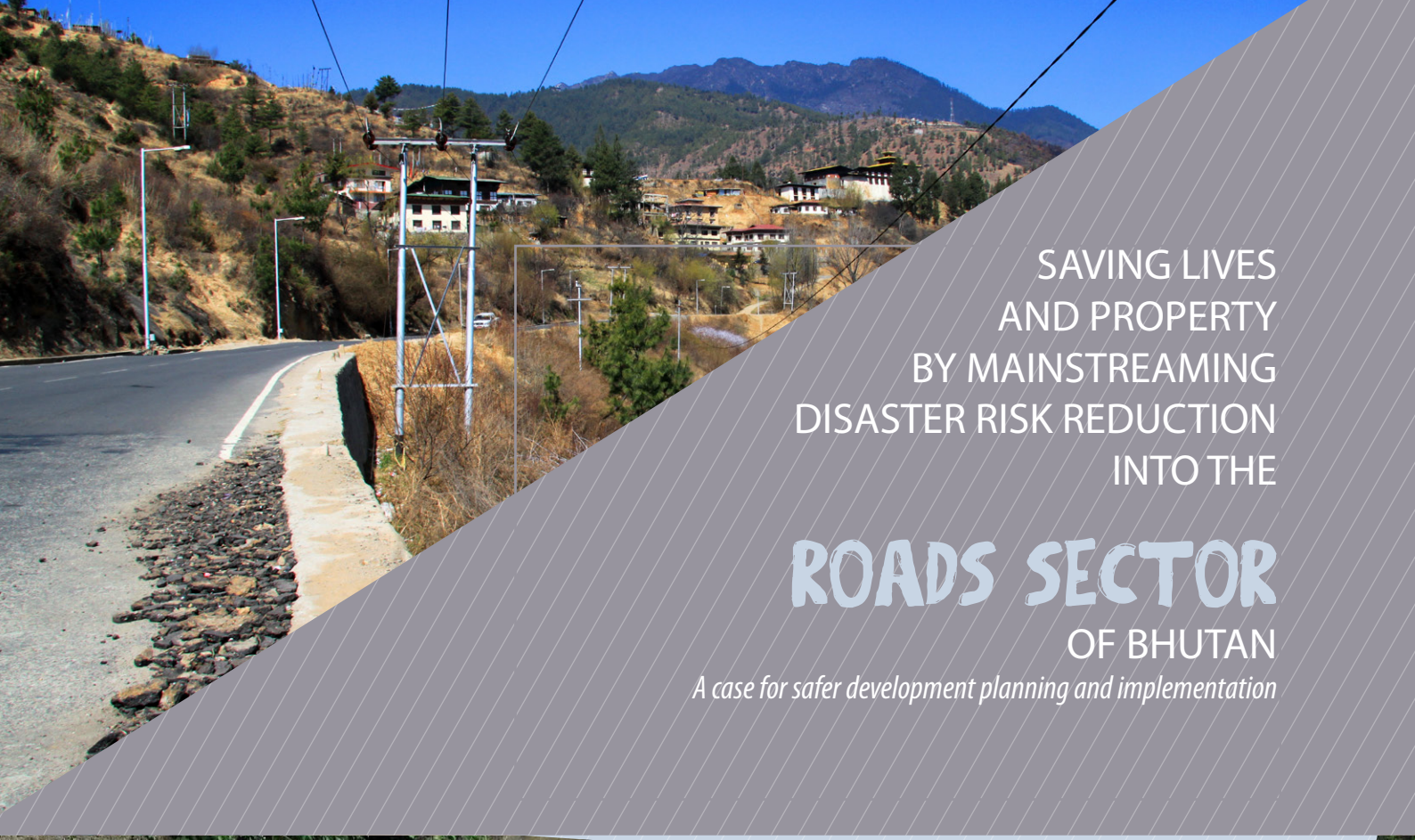


SAVING LIVES AND PROPERTY BY MAINSTREAMING DISASTER RISK REDUCTION INTO THE

ROADS SECTOR

OF BHUTAN

A case for safer development planning and implementation

Department of Disaster Management

adpc

Cover photo credit Travis Lupick (top) and Barbara Agnew (bottom)

Abbreviations and glossary

ADPC	Asian Disaster Preparedness Center
CCA	Climate change adaptation
DRR	Disaster risk reduction
EIA	Environmental Impact Assessment
Dzongkhag	District (administrative unit)
FYP	Five Year Plan
Gewog	Block (administrative unit)
GDP	Gross domestic product
GLOF	Glacial lake outburst flood
NEC	National Environment Commission
NU	Ngultrum
SAARC	South Asian Association for Regional Cooperation
SPBD	School Planning and Building Division (Ministry of Education)
UNICEF	The United Nations Children's Fund
USD	United States Dollars

Contents

Foreword

Disasters are on the rise globally causing huge losses, both in terms of lives and property. While it is well known that developing countries are disproportionately affected by disasters, the 2011 Tohoku earthquake and tsunami sent a clear message that developed countries are also vulnerable.

