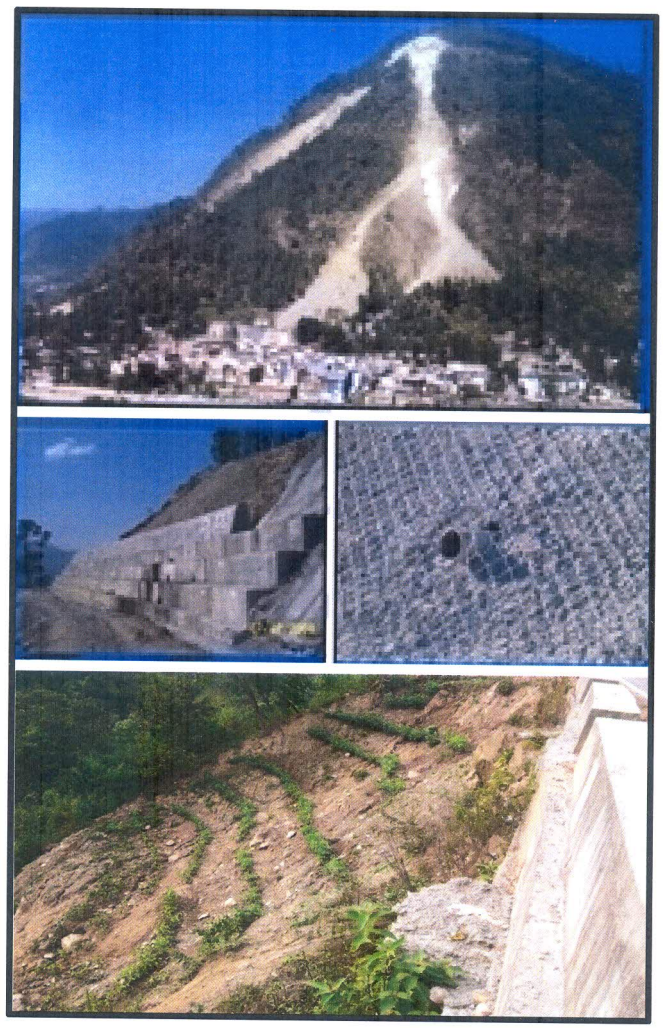
सत्यमेव जयते

Government of India
National Disaster Management Authority

Template for Preparation of Detailed Project Report (DPR) for Site Specific Landslides Risk Mitigation



New Delhi
June, 2015

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FOREWORD

We all know that landslide is one of the natural disasters which causes destruction in terms of loss of lives and property. Landslide affects around 0.49 Million km^2 covering nearly 15 % of the land area of our country. In recent years, the incidence of landslides have increased enormously resulting in heavy losses of property and human lives. The recent landslide occurred in the village of Malin (Pune) on 30th July, 2014 killed around 134 people besides loss to the property and livestock.

Landslides of different types, due to earthquake, heavy rainfall and cloud burst are frequent in geo-dynamically active domains in the Himalayan and other mountainous parts of India. In all 22 States and parts of the Union Territory of Puducherry and Andaman and Nicobar Islands are affected by this hazard. The increasing rate of population and demand for construction of houses has forced people to encroach landslide prone areas. An encroached vulnerable areas and untreated landslides resulted in slope failures causing human and economic loss. Landslides affects mostly in the hilly regions primarily during monsoons to various extents.

There is need for holistic approach to deal with recurring and non-recurring landslides necessitating time bound programme for landslide prevention and mitigation. Therefore, a need for a template for preparation of Detailed Project Report (DPR) of Landslide Schemes has been felt for long time and accordingly National Disaster Management Authority (NDMA) has now prepared the template for preparation of DPR to facilitate the States in landslide mitigation efforts.

