Guideline for

Rapid Visual Screening of Buildings

For Potential Seismic Hazards

Prepared By:

Expert Group from Myanmar Engineering Society, Myanmar Earthquake Committee, and Myanmar Geoscience Society in collaboration with UN-Habitat and Relief and Resettlement Department

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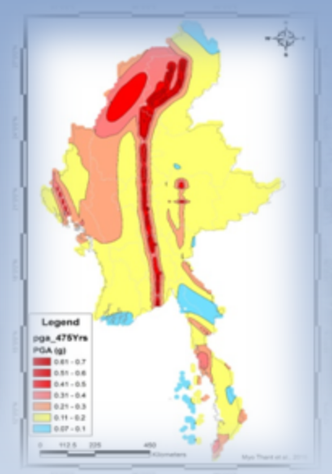

NORWEGIAN MINISTRY OF FOREIGN AFFAIRS

Humanitarian Aid and Civil Protection

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I. INTROCDUCTION

1.1 Background

Myanmar lies in one of the two main earthquake belts of the world with a complex seismo-tectonic process. At least nineteen earthquakes of Magnitude, Ms > 7 have occurred in the region and historical records demonstrate that great and destructive earthquakes have occurred throughout much of the region (Wang Yu, 2014). The Sagaing fault is the most prominent active fault in Myanmar which extends from north of Lake Indawgyi, southward along the Ayeyarwaddy River, north of Mandalay and along the eastern margin of the BagoYoma to the Andaman Sea in addition to the Red River fault, Papun – Wang Chao fault, Three Pagodas fault and other minor faults which crisscross the country.

While Myanmar has experienced destructive earthquake in the past, recent earthquakes in Tarlay Earthquake (2011) and Thabeikkyin Earthquake (2012) highlighted the vulnerability of building stocks. However, very limited work has been undertaken in assessing structural vulnerability of the building stock and the risk to the built environment both in urban and rural areas. Furthermore, the risk knowledge on the earthquake among stakeholders across country is low. Given the high degree of exposure and vulnerability to earthquake and the need to address risk through structural and non-structural mitigation measures, there is a need to develop / adapt and standardize tools which can be used by interested stakeholders in Myanmar.

Tarlay Earthquake

Tarlay Earthquake

Thabeikkyin Earthquake

Figure (1) Building Damages in Tarlay Eathquake and Thabeikkyin Earthquake

Myanmar Engineering Society, Myanmar Geo-Sciences Society, Myanmar Earthquake Committee and UN-Habitat in collaboration with Relief and Resettlement Department are currently working to develop /adapting tools (HAZUS) for assessing earthquake risk at City level and undertook Knowledge Attitude and Practice (KAP) on earthquake risk in 3 cities with the funding support from ECHO through MCCR[1] and Ministry of Foreign Affairs (Norway). As a first step within the framework of broader risk reduction initiatives as part of Myanmar Comprehensive Disaster Risk Reduction Programme (MCDRRP) and Earthquake Risk Reduction Programme of UN-Habitat, an Expert Group meeting is convened to discuss the development of tools to assess structural vulnerability of building stock and the Development of Risk Communication strategy and tools for earthquake. Rapid Visual Screening of Building is part of the development of tools to assess structural vulnerability of building stock.

1.2 Rapid Visual Screening of Buildings for Potential Seismic Hazards (RVS Procedure)

Vulnerability of the buildings is a critical determinant for earthquake risk. Experts say "Earthquakes don't kill people, but unsafe buildings do". Structural vulnerability is a measure of the damage; a building is likely to experience when subjected to ground shaking of a specific intensity. In general dynamic response of a structure during ground shaking is a very complex behavior. It depends on a number of inter-related parameters that are often very difficult to predict precisely. These include ground shaking that the building will experience; the extent to which the structure will be excited by and response to the ground shaking; the strength of the materials in the structure; the quality of construction and condition of individual structural elements; the interaction of the structural and non-structural elements of the building; furnishings and contents present in the building at the time. Most of these factors can be estimated, but never precisely known.

