Second Annual South-to-South Learning Workshop on

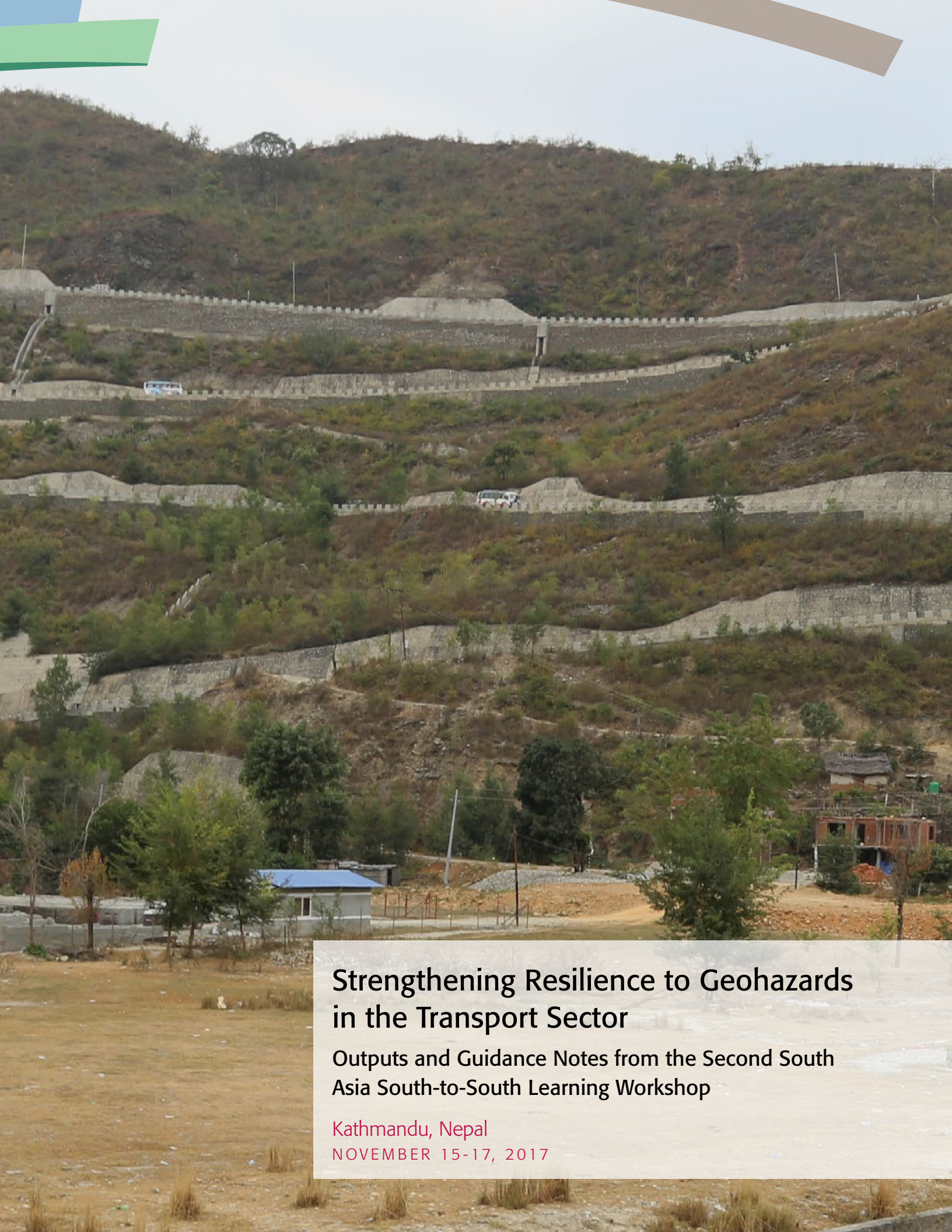
Strengthening Resilience to Geohazards in Transport

Outputs and Guidance Notes

November 15-17, 2017
Kathmandu, Nepal

Geohazard Risk Management in the Transport Sector

GFDRR
Global Facility for Disaster Reduction and Recovery



Strengthening Resilience to Geohazards in the Transport Sector

Outputs and Guidance Notes from the Second South Asia South-to-South Learning Workshop

Kathmandu, Nepal

NOVEMBER 15-17, 2017

Content

Acronyms

CCA	Climate Change Adaptation
DoR	Department of Roads
DP	Disaster Preparedness
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
IDRM	Integrated Disaster Risk Management
MPWT	Ministry of Public Works and Transport, Lao PDR
OPRC	Output and Performance-Based Road Contract
PRF	Poverty Reduction Fund
SSLW	Second Asia Regional South-to-South Learning Workshop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1 Workshop Overview

The Disaster Risk Management and Climate Change Unit of the South Asia Region of the World Bank organized the Second Asia Regional South-to-South Learning Workshop (SSLW) on November 15–17, 2017 in Kathmandu, Nepal to help strengthen the geohazard risk management capacity of policy-makers and operational and technical government counterparts in Afghanistan, Bangladesh, Bhutan, India, Nepal and Sri Lanka[1]. This workshop focused on integrating geohazard disaster risk management, including resilient road asset management and disaster preparedness in each country's infrastructure program to help promote the safety of people within a sustainable transport sector. The workshop is part of the "Building Resilience to Landslide and Geohazard Risk in the South Asia Region" program, which was launched in August 2016 with assistance from the European Commission and the Global Facility for Disaster Reduction and Recovery (GFDRR). This year the workshop focused on overall disaster risk management, resilient road asset management and disaster preparedness in the transport sector. Forty-eight people, including resource persons and the World Bank team, participated in the workshop[2] .

All the countries represented at the workshop suffer from disasters associated with geohazard events. Preparedness for these events is critical to ensure that losses are minimized and managed. This calls for both technical and institutional readiness, whereby proper risk assessment is undertaken and the results of which are used as the basis for risk mitigation and preparedness planning and implementation. Agencies should engage and cooperate with one another to plan for disaster response, combining resources and ensuring that standard operating procedures are in place to respond to them effectively.

The participants' evaluation rated the content, delivery and overall quality of the training very highly because it fulfilled their training needs and objectives which were about enhancing performance in current assignments, professional growth, networking and sharing of information. They identified the following learning benefits from the Workshop:

- The incorporation of geohazard risk management and preparedness measures in sectoral policies;
- Prioritization of risk mitigation activities during planning and budgeting;
- The importance of road-side drainage, slope stabilization and hazard mapping using field and aerial survey (including drones);

1 For details of the workshop agenda, see Appendix A, "Second Asia Regional SSLW Agenda."

2 For the full list of participants, affiliations, and countries see Appendix B, "Second Asia Regional SSLW List of Participants."

- The application of bio engineering;
- The importance of effective road asset inventory, monitoring and maintenance.

Furthermore, it was stated that preparedness is key as natural hazards cannot be prevented, and road construction should not only be environmentally-friendly, but user-friendly as well. According to the evaluation, the greatest benefit the participants received from the training included: consultation and discussion with experts; knowledge and solution sharing between and among countries; group discussion, field visit, lectures, training management; and insight into the use of easy-to-use and efficient technology for data collection, including the use of drones. Participants also provided excellent feedback regarding inputs provided by the resource persons, facilitators and organizers, rating them on an average of more than 4 out of 5 in all categories (knowledge of a subject, quality of delivery and effectiveness).

The workshop was designed as a South-to-South knowledge exchange learning event for senior planning and infrastructure development officials within the transport and geohazard disaster risk management sectors in the six above-mentioned South Asian countries. Workshop participants actively discussed the progress on their action plans from 2016 to 2017, the challenges they faced, how those challenges were addressed and their new action plan for 2018. The inputs on these themes and exchange of experiences thereafter provided additional substance for the identification of action plans to resolve their specific geohazard problems. Participants visited the Banepa-Sindhuli-Bardibas Road and examined the risk assessment, planning, design, construction, road asset monitoring, maintenance and management processes that had been applied to that road.

2 Guidance Notes

2.1. Overview of disaster risk management in the transport sector

Direct physical, economic and financial losses from natural disasters are following a steady upward trend and rising more rapidly than the regional gross domestic product of the countries affected (World Risks Report 2016). National, regional and local development cannot be sustained if disaster and climate risks are not addressed. Hazards can be prevented from becoming disasters if integrated disaster risk management (IDRM) is mainstreamed effectively into development planning. IDRM is a comprehensive approach with a mission to protect nations and communities from uncontrollable losses brought about by geohazard events.

