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***INTER OFFICE MEMORANDUM***

To: PS

Thru: DH

cc: M-MLHUD

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From: Ag CHDEM

Date: 1.03.2017

**MLHUD RESPONSE TO THE EARTHQUAKE THAT OCCURRED ON MONDAY 27TH FEBRUARY 2017.**

Reference is made to your guidance to the Housing Directorate to draft a response to the recent earthquake that rocked Hoima on the 26th February 2017; and earlier ones which occurred in Rakai and Isingiro Districts in September 2016.

The statement captures previous actions taken by the Ministry; and highlights on going action in development of the Building standards for earthquake prone areas.

Please find attached the draft statement for your clearance before it is published.

Irene Gwokyalya

**EARTHQUAKE DISASTER PREPAREDNESS: KEY EFFORTS IN THE HOUSING SUB-SECTOR.**

During the past few years Uganda has experienced an increased occurrence of earthquake disaster; the most recent being the 4.7 magnitude earthquake that rocked Hoima on Saturday 26th February 2017.

The Ministry of Lands, Housing and Urban Development through its mandate of ensuring safe and sustainable housing for all; found it necessary to educate the general public, and also highlight government efforts towards earthquake resistant building construction as part of its efforts to improve preparedness and build resilience to earthquake disaster in the building sector.

**BACKGROUND**

Uganda lies between the two arms of the East African Rift System (EARS), making it prone to Earthquake occurrence. (Geological Surveys and Mines Department). Its west border with D.R. Congo lies almost entirely in the western branch of the EARS, while the eastern border is about a few hundreds of kilometers from the Eastern Branch of the EARS; and there is more seismic activity in the western than in the eastern branch. Other tectonic features that have a great influence on earthquake occurrences in Uganda include:

(a)The Ruwenzori Mountains: The Ruwenzori massif and tectonic movements cause stress accumulation that is released along the border and boundary faults to the mountains. The faults include: -Nyamwamba, Kicwamba,Bwamba, Kitimbi-Semuliki, Rwimi-wasa and Bunyoro–Toro.

(b)The Katonga Fault: This fault starts from foothills of the Ruwenzori Mountains, traverses Lake Victoria and connects to Kavirondo Gulf in western Kenya and Speke Gulf south of Lake Victoria in Tanzania.

(c)Aswar Shear Zone: the shear zone is observed in Uganda from Nimule at Uganda –Sudan Border and joins Mt Elgon on the eastern border with Kenya.

Over the past century, the country has experienced a series of earthquakes of varying magnitudes; among them being the 1994 Kisomoro, Kabarole Earthquake which left 8 deaths, 2693 buildings destroyed with damages estimated at over 60 million dollars; and the 1996 earthquake whose damages were estimated at over 1 million pounds. Among the more recent ones is the September 2016, 5.7 Magnitude Nsunga earthquake event which caused devastating effects in Rakai and Isingiro Districts causing structural damage to over 571 structures and displacing over 200 families. The total estimated cost for the loss incurred in Rakai District alone was UGX 8.278,600,000.

**GOVERNMENT INTERVENTIONS**

After the 1994 Earthquake occurred in Kisomoro; Kabarole District, Government under the Ministry of Lands, Housing and Urban Development commissioned a National Task Force to develop guidelines for construction of earthquake resistant buildings in earthquake prone areas, and build capacity in earthquake disaster management in the building industry.

Among the Major accomplishments included:

1. Guidelines for construction of earthquake resistant buildings were prepared, produced and disseminated to relevant stakeholders;
2. The Uganda Seismic code of structural design that incorporates earthquake considerations in the building code was also developed in collaboration with Uganda National Bureau of Standards;
3. Several Low Cost Prototype plans were developed in accordance with the basic earthquake resistant design principles by MLHUD. These plans are deposited with the District Engineer’s office in earthquake prone areas; who avails them to the public at a nominal fee.

A project, *Support to Earthquake Disaster Victims*, was implemented (1994- 2010) as a strategic framework to sensitize and build community resilience in Earthquake Disaster Management and Mitigation in the building subsector; and to demonstrate earthquake resistant construction techniques in earthquake prone area of the Rwenzori region. The project registered the following achievements:

* Technical and baselines studies were carried out in Kabarole, Bundibugyo, Kasese, Kyenjojo and Kamwenge covering social, economic, building materials, construction technologies and seismological aspects.
* 2 six-week Training of Trainers intensive courses targeting the technical personnel in the Local Government, Private Contracting Firms and Builders were conducted in the districts of Kabarole and Bundibugyo attracting over 200 trainees from the Rwenzori region.
* 2 demonstration houses were constructed in Fort Portal Municipality, Kabarole District and Nyahuka Town Council in Bundibugyo District to demonstrate the application of earthquake resistant construction techniques.
* Refresher and sensitization workshops were carried out in and around the country targeting the Academia, media and contractors as key stakeholders in construction industry to enhance their skills in Earthquake Disaster Management and Mitigation.
* A Publicity programme was conducted on Voice of Toro FM Radio from 2004 -2010 to educate the public about earthquake disaster preparedness.
* An Association of Western Region Earthquake Resistant Contractors was formed to carry out public sensitization and facilitate formation of Disaster Volunteers Teams in every Parish. These teams were responsible for information dissemination on earthquake disaster preparedness besides providing the necessary advice on construction of safe buildings. Furthermore, they coordinated and provided immediate response in case of earthquake disaster to assist the affected victims.