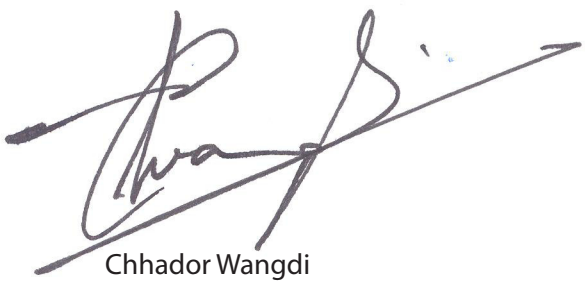
It is said that the impact of disasters on societies and economies has increased considerably over the last two decades and is likely to increase further as a result of climate change and increasing economic development in high-risk areas, especially the developing and poor countries. In Bhutan over recent years, we have experienced more severe floods and storms and this could be linked to climate change.

The concept of mainstreaming disaster risk reduction into development is just few years old in Bhutan. Many people think that disasters are caused by Nature alone, but this is not true. Disasters are caused by our society, by the types of decisions we take when we build roads and towns. It is about how we manage our economies and communities. It is therefore essential that the process of development planning and policy making identifies and analyzes the underlying causes of disaster risk, including the possible impacts of natural hazards on development, and takes steps to reduce the disaster risk wherever possible. This is best achieved by mainstreaming disaster risk reduction into the development framework, including socio-economic and physical planning at all levels.

Over the few years since the introduction of this concept, we have made good progress. The National Disaster Management Act of Bhutan (2013) specifies that mainstreaming disaster risk reduction is a very important aspect of any development plan or project. The Act mandates every agency both at local and national level to not only mainstream disaster risk reduction into their development plans but also to keep necessary budget for this. Mainstreaming disaster risk reduction is also one of the 16 National Key Result Areas, under the Gross National Happiness Commission. Similarly, mainstreaming disaster risk reduction is an important aspect of the Policy Formulation of Protocol Gross National Happiness Commission.

This advocacy document is part of a pair developed in partnership with the Asian Disaster Preparedness Center, Bangkok. These documents are aimed at creating awareness of the importance of considering disaster risk reduction as an essential part of any new development project in the education and road sectors, both of which are among the two most important sectors in our country.

It is our hope that this document will facilitate the advancement of our task of mainstreaming DRR into development planning and help achieve our vision of a "**Safe and Happy Bhutan**".



Chhador Wangdi
Director
Department of Disaster Management
Royal Government of Bhutan

Introduction

Reducing disaster risk is now considered an essential component of reducing poverty, safeguarding development and adapting to climate change.[1] However, in many countries disaster risk is increasing due to changing hazard profiles and the increasing vulnerability of human systems and society. In particular, reports from the International Panel on Climate Change repeatedly confirm that global climate change is altering the geographical distribution, intensity and frequency of meteorological hazards, especially with respect to rainfall patterns.

Compared to developed countries, developing countries experience disproportionately high mortality rates and economic losses. In particular, small island states and land-locked countries not only suffer higher levels of economic loss (with respect to their gross domestic product), but also have lower levels of resilience. Similarly, poorer households and communities suffer disproportionately – especially in terms of income and consumption levels.

South Asia has a high population and its cities have some of the highest population densities in the world. It is also one of the most disaster-prone regions. According to the South Asian Disaster Report 2009 released by the SAARC Disaster Management Center, the South Asian region experienced 42 natural disasters in 2009 resulting in the death of 3,379 people. The amount of deaths made up 31.7% of the total deaths caused by natural disasters in 2009. The region also suffered considerable damage to infrastructure and property.

Bhutan is a small country located in the eastern Himalayas bordered by China to the north, and India by the south, east and west. Bhutan's estimated population for 2012 was 742,000 people. The country is administratively divided into 20 dzongkhags (districts) and 205 gewogs (blocks). According to the most recent Population and Housing Census of Bhutan (2005), the overall life expectancy is 66.3 years. The Bhutan Living Standards Survey sets the average household family size at 5.0 members and the country's overall literacy rate at 59.5%. In 2008, the unemployment rate was 4%, the average inflation rate was 5.2% and approximately 23% of the total population was living below the national poverty line. While poverty and the overall population are predominantly rural (in 2008, 69% of the country's population was living in rural areas and dependent primarily

1 UNISDR. 2009. 2009 Global Assessment Report on Disaster Risk Reduction: Risk Reduction and Poverty in a Changing Climate. Geneva.

on subsistence farming) urban growth hovers around 7%. In 2005, 31% of the total population lived in 61 towns and 40% of this urban population lived in the capital city of Thimphu. An estimated 73% of the population will be living in urban areas by 2020.