The goal of disaster risk management (DRM) and disaster risk reduction (DRR) is to build safe and resilient communities and nations. DRM is the systematic process of addressing specific issues of disaster risks, using administrative directives, organizations, and operational skills to implement strategies and policies to lessen the adverse potential impacts of hazards and the possibility of disaster. DRM aims to prevent, avoid or lessen the adverse effects of disaster events through prevention, mitigation and preparedness.

Prevention is the complete avoidance of potential adverse impacts through pro-active action taken in advance. Complete prevention is frequently very difficult and costly; it requires political will allied to appropriate skills and budget. The most feasible prevention measures are associated with the assessment of current and potential hazards in order to avoid the development of future risks.

Mitigation refers to activities aimed at lessening or limiting the adverse impacts of hazards and related disasters. In the road transport sector, prevention and mitigation refer to the application of well-informed good engineering practice allied to effective road asset management through monitoring and good practice maintenance.

Preparedness is an ongoing process of capacity and knowledge development among all stakeholders, to effectively anticipate and prepare for the impacts of hazard events. The aim is to efficiently manage geohazard events and achieve orderly transitions from response through to sustained recovery.

Response refers to the provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected.

Recovery is the process of restoring and improving facilities, structures, livelihoods and living conditions of disaster-affected communities, including reducing future geohazard risk factors. Recovery activities provide a valuable opportunity to develop and apply the "build back better" principle.

2.2. Resilient Road Asset Management: Monitoring and Maintenance

Effective asset management is critical to the sustainability of road investments. Each road asset has a nominal design life and it is important to ensure functionality of these assets throughout their design life and beyond. As with all engineering infrastructure, it is important to apply the concept of 'fit for purpose' when devising an asset management strategy, and this is especially the case on low volume roads where available budgets pose a significant constraint on maintenance expenditure.

In mountain areas, geohazards pose a significant and frequent threat to road assets. These geohazards are usually driven by rainfall, resulting in landslides, floods and erosion (**Figure 1**). In high altitude areas snow and ice can also pose hazards to the management of road assets and result in extensive delays to traffic in the same manner as landslides and earthworks failures. Earthquakes are another major source of geohazard and can trigger major landslides.

Effective road asset management relies on routine and periodic, preventative, emergency and remedial intervention (**Plates 1,2**) to ensure functionality and serviceability. Road asset managers will be familiar with these terms and they therefore do not require definition nor elaboration here. Emergency maintenance includes emergency works undertaken to reinstate safe access if a road is blocked by a slope failure or undermined by a retaining wall failure, for example. Remedial maintenance is probably the least effective approach to asset management, though it is often the most common where manpower and financial resources are stretched.

Asset inventories, condition surveys and programmed field inspections are central to effective asset management. It is important to have a record of all road assets (**Figure 2**) so that a program of inspection and maintenance can be devised. It is important that the inspection system allows off-road inspections as well as road-side observation. In mountain terrain, it is often necessary to support or protect the road by the construction of drainage systems, erosion protection, scour protection and retaining structures located some distance below or above the Right of Way, and these structures must be fully accounted for in the inspection process. An inspection regime that is based on an annual survey, for example after each wet season, would be the most effective. This would be followed by an inspection of drainage structures prior to the commencement of the following wet season to ensure they are functional and clear of debris.

Following a significant geohazard event an inspection will need to be implemented immediately to inspect all assets for damage or failure, certainly on major highways or key access routes. During heavy rainfall it is usually the case that the most common problems will relate to slope failures from above

PLATE 1: The importance of routine maintenance cannot be over-stressed

PLATE 2: Timely preventative interventions can avoid structural failure and loss of investment

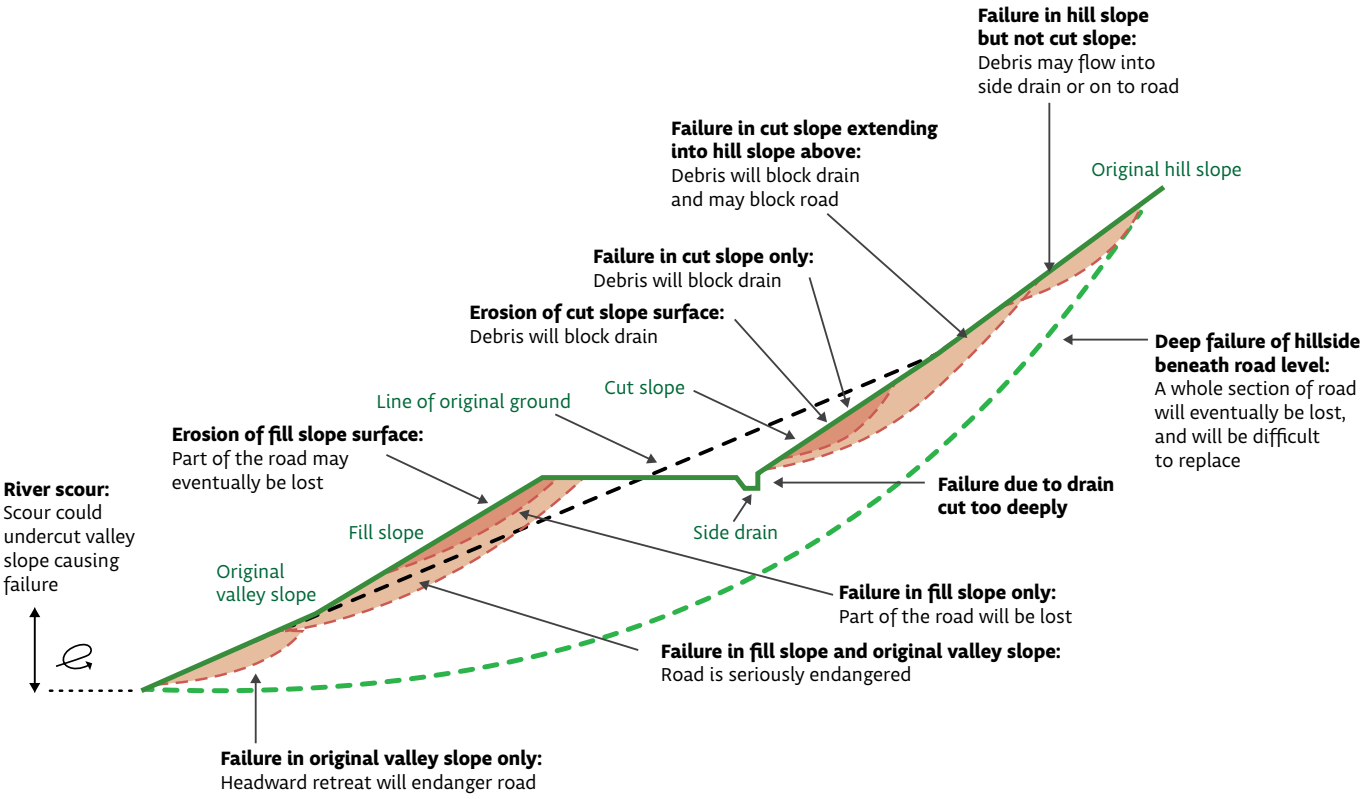

FIGURE 1: Sources of slope instability that commonly affect mountain roads (DoR, Nepal 2001; MPWT, Laos 2008; Geological Society, London 2011)

the road and these will need to be safely cleared as part of the process of opening the road. It may be the case that problems below the road, such as erosion, slope failure and wall failure will also require remedial action. Usually, slope remediation works will require prioritization because it may not be possible to implement all remedial works at the same time. A simple system that prioritizes remedial interventions based on risk is usually the best approach. The inspection team should consider three questions:

1. Is the level of risk posed by the failure or the defect sufficiently serious that it requires immediate action?
2. Can remedial action be delayed (for example, until after the wet season) when it can be programmed along with other works?
3. Is the level of risk sufficiently low to allow an approach based on monitoring and 'wait and see' to be applied?

If the answer to Question 1) is 'yes' then a decision will need to be made as to whether the intervention will be based on the implementation of temporary works or permanent works. In some circumstances, permanent works may require ground investigation and specialist geotechnical assessment. Implementing these investigations may take time, and therefore a temporary solution may be most pragmatic. In some environments, a road authority may be faced with multiple hazard types, including landslides, floods and snow avalanches, for example. If these hazards impact the road network or sections of it during the same season, it will be necessary to evaluate the risk posed by each before developing a prioritization strategy. See DoR (2006) and Hearn & Hunt (2011) for further guidance.