The template has been prepared with the consistent efforts of team of experts drawn from Central Building Research Institute (CBRI), Central Road Research Institute (CRRI), Geological Survey of India (GSI) and National Disaster Management Authority (NDMA). The Template among other things also includes names of Resource Departments / Organisations and References and Codes which will be useful for preparation of DPRs. I hope this document will be useful for preparation of DPR for landslide mitigation schemes, and will help in execution of landslide mitigation projects in a better way.

9/6/2015
(R. K. Jain)

June, 2015
New Delhi

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PREFACE

Himalayan and other hilly region of India are affected by landslides and related mass movement activities. Some of the important landslides incidents happened in the past are Malin-2014 (Pune), Dasalgaon-2007 (Maharashtra), Varunavat Parvat-2003 (Uttarakhand), Amboori-2001 (Kerala), Malpa landslide-1998 (Uttarakhand), Kalimpong-1993 (West Bengal), Kohima-1993 (Nagaland) etc. Every year in India, especially in the mountain regions like Himalayas, landslides damage and destroy many houses, roads, railways, pipelines, agricultural land, crops as well as loss of life. States are required to take pro-active action for treatment of recurring and problematic landslides.

Many of the landslide prone States have expressed difficulties in preparing Detailed Project Reports (DPRs) for site specific landslide Projects. NDMA therefore, took an initiative to prepare a standardized template for preparation of DPRs. Main objective of development of the template is to provide technical assistance to the State Governments and other implementing agencies for speedy preparation of DPR's and hence execution of tasks. This standard template is prepared on the basis of comments / suggestions received from seventeen experts on landslide management from different Departments / Institutes and two States (i.e., Madhya Pradesh and Nagaland). The comments/suggestions received were examined by a Committee of Experts from Geological Survey of India, Central Road Research Institute, Central Building Research Institute, Roorkee and NDMA, which finally finalised the Template. This template is a technical document intended for providing guidence to the States and implementing agencies. Since, stabilization and fixing of landslides depends on specific characteristic and nature of the landslide, wisdom and scientific expertise of implementing agencies, counts to a greater extent for successful mitigation of landslide. We need to adopt a problem solving approach to mitigate recurring and non-recurring landslides in a sustainable manner.

Sanghi
09/06/2015

(Anil Kumar Sanghi)

June, 2015
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INTRODUCTION

India is a federal State, whereby matters of land, forest, water and leasing of land for different purposes are state subjects, and transgression of authority into their domain is not desirable, as it would create conflicting situations.

Many landslide prone States have little expertise and technology to deal with landslide and take necessary mitigation measures for management of landslides. Therefore, there is a need for taking landslide mitigation through a holistic approach with the help of well drafted document in the form of template to facilitate, encourage and provide guidance to the State Government for management of landslides.

As many Landslide prone States are facing difficulties in preparing Detailed Project Reports (DPRs) for site specific landslide schemes, therefore, NDMA decided to prepare a Template for preparation of DPR for mitigation schemes and circulate the same to the States. Towards this, a draft Template was prepared in NDMA with the help of other Stakeholders and shared with subject experts and the States. Comments / suggestions on the Template were received from 17 subject experts and 2 State Governments. The draft template incorporating the suggestions made the experts and the states were discussed with a group of experts drawn from Geological Survey of India (GSI), Central Road Research Institute (CRRI)-Delhi, Central Building Research Institute (CBRI)-Roorkee and National Disaster Management Authority (NDMA). The final template was approved by GSI. The template is constituted in two distinct portions, Summary of Detailed Project Report and Detailed Project Report (DPR).

The Template will be useful for preparation of DPRs of Landslide Schemes. While preparing DPR it may be noted that application of preventive measures for treatment will vary depending upon the requirement of specific landslide site. The technical methods / details / specifications in each DPR may differ depending upon the specific conditions of treatment of the site. The State Government should apply suitable and appropriate technology / solution available and maintain standardized quality work for treatment of slopes. In order to enable preparation of DPR a separate list of Activity Wise Resource Departments is also enclosed at annexure-'A'.