These activities were expected to be replicated in the five project districts located in earthquake prone regions namely Kabarole, Bundibugyo, Kasese, Kyenjojo and Kamwenge.

**GUIDELINES FOR EARTHQUAKE RESISTANT BUILDING CONSTRUCTION.**

Earthquake resistant structures are structures designed to withstand earthquakes. While no structure can be entirely immune to damage from earthquakes, the goal of earthquake resistant construction is to erect structures that fare better during seismic activity than their conventional counterparts. According to building codes, earthquake resistant structures are intended to withstand the largest earthquake of a certain probability that is likely to occur at that location**.** The Public Health Act and the Building Control Regulations also increasingly bear upon the standards and quality of the building as the provisions of this law is implemented.

Ground vibrations during earthquakes cause forces and deformations in structures. Structures need to be designed to withstand such forces and deformations. An earthquake-resistant building has four underlining principles, namely:

(a) *Good Structural Configuration*: Its size, shape and structural system carrying loads are such that they ensure a direct and smooth flow of inertia forces to the ground.

(b) *Lateral Strength*: The maximum lateral (horizontal) force that it can resist is such that the damage induced in it does not result in collapse.

(c) *Adequate Stiffness*: Its lateral load resisting system is such that the earthquake-induced deformations in it do not damage its contents under low-to moderate shaking.

(d) *Good Ductility*: Its capacity to undergo large deformations under severe earthquake shaking even after yielding, is improved by favorable design and detailing strategies.

Seismic codes cover all these aspects.

In order to construct earthquake resistant structures; it is imperative that consideration is given to all aspects of building development including:

1. **Selection and preparation of site; including the placement of the building on the site;**
   * The construction site should be as far as possible from the earthquake fault line.
   * Avoid sites located in a water logged area
   * Flat terrain is the best.
   * Minimum distance between one storey structures should be equal to their height.
2. **Design of the buildings.**
   * The more compact the plan the better its stability.
   * The building and its super structure should be simple, symmetric and regular in plan and elevation to prevent significant torsional forces.
   * Never interconnect the walls of two buildings.
   * The circle is better than a square, which is better than a rectangular shape.
   * L shaped plans are less stable.
   * Openings should be as small as possible but adequate, located not less than 100cm from corners or other openings.
3. **Selection of building materials.**
   * Generally safest building materials in earthquake areas are the lightest and most flexible. Among the good materials are concrete, bamboo, Burnt clay bricks, timber and reinforced earth.
4. **Use of special techniques for reinforcing of building foundations, floors, walls and roofs during construction**
   * The foundation, walls and roof should be well inter connected and so rigid that no deformation occurs during the earthquake.
   * Walls, floors should be stabilised with reinforced concrete elements.
   * Fix the roof to the columns that are separated from the wall, so that both structural systems can move independently since they have different frequencies.
   * There should vertical reinforcement on the openings from the foundation to the roof.
5. Maintenance of buildings
6. Addressing non-structural components. The safety of components eg Furniture, electrical appliances and Partitions should also be considered.

Detailed information about these and more on construction of earthquake resistant buildings in Uganda, is available in the ***Handbook for Earthquake Resistant Construction and Seismic Safety*;** and the ***Uganda Seismic code for structural design*** available on the Ministry website.

The public is hereby encouraged to be vigilant in ensuring their safety and safety of property by complying with earthquake compliant construction methodologies, in addition to adopting seismic safety measures. Developers and contractors in these regions should endeavor to comply with the recommended guidelines to safeguard against future seismic hazards.

These guidelines are currently being reviewed to identify gaps and develop mandatory Standard Code of Practice for Earthquake resistant building design and construction per earthquake zone to reflect the latest trends and knowledge; to develop Earthquake vulnerability assessment methods for existing buildings in earthquake prone areas, to develop guidelines for retrofitting of vulnerable existing buildings and to Develop Seismic damage evaluation methods for damaged buildings after an earthquake. To build resilience to all such natural disasters; the Directorate of Housing is also in the process of developing Building standards and guidelines for areas prone to other natural disasters affecting Uganda including, landslides, floods, wild fires and lightning.