One of the most important lessons to be learnt at management level is that money spent on attention to detail during maintenance can lead to significant savings in the future if it enables a more robust road corridor to be established. (**Plates 3,4**) For example, side-casting of spoil at source, may be a cost-saving expedient in the short-term, but it can lead to serious engineering and environmental losses in the longer-term and can usually be easily avoided through a suitably planned and implemented spoil management policy.

Increasingly, road authorities are turning to Output and Performance-Based Road Contract (OPRC) methods of procuring contractors to carry out road improvement and maintenance. This method of contracting was discussed by delegates and concern was raised as to the extent to which provision for major geohazard events and emergency response could be accommodated in such contracts. Delegates from Himachal Pradesh noted that they had made provision for Emergency Works in their contracts and their document may be accessed on the website[3].

Usually, a range of government agencies are involved in the management of land, resources and geohazards within road corridors and in the wider landscape. It is imperative that these agencies work in unison with the road authority to combine and

3 For details, see Appendix C. Extract from Output and Performance Based Road Contract

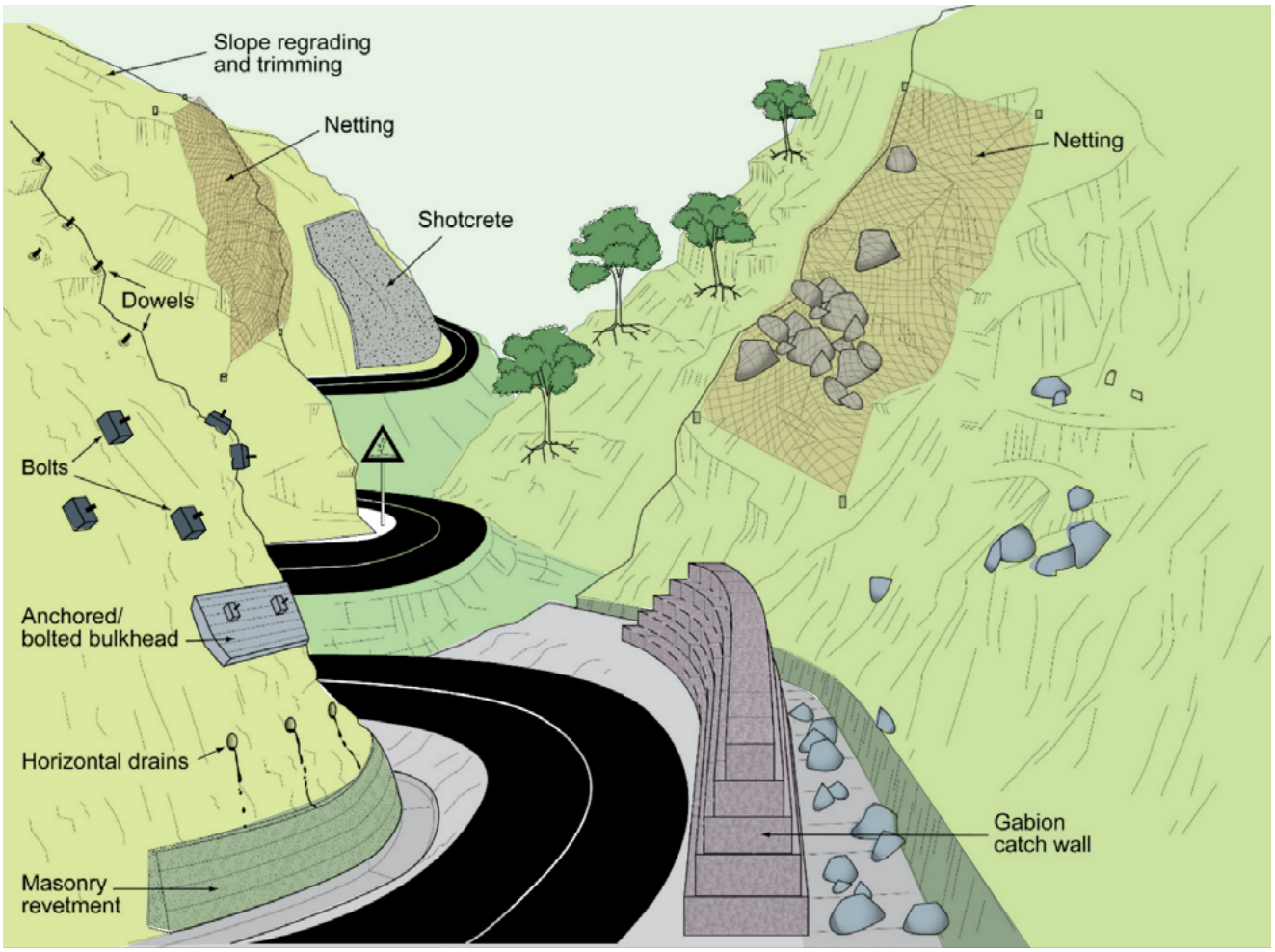

FIGURE 2: Preventative and remedial measures are essential for managing the hazard from rock slopes as well as soil slopes (Geological Society, London 2011).

PLATE 3: The control of road runoff is imperative. Without it, conditions can deteriorate rapidly.

PLATE 4: This slope is beginning to deteriorate and could erode and fail without intervention.

share datasets and ensure that actions taken are for common benefit, rather than on a unilateral basis.

SUMMARY POINTS TO TAKE FORWARD:

- Many slope problems on mountain roads are shallow and are amenable to bio-engineering techniques. However, bio-engineering is not a cure-all solution: deep-seated landslides require geotechnical solutions. Identify the cause and mechanism first, then decide on the best approach
- Do not lose sight of the critical importance of engineering geology and geotechnical engineering: road asset managers must make use of all available expertise to help resolve asset management problems
- All data collection and remote sensing must be fit for purpose.
- It is imperative that all data and knowledge is fully captured and utilized in geohazard assessment for engineering and conservation purposes
- The geohazard skills to optimize asset design and management are available in the South-to-South region. They must be fully utilized.
- Geohazard Risk Management for Road Asset Management: avoid, stabilize, anticipate; avoid; stabilize and accommodate geohazards, using appropriate levels of investment and technology that are consistent with the need to manage risk, justify expenditure and ensure sustainability and serviceability
- Sound engineering observation, assessment, judgement and decision-making are paramount.

2.3. Disaster preparedness in the transport sector

Preparedness may be described as a series of pre-disaster impact activities that establish a state of readiness to respond to an extreme event that has the potential to effect elements of the transport network. Preparedness is closely linked to, and should lead towards, response whilst at the same time stemming from an overall mitigation process. **FIGURE 3.**

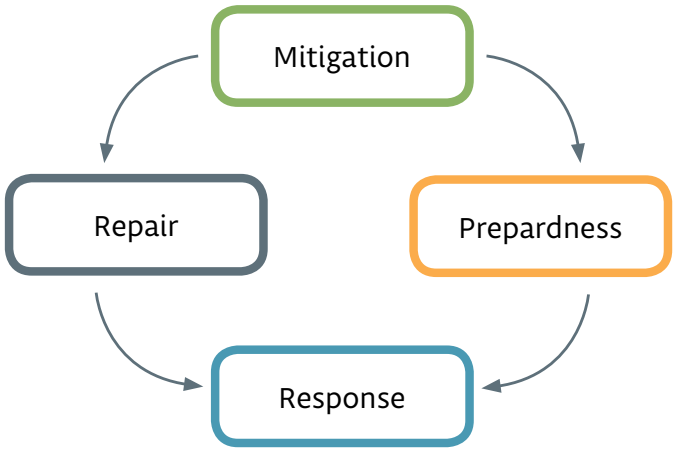

FIGURE 3: Preparedness within The DRM Cycle

Disaster preparedness (DP) necessarily takes into account elements of reducing the risk both of a disaster occurring and the consequent impacts through avoidance. The engineering issues surrounding this are largely dealt with in the previous section (2.2) and are concerned primarily with design and appropriate maintenance.

Preparedness procedures may be derived from a combination of the disaster environment: regulations and policy; and available resources. The Disaster Environment is made up of a wide range of factors, including:

- The nature and size of the potential disaster
- The nature and vulnerability of the transport asset(s)
- The terrain
- The availability of mechanical plant
- Climate impacts.