NATIONAL DISASTER MANAGEMENT AUTHORITY

Template for preparation of Detailed Project Report (DPR) for Site Specific Landslides Risk Mitigation

The template constitutes two distinct portions, Summary of Detailed Project Report (DPR) and Detailed Project Report (DPR) with Annexure(s).

Summary of Detailed Project Report

Content-I Salient features of the project.

i) Location of the project with longitude, latitude and altitude with a reference to District HQ, nearest highway / railway station / locality and name of the Landslide (if any) etc.

ii) District

iii) State

iv) Nature of scheme / project

v) Purposes

vi) Total estimated cost of the project

vii) Basis of rates (Like CPWD / PWD SOR etc)

viii) Term of reference (TOR) / Deliverables / Time line of the project.

ix) Name of Department / Expert Agency etc. who has / have prepared DPR and associated members / organization. (The qualification of a Consultant if hired for this purpose should be Post-graduate and above in the relevant subject with minimum five years of experience in dealing with landslide mitigation work).

x) Name of State Government / SDMA through which DPR is submitted.

xi) Implementing Department / Agency of the project.

xii) Monitoring Department / Agency for the project.

Content-II Brief executive summary of the project highlighting mitigation measures for landslide including measures to avoid re-occurrences and prevention of existing and potential landslides. The executive summary should highlight problem of areas, possible causes, remedial measures, monitoring and development of Early Warning System (EWS), if feasible. Details of any innovative method or material being used as part of remedial measures along with details of its successful implementation in other Projects may be brought out.

Content-III Abstract cost of the project component wise, including cost of road diversion, construction of new roads, rehabilitation of habitants etc., if any.

Detailed Project Report (DPR)

Chapter 1. Introduction of the area

a) Background & Location

Background must include details of studies/ investigations made in respect of the proposed landslide site, undertaken by GSI, DST, State Governments or any other institutions / organizations etc, or any scheme / programme already undertaken and whether the same has been completed. The proposal should also indicate whether the gaps, if any, in the studies conducted / schemes undertaken earlier were identified so that future studies may address the same.

b) Status and purpose of previous studies on mitigation of site specific landslide should in brief give location, name of landslide, district, geographic coordinate, including landslide inventory and the past incidences including photographs of past and present landslide sites, if available. Details to be annexed.

c) Importance of the Project: Parameters for site selection should include problematic landslides, vulnerability to elements-at-risk such as human habitation, trade routes, communication roads, tourist / pilgrimage routes and other state specific factors like border areas etc. with photographs (past & present) indicating loss of life and infrastructure, runout effect, highlighting importance of the project etc.

d) Slope morphology / geometry (i.e., slope dimension, slope aspect, slope angle etc.), terrain analysis with the help of remotely sensed data products (at least 1:25,000 scale) e.g., Digital Elevation Model (DEM) or Digital Terrain Model (DTM) should be included with land use & land cover (temporal) information, If available.

e) Drainage / Hydrology i.e., surface and sub-surface hydrology, water seepage, water discharge etc.

f) Climatic conditions i.e., daily maximum rainfall, rainfall pattern, humidity, temperature etc. Source of data of rainfall from IMD or any other source should be invariably mentioned.

g) Demography including population and transport affected by landslide.

h) Hazard and risk maps of the area with source, if available.

i) Mechanism for long term monitoring of the project indicating period, depending upon nature of the slope, should be given.

Chapter 2. Detailed investigation

a) Type of landslide and triggering factors of landslide occurrence (i.e., whether earthquake, heavy rain, land subsidence, geotechnical failure etc.) with its initiation, history, evolution, recurrence etc. Size and composition of slope mass involved in the movement with thickness of overburden and characteristics of discontinuities.

