V1.0 ***DRAFT FOR CONSULTATION***

Haiti 2010 Earthquake Response

Seismic, Geological and Building Hazards

Interim Risk Management Plan: March – December 2010

A joint report from the Government of the Republic of Haiti

and the United Nations

EXECUTIVE SUMMARY

Introduction

This interim risk management plan has been produced by a joint United Nations, government and international academic team for use by all stakeholders present in Haiti and those outside of Haiti and engaged in the relief effort and recovery planning processes.

In the context of the January 12th 2010 earthquake and relief programme, its purpose is to launch a programme of action to directly protect the population of Haiti and international visitors, the economy and the relief effort from ongoing major and life threatening seismic, geological and building hazards. It is also designed to inform decision makers engaged in the recovery and reconstruction process.

There are essentially two types of hazard to be addressed:

- Regional scale hazards, (Enriquillo Fault aftershocks and triggered earthquake, earthquake on the Septentrional Fault and tsunamis) where the exposed/vulnerable population can be in the order of millions.

- Point source hazards (landslides, building collapse and debris falls), where the exposed vulnerable population for each potential incident is typically in the order of individuals to hundreds but for all of the buildings across the impact area this still adds up to over 2 million vulnerable people.

A plan of action is proposed with the following objectives:

- Reduce the vulnerability of nearly 3.0 million people to identified life threatening hazards;
- Avoid major disruption to the economy;
- Avoid major disruption to and where possible assist the relief programme;
- Inform and thereby influence the recovery planning process.

The planned main activities are:

- Communication and emergency preparedness;
- Landslide assessment and emergency works;
- Building assessments;
- Hazard marking and barricading;
- Emergency demolition;
- Emergency repairs;
- Seismic programme;
- Interim seismic risk zoning;
- Interim building code and permitting scheme;
- Participation in the Post Disaster Needs Assessment and recovery planning process
- Multi-hazard assessment and plan revision

The cost of the plan is approximately US$ 19 million and can be implemented as part of the relief and recovery programme within 2010 under the oversight of the Ministry of Public Works. The most novel part of the plan is a proposed new programme on seismic risk, whilst the majority of the cost is linked to fairly straightforward but urgent engineering works. At present the plan is only 3% funded and so the next step is to secure funding.

Several documents are annexed to inform all parties of the UN position on these hazards and to continue the process of earthquake risk communication and education.

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1 Introduction

1.1 Purpose of this report

This interim risk management plan has been produced by a joint United Nations, government and international academic team for use by all stakeholders present in Haiti and those outside of Haiti and engaged in the relief effort and recovery planning processes.

In the context of the January 12th 2010 earthquake, its purpose is to launch a programme of action to directly protect the population of Haiti and international visitors, the economy and the relief effort from ongoing major and life threatening seismic, geological and building hazards. It is also designed to inform decision makers engaged in the recovery and reconstruction process.

It is designed for rapid implementation and distribution and so is based on relatively limited information on some of the geological hazards. Nonetheless it is also based on a foundation of substantive recent fieldwork, national ownership and wide ranging international experience of post-earthquake hazards and appropriate risk management plans.

The United Nations was significantly affected by the earthquake and now has thousands of international and national staff engaged in the relief effort. Hence this report is also addressed to this workforce and can be considered also highly relevant for the 1000+ other international organisations working in Haiti.

Note that the science in this report is drawn from a number of technical sources. All key sources are referenced however it must be noted that many of the references are short reports from the relief effort, not technical documents.

1.2 Time validity of this report

The risk factors present after an earthquake change substantially over time. In addition the risk management plan proposed includes a range of measures designed to gain a better understand some hazards and also to directly intervene to remove others. Finally the first wet season in Haiti commences in April and the hurricane risk season commences in June.

Hence this report is anticipated to be made obsolete in part by events and interventions and should be considered as valid only for the period **March to December 2010.** In the interim the teams within Haiti will develop solutions and provide input for a more comprehensive and fully informed risk management plan proposed for release later this year.

1.3 Science and information limits on hazard and risk assessments

There are significant scientific and information limits on the assessment and risk management for earthquakes and other geological/natural hazards such as landslides and tsunamis. Analyses and forecasts made with the best available science and data may still have high levels of uncertainty. In this report, such forecasts are made to assist the risk management process, however readers should

also bear in mind the linked assessment of certainty – where possible expressed as percentage figures, but otherwise expressed as high, medium or low.

1.4 Scope limits - exclusion of hydro-metrological hazards

There are two main generic groups of natural hazards relevant to Haiti:

1. Hydro-metrological hazards – floods, strong winds, storm surges.

2. Geological hazards – Aftershocks, earthquakes, landslides, tsunamis

   In addition as a result of the January 12th earthquake, people in the impacted are faced with a third type of hazard:

3. Building hazards – collapses and debris falls

This report covers only the management of hazard groups 2 and 3 as these are relatively new to the current population of Haiti, whilst the hazards from group 1 are severe but also better understood and well established.

2 Earth Science Background

1.1 Tectonics of Haiti

Haiti is part of the Caribbean Plate, which in simplified terms is a section of the earth's crust which is bounded by major faults and changes in geological structure. Movement of the different plates along the fault boundaries causes earthquakes. Within plates, faults are also present and divide the plate into micro-plates.

On a geological timescale the Caribbean Plate is moving eastwards at approximately 20mm per year. This movement does not occur smoothly but as a series of short jumps and shifts, each such event signalled by an earthquake. The timing between shifts is not accurately predictable, however specialists can assess the scale of movement and energy stored in the system and thereby indicate what scale of earthquake is possible and on what major fault. Accurate prediction of earthquake locations is also not possible but again analysis can indicate likely risk areas, given sufficient data.

Haiti is on a micro- plate and has two major faults of concern for earthquake risk: the Enriquillo fault which crosses the southern peninsula from east to west and the Septentrional Fault which runs east to west along the northern coast of Haiti (See Figure 1). Both faults are part of larger systems and continue east and west of Haiti for over 1000km.

Both of these faults have generated earthquakes over the centuries, destroying Port-au Prince in 1751 and Cap Haitian in 1842. (See Figure 2)

2.1 Geology and topography of Haiti

On a smaller scale geology and topography have strong links with earthquake and geological hazards.

In very simplistic terms, Haiti has three layers of geology. The bottom layer is very old Jurassic/Cretaceous) metamorphic rocks, that form the backbone and basement of the island. These rocks are overlain in many areas by thick but variable layers more recent sediments such as limestone. Both of these formations are cut by faults. Finally erosion of both of these types of formation has resulted in the deposition of beds of loose sediments in the rivers, floodplains and coasts. These geologic variations are actually critical to earthquake vulnerability: in general it is better to have buildings on solid bedrock rather than loose sediment.

Haiti is a highly mountainous country, with steep mountains and narrow valleys and relatively few major regions of sediment and floodplains. This steep topography is directly linked to earthquake vulnerability and landslides.