Any DP framework must work within governing regulations and policy, not only regarding disaster preparedness-response but also within the wider context of such issues as: transport service levels; Health and Safety; evacuation guidance; emergency powers; and, by no means least, financial controls.

Resources for a DP framework need to be assessed in human, mechanical and budgetary terms. The DP plan for a major highway will, for example, involve mechanical excavation stand-by as part of maintenance contract or availability through other prior arrangements. Rural area DP plans are more likely to rely on labor-based village support groups.

In terms of planning to deal with a disaster event related to transport there are four key questions:

- What is nature of the event?
- What immediate initial actions are required?
- How best can access be restored?
- How best can the resulting damage be repaired?

A DP plan should have protocols or guidance in place to answer and give guidance on these key questions. Preparedness requires a clear understanding both of the disaster and an understanding of the disaster "triggering" mechanism. Typical natural disaster scenarios include:

- Landslides
- Flash floods
- General flood
- Storm surge/tsunami
- Snow avalanche
- Earthquakes

Examples of triggering mechanisms are:

- Intense rainfall (particularly after a wet period)
- Earthquakes (as landslide-triggering mechanisms)
- Change in land use (clearing of natural vegetation)
- Inappropriate construction (undercutting/overloading of foundations/earthworks)
- Slope age (natural stress relief and weakening of rocks through progressive weathering)

Equally important is the nature and vulnerability of the transport asset, principally roads and associated structures. These may range in importance from major highways to rural roads. Each will have different expectations in terms of disaster response and hence a different level of preparedness that needs to be accounted for. Disaster preparedness should include processes or actions for dealing with the actual event. This will involve a practical decision-making process

that needs to be based on firm field evidence. Management decision making should take into account:

- Basic data acquisition
- Post-disaster risk
- Immediate access
- Initial repair/stabilization
- (Long term solutions)

Typical standard forms for initial data collection and decision-making in the case of landslides may be found in the Nepal Department of Road (DoR) document: "Roadside Geotechnical Problems: A Practical Guide to their Solution", available on the website, and Hearn & Hunt (2011).

These initial data collection processes are important in terms of ensuring that further failures are not initiated or the eventual repair solutions are not compromised. Initial debris clearance is frequently an important issue in disaster response and hence its inclusion in DP plans is vital. Crucially from a DP viewpoint a maintenance contractor operating an OPRC has a strong financial incentive to understand the nature and characteristics of the road asset, and is also very likely have plant on site that would be available for initial disaster interventions.

NON-ENGINEERING KEY ISSUES ARE SUMMARIZED BELOW:

Warning: it may be possible to have warning systems in place, either for specific road assets or for some types of geohazard, such landslides, tsunamis, glacial lake outbursts and severe tropical storms. These must be effective and be embedded (and trialed) in the local DP management systems.

The **monitoring** of high risk landslide areas can be linked to early warning methods that may range from observational approaches to sophisticated automated movement sensor systems.

Training and workshops on DP are particularly useful in rural areas where the involvement of local communities will be vital in disaster response. Elsewhere, the training of professional staff in DP should be standard practice.

In order to implement resilience prioritization within DP and DRM initiatives it would be necessary to look at **defining levels of acceptable risk** for a range of common situations.

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

Communications: Do not assume mobile phone or internet systems will be still operational in a disaster area. Consider emergency communications with perhaps a fallback situation set up with the military or police force for radio communication.

DP 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.

DP 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. DP 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 regulatory issues. It is vital that any initiatives are cross-sectoral and inter-ministerial.

SUMMARY OF THE KEY ELEMENTS OF DP STRATEGY THAT SHOULD BE IN PLACE ARE:

1. An effective DP management structure that is cross-sectoral and covers all elements of the transport network from national highways to rural access.
2. A DP managerial mandate that is derived from clear guidelines and policy laid down by relevant national and/or regional institutional bodies or committees.
3. A knowledge-base of modes of disaster that are likely to impact on the transport network together with information on past disasters, and how effectively they were dealt with.
4. Tried and tested procedures for early warnings of impending potential disasters
5. A key suite of managerial tools related to the data collection, evacuation requirements and immediate stabilization or repairs
6. A robust communication network with clear lines of responsibility and authority for reporting disaster location, type and magnitude in order to enable the mobilization of appropriate resources

2.4. Summary

- The DRM process is an essential series of steps to guide the development of key management and technical processes. Participatory disaster risk management is the recommended approach which should be based on:
- Disaster risk assessment, including hazard, exposure and vulnerability assessment
- The assessment, identification and prioritization of disaster risk reduction measures
- Development of a DRM DRR Plan, with funding a key factor
- Implementation of the Plan
- Monitoring, maintenance and evaluation as an ongoing activity
- Reporting and taking advantage of lessons learnt.
- Capacity development applicable to all the steps and components.

Geohazards need not become disasters, if: a) hazards are understood and anticipated; b) exposure and vulnerabilities are reduced; and, c) resilience capacities are enhanced. Road transport networks need to be pro-actively managed, monitored and maintained to maximize their disaster resilience. All DRM activities build towards resilient communities and contribute to the attainment of the 2015-2030 Sustainable Development Goals. Disaster risk management is about understanding how an extreme natural event affects people; how vulnerable people are to natural hazards; to what extent communities can cope with emergencies/disasters; and how the responsible organizations can take preventive, mitigation and preparedness measures to face natural hazards now and in the future.

3 Nepal Experience on the Banepa (Dhulikhel)-Sindhuli-Bardibas Road

3.1. Introduction

The Banepa-Sindhuli-Bardibas road (BSB road) is an important road that links the Terai with the eastern Kathmandu valley. Initially, the road was intended as an agricultural access road, but it has become one of a few alignments that provides all-weather access between the Terai and Kathmandu. During the 2015 earthquake, for example, it proved one of the most reliable means of access into Kathmandu from the south.

The road project was 20 years in the making, between 1995 and 2015, from planning, through design to construction and flood damage rehabilitation. It has a total length of 160km, of which approximately 36km is through the mountainous terrain of the Mahabharat Lekh and a further 50km is located in the hilly terrain between Nepalthok and Dhulikhel. The entire project was funded through a grant to the Nepal Government by JICA.

3.2. Risk assessment and planning

According to project engineers, considerable effort was placed in route corridor and alignment selection. The alignment was selected based on the use of hazard maps ensuring that large landslides were avoided.

3.3. Design and construction

It is apparent that the approach to design was based on the principle of balancing cut and fill. A balanced cut and fill, and a reduction in excavations, lead to a lower physical impact of road construction on the environment. A range of retaining walls have been used, including gabion, mortared masonry, reinforced concrete and reinforced fill. Unusually, gabion has been used extensively in the construction of road fill retaining walls, apparently as a construction cost-cutting measure. Several cut slopes have been protected with shotcrete, although bio-engineering has also been applied on the lower risk slopes.

It is also apparent that considerable effort has been invested in the control of drainage. Drainage works include off-road drainage systems, side drain turnout protection and culvert outlet control on flow and scour potential. A high commitment to quality control is evident throughout the works.

3.4. Monitoring and maintenance

During flooding in 2001 the road was damaged in thirteen locations where it has been constructed alongside the Sun Kosi River. In total between 100m and 200m of road was severely damaged or destroyed. The Emergency Rehabilitation Project was implemented between 2003 and 2005 with JICA

funding to reinstate these damaged sections. During the 2015 earthquakes, some of the walls on the hill section suffered deflection, with total failure occurring in one or two locations. The total period of road closure during this event was, apparently, no more than four hours.

3.5 Other considerations

Given the extent of retaining structures and slope protection measures both above and below the road, there will be little opportunity to widen the carriageway in the future to accommodate increased traffic, without expensive reconstruction. This could be seen as a limitation in the long-term sustainability of road access. Also, many of the walls are earth-reinforced and, in places, high-investment retaining structures have been employed, such as bolted and anchored reinforced concrete crib walls. Any failure of these structures might prove difficult to reinstate, both technically and financially. It is apparent that the underlying principle in the design and construction has been the creation of a road that will require routine and periodic maintenance only. If these activities are not implemented effectively, drainage, slope and structural deterioration could become expensive to rectify. PLATE 5

PLATE 5: Heavily-engineered design. Earth-reinforced walls; bolted reinforced concrete crib walls and shotcrete.