Regional geological setting including seismo-tectonic setting (i.e., rock types, faults / thrust / lineaments etc.) and seismic records. Source of data from IMD or any other source should be invariably mentioned.

b) Geological investigation of the sites (i.e., rock type, soil type, soil depth, discontinuities, hydrology etc.).

c) Landslide morphology (i.e., its dimension / morphology at Scarp, Crown, Head, Toe, Foot, Tip Flank etc.) with photographs and field sketches.

d) Site specific detailed mapping of landslide representing present site condition:-

i) Contour Map: Contour map of the slide area preferably on 1:500 to 1:1000 with 1-2 meters contour interval.

ii) Geological Map: Geological map showing exposed rocks, soil, debris along with important features such as cracks, bulging etc.

Detailed mapping of the landslides should be carried out on 1:500 to 1:1,000 scales with 1-2 meters contour interval through geodetic surveying using Total Station, field traverse, location survey etc. Geological features such as shear zones, joints and other discontinuities of considerable persistence can be suitably indicated on the map. In case of rock fall and debris flows, its influence areas or areas likely to be affected should be included. Cross sections showing the disposition of lithology and discontinuities may be prepared for the mapped landslide.

iii) Land use / land cover map.

e) Geophysical investigation (if applicable):

- Resistivity and Engineering Seismograph survey to unfold sub-surface structure till bed rock depth.

f) Geo-technical investigation:-

i) Soil / Debris slope :

- Soil sampling (Collecting disturbed and undisturbed soil sample).
- Location of sample.
- Depth of sample.
- Conducting of Soil Penetration Test (SPT) as per IS: 2131.
- Drilling bore hole to determine sub-surface strata up to the over burden soil depth as per IS: 1892.
- Proctor density test {Maximum Dry Density (MDD) & Optimum Moisture Content (OMC)}, if drilling is not possible.
- Grain size, density of soil, specific gravity, Unit weight (dry and wet).
- Atterberg limit (liquid and plastic limit).
- Shear Strength Parameter at field density or 95% of MDD: Cohesion (c) & friction angle (Ø).
- Permeability / field permeability (if drilling is not possible).

Note: All the above laboratory tests are to be conducted as per relevant IS: 2720.

ii) Rock slope :

- Rock sampling.
- Rock Quality Designation (RQD).
- Discontinuity parameters, such as joint spacing, joint conditions, seepage conditions.
- Rock Mass classification (RMR etc.).
- Slope Mass Rating (SMR).
- Uni-axial Compressive Strength (UCS) etc.
- Shear properties of vulnerable discontinuity/ joint plane.

g) Slope Stability Analysis: Determination of Factor of Safety for selection of appropriate mitigation measures following 2D and 3D slope stability analysis under both dry and saturated conditions.

h) Instrumentations and real time monitoring (if any using instrumentation) like Inclinometers, Piezometers, Wire Extensometers, Load Cells, Crack meter, Total Station, GPS etc. depending upon nature of slope and slope movements. Details of real time monitoring data, if available, to be annexed.

Chapter 3. Proposed mitigation measures

a) Site Preparation and selection of suitable sites for debris disposal with cost (if applicable).

b) Proper alignment of road (if applicable)

c) Remedial and Control Measures:-

i) Scheme of design details for preventive measures supported by maps and engineering sections.

ii) Drainage Measures:

- Designed surface and sub-surface drainage measures.
- Check dam, spill dam, culverts, drainage canals, diversions etc.

iii) Retaining structures:

- Type of retaining walls such as RE wall, Gabions wall, Concrete Clad wall etc., with relevant and effective design, drawings / plans, cross section, calculation and codes / standards.

d) Slope reinforcement:-

i) Soil nailing, geogrid reinforcement, rock anchoring, rock bolting, cable anchoring, piling, shotcreting etc.

ii) Use of Geo-synthetic materials like Geo-bags, Geo-tubes, Geo-nets, Geo-grids, Geosynthetic Clay Liners (GCL) etc.

e) Bio-engineering measures:

- Bio-engineering measures supported with engineering measures like weeds / grass / plants suitable for particular slope according to local condition.

f) Details of River training works.

g) Expected interaction / permission from other ministries like MoEF / Defence etc (as required).

Chapter 4. Time lines of various activities (post sanction) in form of bar chart.