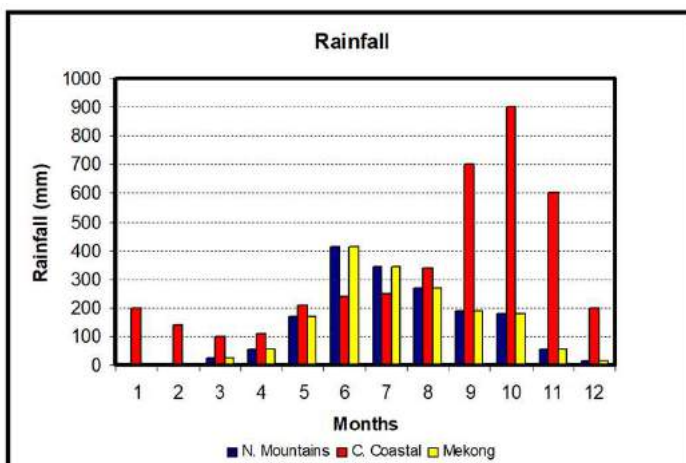
Preparedness must acknowledge expectation on Level of Service

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.



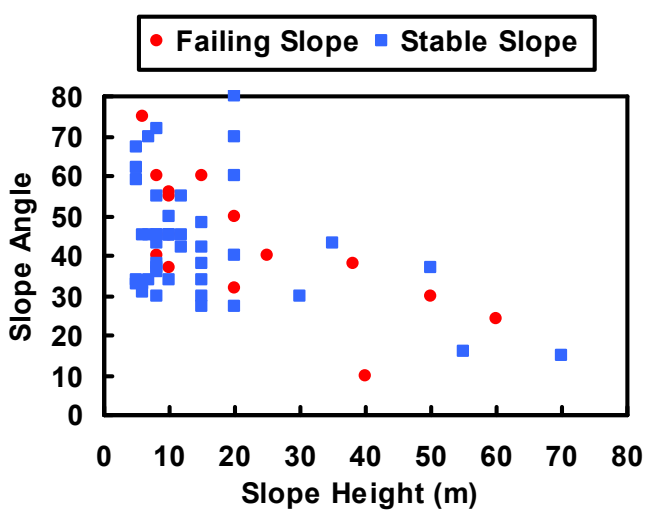


Marginal Geotechnical Environment + Land Use Trigger(+ Rain?)

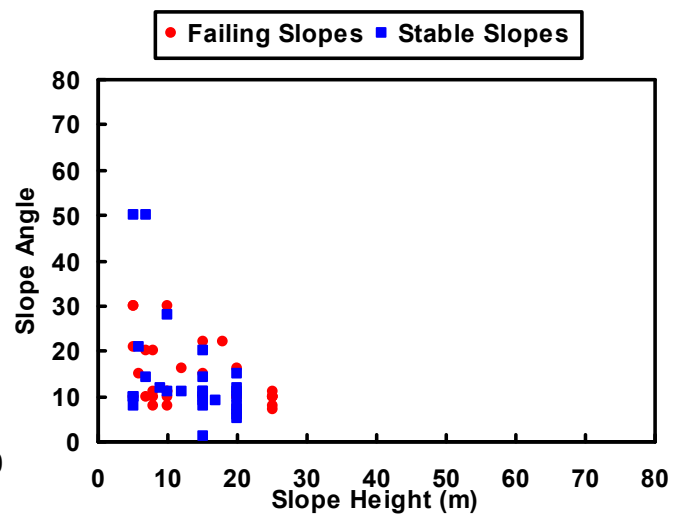


Marginal Geotechnical Environment + Construction Trigger (+ Rain?)

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



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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.