Bhutan is vulnerable to multiple hazards ranging from earthquakes to flash floods, fires and windstorms. The Eastern Himalayas is one of the most seismically active regions in the world making Bhutan particularly exposed to seismic activity. The country regularly suffers setbacks due to earthquake events (Table 1).

Table 1: Earthquake Events in and around Bhutan 1713-2011

Year	Magnitude	Location
1713	7.0	Arunachal Pradesh/Bhutan
1806	7.6	Tibet, near eastern Bhutan
1906	6.5	Bhutan-China-India border
1910	5.7	North of Punakha, Bhutan/India border
1934	8.0	Bihar-Nepal border
1941	6.7	West of Trashigang, Bhutan-India border
1947	7.3	Arunachal Pradesh-China border
1950	8.69	Indo-China border
1954	6.4	Bhutan-China-India border
1960	6.59	Near Tsirang
1980	6.39	Near Sikkim
1988	6.8	Udaypur Gahri, Nepal
2003	5.5	Gunitsawa, Paro
2006	5.0	Arunachal Pradesh
2006	5.7	Gangtok, Sikkim
2006	5.8 and 5.5	Trashigang, Bhutan
2009	6.1	Narang, Mongar
2011	6.9	Sikkim, India

Magnitude is measured on the Richter scale.

Source: Royal Government of Bhutan, Department of Disaster Management. 2011. A Study on the Importance of Mainstreaming DRR in Development Planning. Impact of May 2009 Cyclone Aila precipitated floods and 21st September 2009 earthquake on Education and Road Sector in Bhutan. Thimphu.

Another pertinent hazard related to climate change is the risk of glacial lake outburst floods (GLOF). Bhutan has 2,674 glacial lakes and 25 of them have been identified as potentially dangerous according to studies conducted by the Department of Geology and Mines in collaboration with various regional and international agencies. According to the National Adaptation Plan of Action (2006), the threat of glacial lake outburst floods is increasing due to global warming and the rapid and unprecedented rate of glacial retreat. Bhutan has experienced major glacial lake outburst floods and flooding events in its past (Table 2).

Table 2: Flood Events in Bhutan 1957-2009

Year	Cause	Impact
1957	Flood due to glacial lake outburst	Damaged the Pho Chu River sub basin.
1960	Flood due to glacial lake outburst	Damaged the Pho Chu River sub basin.
1994	Flood due to glacial lake outburst	Damaged more than 1,700 acres of agriculture and pastureland, a dozen houses, six tons of grain and washed away five water mills and 16 yaks.
2000	Flood of Doteng Chu River	Much of Phuentsholing was impacted.
2005	Flood due to heavy rainfall.	More than 200 people lost their property in Phuentsholing and Pasakha.
2004	Flood due to heavy rainfall	The flooding affected 1,437 households across six eastern dzongkhags, nine people died, 664 acres of wet and dry land were destroyed, and hundreds of tons of crops were lost.
2009	Flood due to heavy rainfall	Almost all 20 dzongkhags were affected, 13 people died and properties worth BTN 594 million (USD 12.3 million).

Source: Royal Government of Bhutan, Department of Disaster Management. 2011. A Study on the Importance of Mainstreaming DRR in Development Planning. Impact of May 2009 Cyclone Aila precipitated floods and 21st September 2009 earthquake on Education and Road Sector in Bhutan. Thimphu.

In addition to these major hazards, windstorms and fires regularly affect the country. Windstorms occur annually and damage houses, schools and government facilities. In 2011, windstorms damaged 2,424 houses and 57 schools across the country. Similarly, 2010 and 2011 saw the outbreak of two fires each year.

This advocacy paper seeks to provide an evidence-based case for mainstreaming DRR into Bhutan's road sector as a cost-effective choice supporting local, regional and national development. It will provide evidence from Cyclone Aila and its unprecedented floods from May 2009.