4 Country Action Plans: Progress, Key Issues and Challenges

4.1. Introduction[4]

Towards the close of the workshop, delegates from each respective country were asked to complete a Country Action Plan that summarized progress made against 2016 action plan targets and set out planned actions for 2017/2018 that would address the shortfalls and move the application forward. These actions plans were developed for the key topics of:

- Risk assessment
- Risk mitigation planning
- Resilient asset management
- Disaster preparedness for transport and disaster risk management

The outcome of this exercise is summarized below for each key topic.

4.2. Risk assessment

Progress. Most risk assessment activities undertaken have included the development of landslide hazard studies, predominantly through mapping exercises. For example, avalanche hazard and rockfall prone areas have been identified in Afghanistan and geohazard maps have been prepared in Nepal. Road Master Plans for road slope management in Bhutan have included elements of risk assessment.

Planned activities. Planned activities include the continuation of these mapping exercises and the investigation of landslides in all countries to facilitate the design of mitigation measures. Drone-based mapping systems are planned for Himachal Pradesh while geohazard monitoring systems are planned for Nepal.

4.3. Risk mitigation planning

Progress. Geotechnical condition surveys have been implemented in Afghanistan as the basis for risk mitigation planning. Pilot risk mitigation works have been implemented in Bhutan.

Planned activities. All countries intend to continue with planned works to mitigate landslide hazards. For example, in Himachal Pradesh 20 landslides have been identified for mitigation, while in Mizoram the use of bio-engineering works will be expanded, along with afforestation. In Sri Lanka landslide mitigation works will be developed for unstable slopes along national and provincial highways.

4.4. Resilient asset management

Progress. The Rural Road Network Planning System in Afghanistan is in place and the inventory and condition database is 70% complete. In Nepal,

4 For details, see Appendix D "Country Action Plans"

along the Karnali Highway, geotechnical design is complete, based on geohazard mapping and ground investigation.

Planned activities. In Bhutan, the intention is to fully develop and make operational a road and bridge maintenance management system. This will be applied to national highways and district roads. In Mizoram, a Road Asset Management System will be developed, while in Sri Lanka, the road asset inventory and condition survey already established will be continued.

4.5. Disaster preparedness for transport and disaster risk management

Progress. Generally, progress in this field has been made through the establishment of disaster management authorities and the promotion of cross-ministry co-ordination. In most countries provision has been made for emergency works planned to be stationed at critical locations to respond to geohazard events, including landslides.

Planned activities. Disaster preparedness committees and disaster preparedness plans are proposed for almost all countries. Training of staff in disaster preparedness is also planned in some countries, as is the development of early warning systems. *In one case, government restructuring is being considered to facilitate disaster preparedness.*

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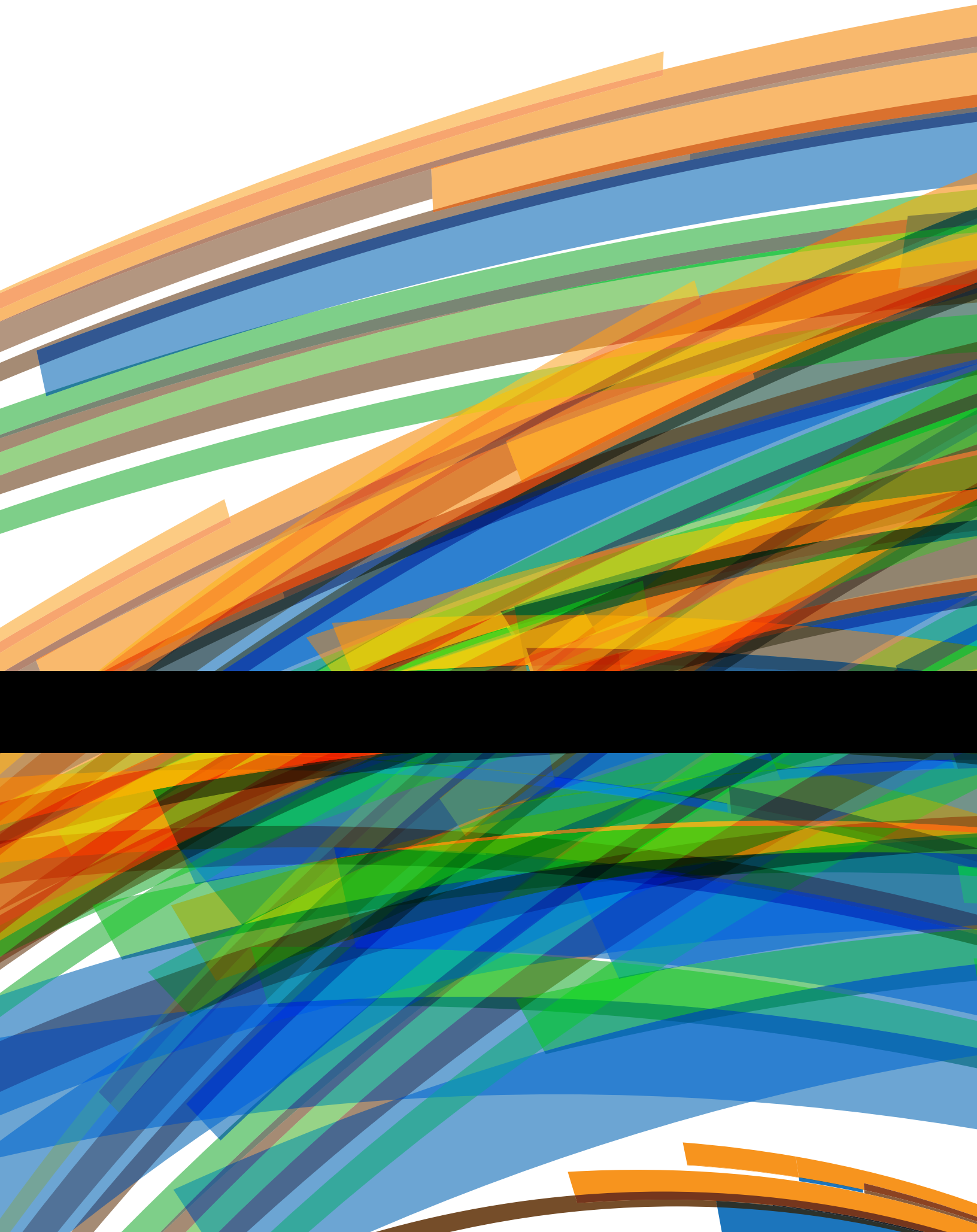

APPENDIXES

APPENDIX A

Second South Asia Regional South-to-South learning workshop on "Building Resilience to Landslide and Geo-Hazard risk in the Transport Sector" Workshop Agenda

Kathmandu, Nepal

NOVEMBER 15-17, 2017

Date/Time	Topic/Activity	Resource Person/Facilitator/ In charge
Arrival Date: Tuesday, November 14		
	Arrival	All Country Delegates
Day 1: Wednesday, November 15		
8:00-8:45	Registration	
9:00-9:05	Opening Ceremony – Nepal tradition	
9:05-9:10	Welcome Remarks	Ms. Yuka Makino
9:10-9:15	Remarks by the World Bank Acting Country Manager	Mr. Bigyan Pradhan, Acting Country Manager
9:15-9:25	Remarks by European Union representative	Mr. Ranjan Prakash Shrestha, EU Head of Cooperation
9:25-9:40	Remarks by the Government of Nepal	Mr. Rajendra Sharma Kaphle, Joint Secretary, MOPIT
9:40-10:10	Introduction of Participants and Resource Persons	Ms. Zenaida Delica-Willison
10:10-10:45	Objectives, Expected Outcome and Schedule	Ms. Yuka Makino
10:45-11:00	Coffee Break	
11:00-12:00	Part 1: Panel presentation on Accomplishments as per Action Plan 2016 (Panel of 3 Presenters and 3 Reactors)	Country Panelists and Reactors
12:00-12:30	Discussion Session	Ms. Zenaida Delica-Willison
12:30-1:30	Lunch Break	
1:30-2:15	Part 2: Panel presentation on Accomplishments as per Action Plan 2016 (Panel of 3 Presenters and 2 Reactors)	County Panelists and Reactors
2:15-2:45	Discussion/Input: Disaster Risk Management	Ms. Zenaida Delica-Willison
2:45-3:15	Input: Resilient Transport Asset Management: Monitoring and Maintenance	Mr. Gareth Hearn
3:15-3:45	Discussion session	Ms. Yuka Makino
3:45-4:00	Coffee Break	