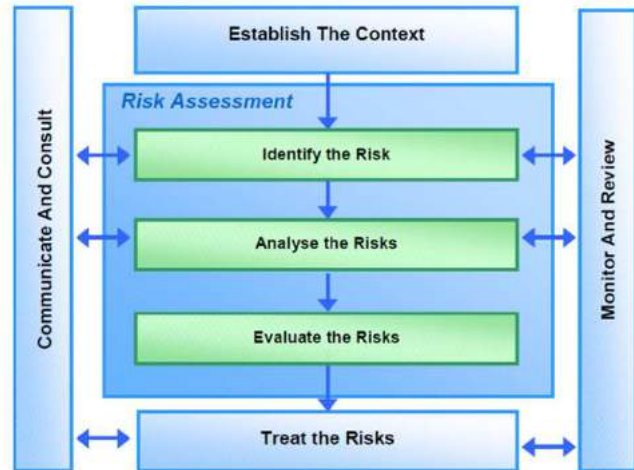
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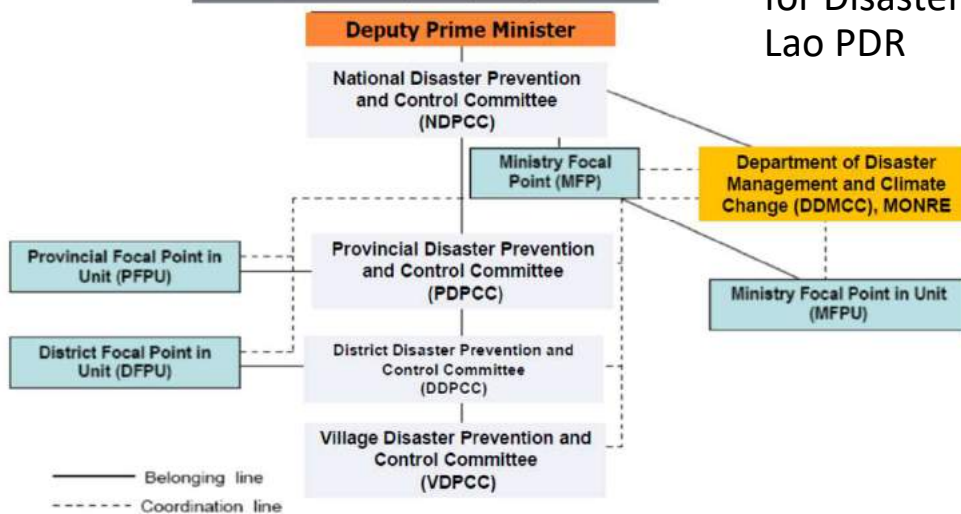


General Preparedness Requirements

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 .

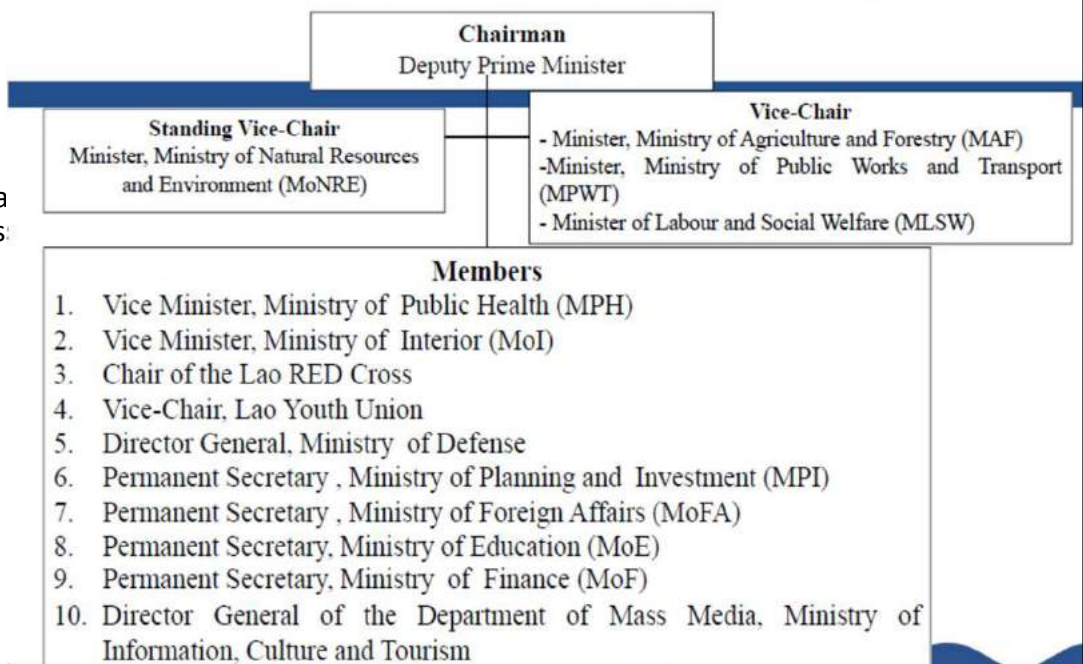
It is important that any initiatives are **cross-sectorial** and **inter-ministerial**.



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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



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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?



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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.

Some References



Useful references on recent and current research on:

- Maintenance
- Climate adaptation
- Remote sensing options for Low Volume Rural Road assessment
- Bio-engineering

Can be found of the UKAID-DFID funded Research for Community Access Partnership (ReCAP) website.

http://research4cap.org/SitePages/Rural_access_library.aspx