As of June 2013 Bhutan has 1860 kms of Primary National Highway, 578.26 kms of Secondary National Highway. Some of the other road network which has connected Bhutanese people are Dzongkhag roads (1178.29 kms), Urban Road (349.67 kms)[2]

The Department of Roads under the Ministry of Works and Human Settlement mandated to enhance the reliability and safety of road transport through reduced road-user costs, travel time, accidents and transportation costs of goods and services. Road Sector Master Plan 2007-2027 envisages the construction of more than 2,500 kilometres of feeder roads throughout the country, the construction of a second east-west highway, an increase of 400 kilometres of highway, and an improvement and realignment of roads. Bhutan 2020 (the national strategic vision for development published in 1999[3] underscores the government's commitment to upgrading current national trunk route, ensuring that 75% of the rural population live within a half-day walk from the nearest road, and extending the transnational highway network.[4]

As a sector with one of the highest budget allocation in the 10th FYP, the road sector requires special attention. Evidence from past disasters calls for enhanced risk-sensitive measures when building new roads and improving old ones. The Royal Government of Bhutan has renewed its commitment to the sector allocating 9% of the total budget for the financial year 2013-2014 to improve road networks and construct new roads.[5] Therefore, the sector represents an opportunity as well as a challenge for mainstreaming that has the potential to avoid recurring damages to physical communication networks and unnecessary economic losses in the future.

2 Ministry of Works & Human Settlement. 2013. Annual Information Bulletin: 2013. Thimphu, Bhutan: Royal Government of Bhutan, Policy and Planning Division.
3 Royal Government of Bhutan. 1999. Bhutan 2020: A Vision for Peace, Prosperity and Happiness. Thimphu.
4 Royal Government of Bhutan, Department of Disaster Management. 2011. A Study on the Importance of Mainstreaming DRR in Development Planning. Impact of May 2009 Cyclone Aila precipitated floods and 21st September 2009 earthquake on Education and Road Sector in Bhutan. Thimphu.
5 Royal Government of Bhutan, Ministry of Finance. 2013. National Budget Financial Year 2013-2014. Thimphu.

What is Mainstreaming Disaster Risk Reduction into the Road Sector?

The impacts of natural hazards on roads and bridges range from temporary traffic disruption to major calamities resulting in deaths, the long-term loss of access to major economic corridors, interrupted national development, and higher user-costs. Roads are not only important paths for development; they are critical to poverty reduction. In Bhutan's rural areas where the poor are predominantly represented, roads enable access to a variety of important services. These include access to markets in order to sell produce and purchase goods, engagement in income-generating activities beyond the confines of their local communities, access to schools, hospitals and clinics, and utilization of urban and cultural amenities. Roads are lifelines for development, especially for those in rural areas.

RESILIENT ROADS AND BRIDGES HELP TO ENSURE THE SUPPLY OF VITAL DEVELOPMENT SERVICES SUCH AS FOOD, TRANSPORT, COMMERCE, HEALTH, AND EDUCATION.

Bhutan's terrain makes the road sector particularly vulnerable to floods and landslides, especially during the monsoon. For a landlocked country such as Bhutan, ensuring that DRR concerns are incorporated into development policies, plans, and activities related to roads sector is of paramount importance. This is partly because, landlocked countries are particularly vulnerable to disasters. They suffer higher relative economic losses with respect to their GDPs, such that relatively small disasters can represent major setbacks to national economic development.[6]

The creation of resilient roads and bridges reduces the impact of specific hazards, and helps to improve connectivity and communications, ensuring continued access to good and services. Mainstreaming DRR into the road sector means reducing the vulnerability of the physical network to various hazards. Infrastructures –

6 United Nations. International Strategy for Disaster Reduction. 2009. Risk Reduction and Poverty in a Changing Climate. Invest today for a safer tomorrow.

including roads and bridges – must be durable to support a growing economy and population. This requires the identification of appropriate DRR measures to avoid and limit damage and loss while also introducing adequate risk-sensitive standards during planning, design, construction and maintenance.

There are numerous options for mainstreaming DRR into the road and bridge sector (see Part 4). These options include the use of disaster risk assessments during the construction of new roads and bridges as well as the use of natural hazard and risk information in land use management and planning. The consideration of hazard and risk information at the early stages of the project management process can lead to long-term savings, both in terms of the initial cost of the project (capital outlay) and the cost of maintenance operations over the life of the infrastructure. This is because investment in the mitigation and management of risk has been shown to have high economic rates of return. For example, a careful assessment of landslide hazards in mountainous areas can help planners to avoid areas of high landslide risk when selecting the preferred route for a new road, thereby avoiding costly stabilisation procedures.[7] In the Philippines, feasibility studies, cost-benefit analysis, and Environmental Impact Assessments (EIAs) have been conducted to investigate and evaluate the desirability of a project against technical, economic, social, financial and operational constraints. These are useful tools for ensuring resilience of new infrastructure.[8]

It should be noted that the Department of Roads receives a separate 'Monsoon Damage Restoration Budget' (MDRB), because of the importance of the road network. This budget is normally used to cover a number of restoration expenditures including the physical reconstruction and rehabilitation of roads and bridges. In this context, mainstreaming DRR is a more cost-effective choice over the long-term because it will reduce restoration costs and thereby free up more budget for the construction of new roads, and the improvement of existing roads. The economic losses and increasing costs involved in post-disaster reconstruction pose significant burdens and major constraints on development budgets and resources, and this, in turn, impedes the achievement of development goals and objectives.