4:00-4:30	Input: Disaster Risk Preparedness and Management in the Transport Sector	Mr. Jasper Cook
4:30-5:00	Discussion session	Ms. Yuka Makino
5:00-5:20	Introduction to the Banepa-Sindhuli Bardibas Road risk assessment, planning, design, construction and monitoring/maintenance	Mr. Hiroaki Tauchi (Nippon Koei) and Mr. T. Igari (Hazama Ando Corporation)
5:20-5:45	Planning for the Field Study tour - consensus on objectives Organizing of groups: 1. Resilient road asset management – Mr. Gareth Hearn and Mr. Shiv Raj Adhikari and Bibash Shrestha 2. Disaster preparedness for transport – Mr. Jasper Cook, Mr. Naresh Man Shakya and Ms. Yuka Makino 3. Disaster risk management – Ms. Zenaida Delica-Willison, Mrs. Shila Shrestha and Mr. Vishnu Shreshta 4. Resilient road construction – Mr. Hiroaki Tauchi, Mr. Rakesh Maharjan, Mr. Dhruba Regmi and Ms. Lilian MacArthur	Ms. Yuka Makino
5:45-6:00	Synthesis for the Day and Announcements	Ms. Zenaida Delica-Willison
7:00-9:00	Dinner Reception	
Day 2: Thursday, November 16		
7:30-10:30	Depart hotel for structure site visit – divide into selected vans	Host Country
10:30-11:00	Mulkot site visit and snack break	
11:00-1:00	Sites along the road	
1:00-2:00	Sindhuli-Gadhi site visit and Lunch	
2:00-6:00	Return to hotel	
6:00-7:00	Preparation of summary of findings/learnings per bus for presentation	Team from each bus
7:00-8:00	Dinner	
Day 3: Friday, November 17		
8:30-10:00	Group presentation per van on their findings/learning (10 minutes each) and discussion	Each bus team #1-4
10:00-10:45	Karnali Highway risk assessment presentation and discussion	Mr. Prashant Malla (Aviyan) and Mr. Tuklal Adhikari (EPTISA}
10:45-11:00	Break	
11:00-12:30	Expert group discussions and advisory – (30 minutes each session)	Mr. Gareth Hearn Mr. Jasper Cook Ms. Zenaida Delica-Willison
12:30-1:30	Lunch Break	
1:30-2:30	Country Specific Action Planning (and organizing the discussion result as per the planning template)	Country Representatives with facilitator/recorder

2:30-2:45	Coffee Break	
2:45-4:00	Presentation of Country Action Plan (7 x 7 minutes) and commentaries/clarification	Country Representatives
4:00-4:05	Synthesis: Lessons learned	Mr. Gareth Hearn
4:05-4:10	Synthesis: Lessons learned	Mr. Jasper Cook
4:10-4:15	Synthesis: Lessons learned	Ms. Zenaida Delica-Willison
4:15-4:45	Concluding activities: distribution of certificate of attendance, awarding and closing remarks	Ms. Yuka Makino
Day 4: November 18, 201		
Departure		

APPENDIX B
South-to-South Learning Workshop Participants

	COUNTRY	SURNAME	FIRST NAME	TITLE
1	Afghanistan	Sahil	Hamidullah	Mr.
2	Afghanistan	Baktash	Wali Mohammad	Mr
3	Afghanistan	Noori	Mohammad Salam	Mr.
4	Afghanistan	Arman	Jan Mohammad	Mr.
5	Bangladesh	Ali	Md. Monjur	Mr.
6	Bangladesh	Islam	Mohammad Atikul	Mr.
7	Bangladesh	Husain	Mir Tanweer	Mr.
8	Bhutan	Tenzin	Jigme Tenzin	Mr.
9	Bhutan	Yeshey Penjor		Mr.
10	Bhutan	Chhetri	Dhan Raj	Mr.
11	Bhutan	Gyeltshen P	Dorji	Mr.
12	India	Kulkarni	Shruti	Ms.
13	India	K. Lalbiakthanga	Mabiaka	Mr.
14	India	H. Lalchhandama	C. H. D. A.	Mr.
15	India	Khare	P. C.	Mr
16	India	Mathur	Sanjay	Mr.
17	India	Sharma	Pawan	Mr.
18	India	Rohela	Aparna	Mr.
19	Nepal	Katwal	Krishna Bahadur	Mr.
20	Nepal	Pandit	Shankar Prasad	Mr.
21	Nepal	Guragain	Jeewan	Mr.
22	Nepal	Regmi	Dhrubaraj	Mr.
23	Nepal	Shrestha	Sanjaya Kumar	Mr.
24	Nepal	Maharjan	Rakesh	Mr.
25	Nepal	Mull	Ajay Kumar	Mr.
26	Nepal	Shakya	Naresh Man	Mr.
27	Nepal	Adhikari	Shiva Raj	Mr.
28	Nepal	Shrestha	Shila	Ms.
29	Nepal	Dixit	Avani	Mr.
30	Nepal	Shrestha	Bibash	Mr.
31	Nepal	Ghimire	Drona Raj	Mr.
32	Nepal	Shrestha	Vishnu Prasad	Mr.
33	Nepal	Shrestha	Deepak Man Singh	Mr.
34	Philippines	Willison	Zenaida	Mrs.
35	Sri Lanka	Bandara	N. W. A. M. M. K. N.	Mr.
36	Sri Lanka	Peiris	N. I. C.	Mr.
37	Sri Lanka	Wijayasundara	P. A. D.	Ms.
38	Sri Lanka	Jayasundara	S. M.	Mr.
39	Sri Lanka	Thennakoon	Dhanushka Parakrama	Mr.
40	UK	Cook	Jasper	Mr.
41	UK	Hearn	Gareth	Mr.
42	US	Kaupa	Stefanie	Ms.
43	US	MacArthur	Lilian	Mrs.
44	US	Makino	Yuka	Ms.

APPENDIX C
Extract from Government of Himachal Pradesh, Public Works Department, OPRC Bidding Documents, OPRC - 2

Section VI, Part G Specifications for Emergency Works

LIST OF CONTENTS

G1. DEFINITION OF "UNFORESEEN NATURAL PHENOMENA"

Emergency Works are designed to repair those damages to the roads under contract which are caused directly by unforeseen natural phenomena with imponderable consequences , due to the reasons beyond the control of contractor occurring either in the area of the roads or elsewhere, but with a direct impact on the roads. "Unforeseen Natural Phenomena" are defined as follows:

(i) Flooding where water levels rise above the crown level of the road resulting in complete or partial washout of the culvert or road embankment causing disruption of traffic. Any damage which results from insufficient maintenance of drainage structures will not be considered as "emergency" and will need to be repaired from within the Ordinary Maintenance Services.

(ii) Major landslides (greater than 50 m^3 *per emergency event* per KM measured between KM stones) which block the road carriageway and drains, encroach onto the road surface and interrupts the flow of traffic or is unsafe. Can be caused by heavy rains or earthquakes. Landslides within the right-of–way caused by overflow of poorly maintained cut-off drains or catch dams will not be considered as an "emergency" and will need to be removed as part of Ordinary Maintenance Services.

(iii) Traffic accidents which interrupts traffic and causes insurmountable damage to the road. Nevertheless, the Contractor will be responsible to provide full support to the police and road users and arrange signing and cleanup of site or sanding as necessary is part of Ordinary Maintenance Services.

(iv) Due to the reasons beyond the control of contractor in routine maintenance of road under contract conditions like continuous/ incessant rains , other events listed in the clause 38.1 of General Conditions, etc.,

(v) The snowfall of more than 300 mm in a single event resulting in the suspension of traffic

G2. PROCEDURE FOR REQUESTING EMERGENCY WORKS

If damages clearly caused by "Unforeseen Natural Phenomena" result in a reduction of Service Levels below the normal threshold values specified in this contract, the Contractor may make a formal request to the Engineer to carry out Emergency Works designed specifically to remedy those damages. If the Contractor decides to make a request for Emergency Works either on his own or at the request of the Engineer, he must (i) immediately inform the Engineer of his intention to do so, by telephone, radio or other means, (ii) document the circumstances of the Force Majeure event and the damages caused, through photographs, video and other suitable means, (iii) prepare a written request, stating the type of works he intends to carry out, their exact location and the estimated quantities and costs, including photographic documentation. In any case, a request for Emergency Works must be made immediately after the Contractor gains knowledge of the existence of damages caused by "Unforeseen Natural Phenomena".

The Engineer, upon receipt of the request and not later than 24 hours thereafter, will evaluate the request made by the Contractor based on a site visit, and issue an order to carry out the Emergency Works. The order will specify the type of works, their estimated quantities, the remuneration to be paid to the Contractor, and the time allowed for their execution. The order may indicate a requirement for an engineering/geotechnical assessment of the options for the permanent repairs to the site.

G3. REMUNERATION OF EMERGENCY WORKS

Emergency works are remunerated by the Employer from the provisional sum for each work order established on the basis of executed quantities at the unit prices covered under Schedule 4 for similar items and for other items the unit prices shall be arrived as per Clause 61 and 63 of General Conditions of Contract.

In the event of unforeseen events, works shall be conducted as Emergency Works (*Dayworks*). These Works shall be undertaken under Dayworks only where formally approved by the Engineer. Works carried out under Dayworks shall be for minor items of works which are not within the scope of Schedule 1, 2, 3 or 4 activities. The Contractor shall maintain detailed records for the items of plant or materials utilised under Dayworks and shall obtain the Engineer's Surveillance Officer's endorsement of the site dockets to verify times and quantities used.

In emergency incidents, where the emergency work is beyond the scope of OM responsibilities and not listed in the schedule, the Contractor shall provide the Engineer a full listing of costs in accordance with the rates tendered in work Schedule 4. Once the site has been made safe, the Contractor is not to proceed with remedial works until the approval of the Engineer is received.

G4. PROVISION FOR EMERGENCY WORKS

the total contract amount will include a provisional sum of emergency works during the contract period. the actual payments for emergency work will be based on the actual quantities executed.

G5. OBLIGATIONS OF CONTRACTOR DURING EMERGENCIES AND EMERGENCY WORKS

given the nature of this contract and the fact that emergency works are remunerated separately, the contractor will, during the execution of emergency works, continue to be responsible for assuring the normal service levels on all roads included in the contract. in particular, the contractor will do everything reasonably possible in order to ensure the normal use of all the roads under contract, including the sections affected by emergencies.

if road traffic has been interrupted because of an emergency, the contractor will take the measures necessary (i) to reopen the road to traffic in the shortest time possible, and (ii) maintain the road open during emergency works, without being entitled to a specific compensation for those measures. this is valid specifically for trees or other objects which may have fallen on the road, damage to access ramps to bridges, erosion of embankments, collapse of slopes, traffic accidents, flooding, rectification of natural streams for damages caused due to flood etc.

G6. MINOR REPAIRS MADE NECESSARY BY "UNFORESEEN NATURAL PHENOMENA"

If the works necessary to remedy damages caused by an "Unforeseen Natural Phenomena" are below certain threshold values, the Contractor will carry out those works as part of his normal obligations and without having the right to invoke the provision of the contract concerning emergencies and the remuneration of emergency works. In these cases the consent of the Engineer is not needed and the Contractor will simply carry out the works on his own initiative. He will nevertheless inform the Engineer of the damages occurred and the remedial measures taken.

The threshold values for minor repairs are as shown in the table below:

ACTIVITY	UNIT	THRESHOLD QUANTITY PER EMERGENCY EVENT PER KM MEASURED BETWEEN KM STONES
Slides of material onto road	m^3	50
Snow clearance(depth of snow)	mm	300
Culverts/Bridges/ causeways	Number	1
Bituminous works	m^3	20
Base course	m^3	50
Concrete/ stone masonry	m^3	5
Embankment/ shoulders	m^3	50

APPENDIX D
Country Action Plans.

Objective: To develop an action plan for geohazard risk management in the transport sector/road project for November 2017 to October 2018

1. AFGHANISTAN

Action Plan 2016 Kandy, Sri Lanka	Accomplishment 2016-2017 Based on 2016 Action Plan	Action Plan 2017 -2018 Katmandu, Nepal (Activities/Agencies responsible/ Completion date)
Risk Assessment **Institutional setup in NRAP and THRCP** • Coordinate with and prepare presentations to ministries to convince them to work on geohazard risk management actively and to encourage top-level support. • Collaborate between World Bank assigned team and the ministry staff.	• Maintenance section is active in NRAP for recovery activities. • THRCP conducted initial studies on B2B and Salang Pass. • Avalanche and rock fall prone areas have been identified. Data was shared with World Bank team.	• Finalize both technical assessment and DSS through compiling the completed visual assessment on B2B road and on Salang Pass in DSS process *Agencies Responsible:* THRCP/MPW and Consultant *Completion Date:* March 2018 • Finalize the process and modeling through following up the World Bank to receive the final model *Agencies Responsible:* THRCP and World Bank *Completion Date:* December 2017
Risk mitigation planning • Apply workshop learning to ongoing projects like B2B and Salang Pass.	• The DSS finding considered in B2B road design and in Salang Pass. • Relevant geohazard risk management and mitigation measures addressed to MRRD, MPW and ANDMA leadership.	• Rectify the design of B2B road vulnerable locations through design verification and rectification, which will be conducted based on DSS recommendation. *Agencies Responsible:* THRCP team and consultant *Completion Date:* March 2018
Resilient Asset Management – Monitoring, maintenance • Rural Road Network Planning System	• Software has been developed • 70% Data collection for district roads have been completed.	• Complete the remaining 30% data collection for district through continued data collection survey and data entry in the system. *Agencies Responsible:* NRAP and MPW *Completion Date:* October 2018

Disaster Risk Management	• Relevant Geo Hazard Risk Management and mitigation measures addressed to MRRD, MPW and ANDMA leadership.	• Continue discussion with Ministries leadership through scheduling regular meetings • Conduct training to relevant projects engineers through presentations using in house resources. *Agencies Responsible:* THRCP and NRAP *Completion Date:* April 2018

2. BANGLADESH

Action Plan 2016 Kandy, Sri Lanka	Accomplishment 2016-2017 Based on 2016 Action Plan	Action Plan 2017 -2018 Katmandu, Nepal (Activities/Agencies responsible/ Completion date)
Risk Assessment		
Risk mitigation planning • Construction of new roads above the Highest Flood Level (HFL). • Construction of bridges considering the HFL. • Construction of submergible Roads. • Construction of multipurpose school cum cyclone shelter in coastal belt.	• 668 km climate resilient rural roads along with sufficient structures have been constructed by the Local Government Engineering Department (LGED). • 220 km submergible roads have been constructed. • 274 multipurpose school cum cyclone shelters have been constructed in the coastal belt of the country.	• Address the land slide issues in hilly areas of Bangladesh through road construction and maintenance program. • Construction of submergible roads in flash flood vulnerable areas in north-east Haor part of the country. • Construction of climate resilient infrastructure including road, structures, & school cum disaster shelters in vulnerable areas. *Agencies Responsible:* LGED *Completion Date:* Ongoing
Resilient Asset Management – Monitoring, maintenance		Development of web based Road and Structure Database Management System (RSDMS) for rural road network. *Agencies Responsible:* LGED *Completion Date:* 2018
Disaster Risk Management/Disaster preparedness in the Transport Sector		Awareness raising and capacity building on landslides *Agencies Responsible:* LGED *Completion Date:* On going

3. BHUTAN

Action Plan 2016 Kandy, Sri Lanka	Accomplishment 2016-2017 Based on 2016 Action Plan	Action Plan 2017 -2018 Katmandu, Nepal (Activities/Agencies responsible/ Completion date)
Risk Assessment • Master plan study on road slope management in Bhutan, which included risk assessment • Formulation of contingency: Assess mapping of landslide.	• Technical Assistance from JICA - The project for master plan study on road slope management in Bhutan	• Prepare map of potential and existing landslides on selected roads, as the basis for the development of risk assessment methodology. • Have more studies as currently, Bhutan has limited studies focused on few sites/ sections only. *Agencies Responsible:* DoR in collaboration with Donor Agency *Completion Date:* October 2018
Risk mitigation planning Formation of Road Response Committee: Pilot landslide mitigation work along the road • Stockpiled Bailey bridge parts at strategic locations.	Ongoing • Two sets of Bailey bridge parts and launching equipment per region	• Continue the piloting of landslide mitigation work *Agencies Responsible:* DoR with JICA *Completion Date:* October 2018
Resilient Asset Management – Monitoring, maintenance • Formation of Road Response Committee: Set response unit and Machinery Station. Stockpile relief supplies at strategic locations	• Machinery Stations were established in slide prone areas. • Combination of different mitigations tried • Maintenance Division is coordinating with DDM	• Develop and operationalize fully the road and bridge maintenance and management system. This will be applied to national highways and district roads. *Agencies Responsible:* DoR with JICA and World Bank *Completion Date:* Oct. 2018 • Utilize the outcome of the hazard studies to consider risk to help plan for emergencies more effectively *Agencies Responsible:* DoR, Armed Forces, District Engineers *Completion Date:* October 2018
Disaster Risk Management/ Disaster Preparedness for transport • Coordination: Set up link between DoR and DDM. • Institutional arrangement: Setup of disaster management unit in transport services. • Provide training on launching of bailey bridge	• Link has been established • Disaster Management (DM) system set up • Trained 220 personnel on emergency bridge launching.	• Ongoing • Strengthen DM system through regular meetings. *Agencies Responsible:* • Provide more training *Agencies Responsible:* DoR and DDM *Completion Date:* October 2018