7 Asian Disaster Preparedness Center. 2008. Incorporating Disaster Risk Assessments as Part of Planning Process Before Construction of New Roads. Mainstreaming Disaster Risk Reduction in Urban Planning and Infrastructures.

8 Asian Disaster Preparedness Center. 2008. Towards Mainstreaming Disaster Risk Reduction into the Planning Process of Road Construction. Philippines. Bangkok.

Impact of Cyclone Aila on the Road Sector in Bhutan

Cyclone Aila brought continuous rainfall over 25–26 May 2009 that resulted in unprecedented levels of flooding in almost all dzongkhags. The severity of the cyclone and the high amount of rain is considered to be linked to climate change. The damage and loss caused by the floods highlights Bhutan's vulnerability to extreme weather events and the need to reduce and mitigate flood risk in the country.

Impact on Physical Structures

According to the damage and loss assessments carried out by respective dzongkhag administrations following the passage of Cyclone Aila, 13 lives were lost and the total damage was estimated at Nu. 766 million (approximately USD 16 million). In the road sector, damage was seen across national highways, farm and feeder roads, and bridges. Similarly, the floods damaged drinking water systems, irrigation channels and hydropower plants that contribute nearly 45% of national revenues. Landslides due to the heavy rain and floods caused most of the damage. This resulted in roads being blocked and many communities were made inaccessible. This greatly impeded evacuation efforts and the provision of assistance.

ROAD ACCESS, BOTH FOR EVACUATION AND FOR DELIVERY OF EMERGENCY SUPPLIES, IS CRUCIAL FOR AN EFFECTIVE RESPONSE TO A DISASTER.

While only eight dzongkhags were severely affected by the floods, widespread damage to schools, health care facilities and water supplies greatly undermined recovery and has had a far reaching impact on the underdeveloped sections of the population, especially those in remote areas. In total, 7% of the bridges in Bhutan were damaged, as well as approximately 6% of the total number of

farm and feeder roads. Government structures took a lot of damage, including hospitals, schools, highways, and many others.[9]

Social impact

During the Cyclone Aila floods rivers swelled slowly – over a period of fourteen hours – as a result most riverside residents were warned of the encroaching floods and given time to prepare. As a result, only thirteen people lost their lives due to the flood.

Lasting impacts were felt across society mainly in the form of lost communication and access to communities due to blocked roads. While heavy rains isolated many communities; travellers – including vendors – were the most affected. In some cases they were stuck on blocked roads for several days. Many marginal groups such as temporary residents in worker camps, who often settle along riverbanks and lack utilities and infrastructure, felt the impacts of the floods especially strongly.[10]

Economic Impact

The first State of the Nation Address made by the former Prime Minister to the Parliament of Bhutan contained several references to disaster risk and the need for its active management. He discussed the risk of glacial lake outburst floods and earthquakes. He also addressed the Cyclone Aila floods, spoke of the response and recovery activities undertaken, and indicated some of the costs involved. According to the Prime Minister, the Royal Government was compelled to divert resources from planned development projects and programs in order to pay for disaster recovery and reconstruction. As a result, the Prime Minister indicated concern over the capacity of government bodies to achieve the 10th FYP targets.

As an example of 'normal' spending priorities for asset development within the roads and bridges sector, the breakdown of the 2013-2014 financial year is indicative. According to the National Budget of 2013-2014, done by the Ministry of Finance a total of Nu. 3,414 million (USD 57.6 million) was allocated for spending as follows:

9 Royal Government of Bhutan, Department of Disaster Management. 2011. A Study on the Importance of Mainstreaming DRR in Development Planning. Impact of May 2009 Cyclone Aila precipitated floods and 21st September 2009 earthquake on Education and Road Sector in Bhutan. Thimphu.

10 Ibid.

- Nu. 1059 million (USD 17.9 million) for construction of primary national highways.
- Nu. 180 million (USD 3 million) for construction of secondary national highways.
- Nu. 35 million (USD 0.6 million) for construction of dzongkhag roads.
- Nu. 210 million (USD 3.5 million) for construction of bridges.
- Nu. 315 million (USD 5.3 million) for improvement.
- Nu. 222 million (USD 3.7 million) for resurfacing.
- Nu. 144 million (USD 2.4 million) for monsoon restoration works.