4. HPSRP-I/UDRP INDIA

Action Plan 2016 Kandy, Sri Lanka	Accomplishment 2016-2017 Based on 2016 Action Plan	Action Plan 2017 -2018 Katmandu, Nepal (Activities/Agencies responsible/ Completion date)
Risk Assessment	• Action plan was not shared by the participants with the new incumbents.	• Develop web-based drone mapping of landslides for HPPWD. • Conduct detailed study *Agencies Responsible:* HPRIDC/HPSRP/USDMA EA HPPWD December 2019
Risk mitigation planning	• Geohazard mitigation measures are already being adopted under the HPSRP-I/UDRP/State Plan.	• Implement EWS • Mitigate landslides on critical upgraded roads • Regularly monitor and persuade Government/EA Agency *Agencies Responsible:* HPRIDC/HPSRP/USDMA EAA *Completion Date:* December 2019 • Award to at least 20 landslide affected stretches of upgraded roads. *Agencies Responsible:* HPRIDC/HPSRP/ USDMA EA *Completion Date:* March 2019
Resilient Asset Management – Monitoring, maintenance		• Continue learning from best practices of HPSRP-I/ UDRP in other state funded roads. *Agencies Responsible:* HPRIDC/HPSRP/USDMA EAA *Completion Date:* March 2019
Disaster Risk Management **Disaster Preparedness in Transport** Disaster Management Authority as Apex Nodal body.		• Coordinate among different line departments. • Periodic review/mock drills through regular monitoring and preparedness activities • Appoint consultant for DSS • Integrate various studies of UDRP. *Agencies Responsible:* HPRIDC/HPSRP/USDMA EAA *Completion Date:* Ongoing

5. MIZORAM, INDIA

	Action Plan 2017 -2018 Katmandu, Nepal (Activities/	Methods/ Agencies responsible/ Completion date)
Risk Assessment	• Identify landslip and geo hazard risk locations.	• Review achievement and shortfall every quarter. *Agencies Responsible:* Project Implementation Unit (PIU), PWD through Consultant
Risk mitigation planning	• Prepare mitigation actions & prioritize implementation of more bio-engineering work in unstable slopes. • Construct gabion structures to protect dump sites and landslip prone areas • Implement afforestation.	• Review achievement and shortfall every quarter. *Agencies Responsible:* PIU, PWD through Consultant and Contractor. *Completion Date:* October 2018
Resilient Asset Management – Monitoring, maintenance	• PWIMS in progress • Implement ODK • RAMS	Exert effort in implementing the system through deploying consultant and experts *Agencies Responsible:* IU, PWD through consultant and Contractor. *Completion Date:* October 2018
Disaster Preparedness in Transport	Form District level Committee in every district and formulate action plan.	Review shortfall of action every two months by the district level committee *Agencies Responsible:* District Committee (DC), PIU and stakeholders *Completion Date:* October 2018
Disaster Risk Management	Conduct geo-technical investigation along alignments for any upcoming project and incorporate risk management action plan in DPR.	Review shortfall of action quarterly in every division. *Agencies Responsible:* DC, PIU and stakeholders *Completion Date:* October 2018

6. NEPAL

Action Plan 2016 Kandy, Sri Lanka	Accomplishment 2016-2017 Based on 2016 Action Plan	Action Plan 2017 -2018 Katmandu, Nepal (Activities/Agencies responsible/ Completion date)
Risk Assessment • Geo hazard mapping • Hire design consultant • Geohazard Risk Management Handbook	• Final draft for 700km RSDP • Mobilized design consultant—work still in progress • Pretested Geohazard Risk Management Handbook	• Complete the testing or the Geohazard Risk Management Handbook *Agencies Responsible:* Department of Roads (DOR), Department of Local Infrastructure Development & Agricultural Roads (DoLIDAR), Department of Water Induced Disaster Management (DWIDM) (supporting agency) *Completion Date:* 2018
Risk mitigation planning Decision support system • Hire consultant Institutional strengthening on application of DSS • Train all sector personnel • Identify software **Monitoring of pilot project** • Apply geohazard maps • Monitoring system • Hire monitoring consultant	• Expressed interest--consultant • Training—in progress • In progress of identifying software • Application of maps • Monitoring system being developed	• Hire consultant and develop DSS • Enhance capacity on DSS • Train sectoral personnel (Federal, provincial and local level including private sector) • Select software • Practice application of design • Develop monitoring system • After system development, hire monitoring consultant *Agencies Responsible:* • DOR, DoLIDAR, DWIDM *Completion Date:* 2018
Resilient Asset Management – Monitoring, maintenance Karnali Highway asset management (234 km)		• Prepare geo-hazard map • Complete and implement geotechnical design *Agencies Responsible:* • DOR, DoLIDAR, DWIDM *Completion Date:* 2018
Disaster Risk Management/ Disaster Preparedness in Transport		Develop response plan *Agencies Responsible:* • DOR, DoLIDAR, DWIDM *Completion Date:* 2018

7. SRI LANKA

Action Plan 2016 Kandy, Sri Lanka	Accomplishment 2016-2017 Based on 2016 Action Plan	Action Plan 2017 -2018 Katmandu, Nepal (Activities/Agencies responsible/ Completion date)
Risk Assessment • Develop a complete data base • Assign responsibilities on gathering and updating data and implementation of measures by responsible government institutes • Handle different geohazards by different institutions- NBRO, DMC, GSMB, Irrigation department • Monitoring of Post construction mitigation activities with advance techniques	• Disaster Information Management database maintained by DMC (DMC web site) • National Building Research Organization (NBRO)-land clearance data base (under constructions) • Meteorological Department -- meteorological data base, weather forecasting Irrigation Department-- dam safety data base • NBRO - continuously undertake landslide hazard/risk management • NBRO in process of establishing LS mitigation for up country railway • Irrigation Department- dam safety measures • Monitoring of landslides with proper instrumentation- still continues (24X7 LWC established) • DMC-GSMB- 24x7 EWC established	• Landslide risk mapping and awareness • Community awareness program to address inadequate international coordination, instruments & equipment *Agencies Responsible:* DMC, NBRO, GSMB, RDA, PRDD *Completion Date:* Annual programming 2018
Risk mitigation planning	• Kandy-Mahiyangana road Completed • Ongoing projects for road sector • Completed a mitigation plan to upcountry railway line	• Land clearance program • Make recommendations for large scale infrastructure development projects – including roads rectification of unstable slopes along selected national & provincial roads *Agencies Responsible:* DMC, NBRO, GSMB, RDA, PRDD *Completion Date:* 2023
Resilient Asset Management – Monitoring, maintenance	• Initial stage of inventory of assets	• Obtain expert knowledge *Agencies Responsible:* DMC, NBRO, GSMB, RDA, PRDD *Completion Date:* Annual 2018
Disaster Risk Management/ Disaster Preparedness	• Established 24x7 EWC	• Transfer knowledge to local staff • Integrate risk mitigation activities in design stage *Agencies Responsible:* DMC, NBRO, Railway Dept. *Completion Date:* 2023

Outputs and Guidance Notes

Second Annual South-to-South Learning Workshop on

Strengthening Resilience to Geohazards in Transport

November 15-17, 2017
Kathmandu, Nepal

Geohazard Risk Management in the Transport Sector

GFDRR
Global Facility for Disaster Reduction and Recovery