This distribution of funding reflects the priorities, needs and goals of the road sector. The achievement of sector goals is slowed when funding for the construction of new roads, and the improvement and maintenance of existing roads, is used for disaster reconstruction. In this context, the need for mainstreaming DRR into the road and bridge sector is of clear importance: above all, it aims to reduce the damage and therefore the cost of reconstruction sustained by the sector when disaster strikes.

Box 1: Impact of the 2012 flash flood in Damji on the road sector

The Damji flash flood on 20th June, 2012 washed away major chunks of road connecting Gasa Dzongkhag to neighbouring areas. The flash flood destroyed two major bridges at Gatana.

As a result of these damages Gasa Dzongkhag remained cut off from the neighbouring areas for 1.5 months. Telecommunications and power lines were also disrupted temporarily Damage to the road sector was estimated at Nu. 24 million (USD 0.4 million). Due to the lost road connection, many people were forced to transport supplies and foodstuffs by horse – a source of sustained hardship in this remote dzongkhag.

Sources:

BBS. 2012. Flash flood causes damage in Gase. June 21. Accessed July 2014. http://www.bbs.bt/news/?p=14345.

Deki, T. 2012. The Bhutanese. August. Accessed July 2014. http://www.thebhutanese.bt/gasa-flash-flood-sweeps-5mn-in-damages/.

Voices From the Field

Throughout Bhutan, the cyclone and resultant flooding caused widespread damage to roads and bridges. "Most of our roads were affected by the cyclone induced rainfall and flash floods," said Mr. Dilip Thapa, Executive Engineer, Department of Roads. "our officials had to work round the clock to ensure that our fellow Bhutanese did not suffer due to the blocked roads."

Nevertheless, disruption to daily life and road services caused certain difficulties. "I'm a vegetable vendor," explained Mr. Tshering Dorji, "and when the roads get blocked our perishable vegetables and fruits are affected." In Mr. Dorji's town, the flood damaged roads and the town's drainage system. "The rivers swelled and even the small streams became big enough to drown people," he said.

BUILDING RESILIENT ROADS REDUCES THE IMPACT OF NATURAL HAZARDS AND THE COST OF REBUILDING.

"The rain disrupted our lifelines," said Mr. Thapa, Department of Roads.

In addition to the impact of the roads and national transportation systems in Bhutan, the rain greatly affected smaller agricultural holdings. Many rural Bhutanese practice subsistence farming, and the heavy rains washed these away. The Royal Government provided grants and compensation for lost crops and livestock.[11]

There is an obvious need for greater preparedness and greater resilience. "We all should work at building disaster resilient roads," said Mr. Thapa.

11 Ibid.


© Barbara Agnew

Taking Action to Mainstream Disaster Risk Reduction into Planning, Policy and Management of Roads and Bridges

Given the critical geographic location of Bhutan, mainstreaming DRR into the road and bridge sector is a strategic decision. Replacing damaged structures in the aftermath of disasters is often beyond the resources of local governments. Funds, if available, tend to be diverted from other development projects. Acknowledging that physical development is costly (economic, environmental, etc.) and taking into consideration Bhutan's peculiar vulnerability to disasters, mainstreaming DRR represents an effective prevention measure that reduces and avoids physical, social and, above all, economic cost of disasters.

Bhutan has set ambitious targets for the development of its road and bridge sector that need to be protected. The Royal Government strives to improve people's quality of life by ensuring their access to socioeconomic facilities and related safety through an improved connectivity network. This effort is reflected in the 10th FYP – in which the road and bridge sector are highly prioritised. Bhutan's commitments to implement the sector reforms are reflected in the Roads Sector Master Plan 2007–2027.[12] Bhutan's 2020[13] milestones for development also represent the country's commitment to upgrade the current national trunk routes, ensure that 75% of rural population lives within a half-day's walk from the nearest road, and extend transnational highway networks.

In order to minimise the impact of disaster on the country's progress towards achieving these goals, greater attention must be paid to mainstreaming DRR into the road and bridge sector, and ensuring safe connections. To this end, both national and local governments should focus on the following areas.

12 Royal Government of Bhutan, Ministry of Works and Human Settlement. 2006. Road Sector Master Plan (2007-2027). Thimphu.

13 Royal Government of Bhutan. 1999. Bhutan 2020: A Vision for Peace, Prosperity and Happiness. Thimphu.

Including Resilience in the National Policy Sector

The Road Act[14] is Bhutan's national policy for roads. However, this policy does not consider natural hazards or climate change. Mainstreaming DRR into the road and infrastructure sector should start at the national policy level. In many countries, this means adapting existing sectoral policy so that 'resilient roads' or 'resilient infrastructure' become an overall objective or component. The policy should explicitly recognize the need to pursue resilient roads. DRR and climate change should be applied to all associated policies, strategies and sectoral plans in a similar way.

> Government should consider 'resilient roads' a sectoral goal and strive to achieve it.

Defining New Technical Standards and Specifications for Roads and Bridges

The Department of Roads can consider revising the technical specifications by which road construction is regulated in Bhutan. The Building Code[15] does not cover road and infrastructure construction. However, the Road Act does provide technical standards to which roads should conform and indicates various considerations as fundamental for road construction and maintenance. However, disaster risk is not explicitly addressed other than through the setting of drainage standards.

Revision of relevant specifications, in addition to extreme events such as disasters, should also consider long-term climate change impacts and associated issues for the sector. This could involve revising specifications for subsurface conditions. The stability of roads and other infrastructure greatly depends on the materials upon which it is built. In particular, in the case of floods and rainfall, the stability of the road will depend on the degree of soil saturation and the expected behaviour of the soil when saturated. The type, composition, strength and protection of subsurface materials may have to be increased in order to handle heavy rain. The Department of Roads currently have specifications for subsurface conditions and technical standards have been set. However, the Department may seek to

14 Royal Government of Bhutan. 2004. Road Act of the Kingdom of Bhutan 2004. Thimphu.
15 Royal Government of Bhutan, Department of Urban Development and Housing. 2003. Bhutan Building Rules 2002. Thimphu.

revise current practices or increase monitoring of construction to ensure quality subsurface conditions.

Land Use Planning for Roads

The placement and layout of roads greatly influence the location and pattern of development. Building a road in a given area encourages economic development, settlement and community growth around it. Therefore, it's important to consider how new roads may be contributing to the development of hazardous areas. This is a complicated issue involving many agencies, particularly in the planning stages upstream of the road project. Therefore, the Department of Roads may seek to collaborate with other planning agencies on this topic.

Greater coordination between land management, development, and transportation routes should be sought.

Developing New Project Screening and Project Scoping Tools

Mainstreaming DRR into roads and bridges projects should be tackled from the earliest stage of the project planning cycle. Risk screening tools have been developed by a number of organizations and could easily be incorporated into the standard project-scoping phase for roads in Bhutan. These tools alert the project officer to potential losses due to natural hazards and climate change. Additionally, they determine whether further exploration for the project is needed. Such screening tools include:

- Opportunities and Risks of Climate Change and Disasters (ORCHID) and Climate Risk Impacts on Sectors and Programmes - http://tinyurl.com/ccorchid
- Climate quick scans - www.nlcap.net
- Climate change portal including ADAPT tool - http://sdwebx.worldbank.org/climateportal
- Community-based Risk Screening Tool—Adaptation and Livelihoods (CRiSTAL) www.iisd.org/pdf/2011/brochure_cristal_en.pdf

The Department of Roads and all agencies involved in road and infrastructure construction can use these tools, or develop similar ones when undertaking road and infrastructure projects.

However, some government agencies are reluctant or unable to invest in adequate surveys during the project screening stage. Adjusting standard operating procedures to allow for this may require changing the budgeting process by providing budget allocations for surveys and investigations for the project screening stage. In addition to those allocations, supplementary investigations are required at the design stage. At the project screening stage (and the eventual incorporation of risk reduction measures into the project) savings due to less damage and loss offsets additional costs in the future.

Adapting Environmental Management Practices

There are numerous environmental options for reducing flood and landslide risk to roads. These focus on the development of environmental buffers and slope stability through increased vegetation and land cover on hillsides, preservation and conservation of forests, wetlands or marshes. These types of measures can be implemented through environmental management plans, and through road and transportation development plans that consider green options.

In addition, the environment impact assessment (EIA) system can be adapted so that vulnerability and risk are considered. Already in 1999, the Bhutanese Environmental Assessment Sectoral Guidelines had recognised the need for road projects of any classification to be subject to a comprehensive EIA followed by the National Economic Council's (NEC) approval.[16] However, this must be taken further. These guidelines could be revised, along with the EIA itself. For the road sector and for road and infrastructure projects the NEC can adapt the EIA so that it:

- Considers whether and in what way the proposed road or infrastructure project will increase vulnerability to hazards within the project area. For example, projects can increase flood risks by disrupting the natural hydraulic process in an area.
- Also considers the likely impacts of various natural hazards on the proposed road or infrastructure project. The EIA is currently focused on the way in which the proposed project is likely to impact the environment in order to protect it. However, the EIA does not consider the way the environment may affect the project, nor the need to protect the project against environmental hazards. In this way, the NEC could revise and enhance the EIA to specifically include

16 Royal Government of Bhutan, Department of Roads. 2000. Environmental Code of Practice. Highways and Roads. Thimphu.

risk reduction considerations. As a project-screening tool, the EIA could ensure that for project proposals to gain approval they must include DRR.

Such a modification has been successfully completed in a number of other countries in Asia, where resilient EIAs are now established. This would involve the modification of specific components, sections, checklists, questionnaires and associated information requirements of the EIA to reflect risk concerns.

In addition, the Environmental Code of Practice (ECOP) for Highways and Roads[17] is another useful means for mainstreaming DRR into road and infrastructure projects. The ECOP is used to manage road projects in an environmentally sound way and in accordance with the recommendations of the sectoral guidelines issued by NEC. The ECOP examines all stages of project management, including planning, design, tendering, contracting, execution, maintenance, and rehabilitation. For all these stages, the ECOP currently focuses on the potential negative environmental impacts of the road project. However, DRR and climate change could be easily incorporated into this code of practice.

The NEC has also developed an Environmental Code of Practice (ECOP) for Storm Water Drainage Systems, which aims to assist relevant authorities and regulates the construction of storm-water drainage systems in urban areas. Natural hazards are considered in this ECOP, with an obvious focus on floods. Similar to the suggestion above, this ECOP should be revised to more fully consider DRM.

The National Environmental Commission can revise its environmental impact assessment to include natural hazards.

17 Royal Government of Bhutan, National Environment Commission. 2004. Environmental Codes of Practice (ECOP) for Storm Water Drainage Systems. Thimphu.

Building the Capacity of Officials within Dzongkhags and Department of Roads Regional Offices

Dzongkhags are not always fully able to realise their roles and responsibilities for resilient development. This is often the case when it comes to construction. Dzongkhags monitor the construction of farm roads in Bhutan, but larger roads are under the control of the national government. Therefore, capacity of dzongkhag officials for resilient farm road construction, and resilient development in general, could be improved. Such capacity building might include:

- Delivering general training to dzongkhag officials and officials of Department of Roads Regional Offices on why resilient construction and development is important and the main components of resilient development – both in education sector and in other important sectors.
- Developing a learning workshop that builds off previous workshops led by the Department of Disaster Management. Build the capacity of officials within dzongkhags and Department of Roads Regional Offices for overall resilient development with a focus on road construction and infrastructure.
- Delivering workshops on how to use the revised EIA, revised construction standards and technical specifications for roads and bridges projects. Other project screening and monitoring tools can be developed for increased resilience of roads and bridges.

Building a National Human Resources Base

Resilient road and infrastructure projects require that certain experts are included on roads and bridges project management teams. These experts might be hydrologists, climate specialists or DRM specialists. Access to and involvement of such experts in development projects should be improved. The creation of a national advisory body, or of a pool or database of such experts would facilitate the inclusion of these experts and their perspectives in road and infrastructure project teams.

Adapting the 'Monsoon Damage Restoration Budget'

Every year the Department of Roads is accorded a 'Monsoon Damage Restoration Budget' to pay for expected damages to roads and bridges as a result of monsoon activities. There is a tendency for this budget to be spent on immediate clearing of roads, and the reconstruction and reconnection of roads. There is little attention given to 'built back better' in order to avoid damage and losses to the same stretch of road during future monsoons. There are some stretches of road where monsoon rains cause similar problems every year. The Department of Roads could pursue an incremental shift towards 'built back better' and long-term reduction of flood and landslide risk along stretches of road particularly prone to monsoon-related hazards.

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In view of the negative impact of hazards on the National development, the Department of Disaster Management of the Ministry of Home and Cultural Affairs, and the Asian Disaster Development Center launched a joint collaboration within the framework of the Priority Implementation Partnership (PIP). This aims to formulate tangible steps to integrate disaster risk reduction in national and local development planning and policy making in Bhutan.

Under the guidance of the Department of Roads under the Ministry of Works and Human Settlement, the roads sector has achieved significant progress over recent years. As a sector with one of the highest levels of public investment, the roads sector requires special attention in order to ensure that these investments are not lost due to the impact of disasters. For this to happen, there is a need for enhanced risk-sensitive measures when building new roads, and improving existing roads.

For more information please contact:

Department of Disaster Management,
Royal Government of Bhutan
www.ddm.gov.bt

Asian Disaster Preparedness Center
www.adpc.net