[1]Myanmar Consortium for Community Resilience (MCCR) is part of the DIPECHO IX Action Plan for South East Asia in Myanmar. MCCR is comprised of five INGOs and one UN Agency namely Action Aid, Plan International, Oxfam, Help Age International, Action Contre la Faim and UN-Habitat

Seismic evaluation of existing Buildings demands a three-tiered process Screening Phase (Tier 1), Evaluation Phase (Tier 2), and Detailed Evaluation Phase (Tier 3) to assess either the Life Safety or Immediate Occupancy Performance Level of the building[2]. Screening Phase (Tier 1) uses a Rapid Visual Screening (RVS) methodology, while the Tier 2 and Tier 3 needs more detailed and sophisticated analysis. Since Myanmar is adopting Myanmar National Building Code that is following International Building Code for design as a first step, FEMA 154 is considered relevant for adaption.

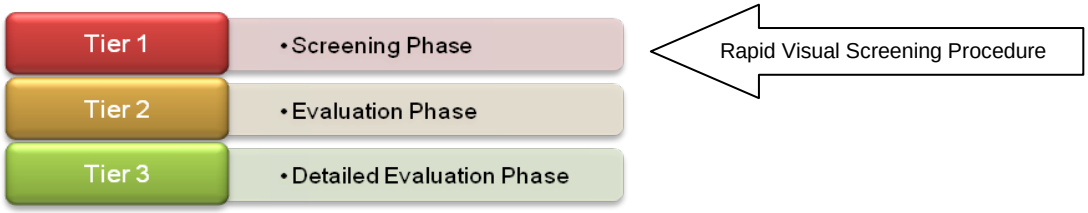

Figure (2) Three-tiered Process of Seismic Evaluation for Existing Buildings

Rapid Visual Screening (RVS) is a quick way of assessing the building vulnerability based on visual inspection[3]. Once identified as potentially hazardous, such buildings should be further evaluated by a design professional experienced in seismic design to determine if, in fact, they are seismically hazardous. The RVS procedure uses a methodology based on a sidewalk survey of a building and a data collection form, which the person conducting the survey completes, based on visual observation of the building from the exterior, and if possible, the interior. If large number of buildings needed to be evaluated, carrying out RVS of buildings minimizes the number of building that requires detailed assessment. Therefore, Rapid Visual Screening will be useful for all buildings except lifeline structures where detailed vulnerability assessment is always necessary. RVS procedure can be implemented relatively quickly and inexpensively to develop a list of potentially hazardous buildings without the high cost of a detailed seismic analysis of individual buildings. FEMA has updated the Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook (Third Edition) FEMA P-154 / January 2015.

This guideline will briefly explain the detailed procedures for RVS building survey. Bridges, large towers, and other non-building structure types are not covered by this procedure. According to recent seismic vulnerability assessment works in Bago, Taungoo, Sagaing and Pyay cities, the major building stocks in Myanmar are - Bamboo, Timber, Brick, Brick Noggin, Concrete and Steel Building. RVS Forms in this guideline cover total 18 buildings type as shown in Table (7).

1.3 Uses of Rapid Visual Screening Results

The main purpose of RVS results is to know the current situation of existing buildings in relation to seismic hazard and other related hazards so that the building owner can know his/ her building requires strengthening or retrofitting measures. The buildings can be identified according to RVS scores. The scoring system provided in each building with a numerical score can be used as a prioritization tool in vulnerability assessment. (FEMA 155, Third Edition)

1.4 Expert Group

Professional engineers and geological experts from Myanmar Engineering Society, Myanmar Earthquake Committee and Myanmar Geo-science Society are invited and prepare the Rapid Visual Screening Data Collection Form in collaboration with UN-Habitat professional engineers. The followings are the lists of the experts from MES, MGS and MEC.

1. U Nyun Maung San (Chairman, Special Project Committee, MES)
2. U Saw Htwe Zaw (Secretary, Special Project Committee, MES)
3. U Ko Ko Gyi (CEC Member, MES)
4. U Nyan Myint Kyaw (Member, Special Project Committee, MES)
5. U Myint Oo (Member, Special Project Committee, MES)
6. Daw Kyi Kyi Khaing (Member, Special Project Committee, MES)
7. U Soe Thura Tun (Secretary, MEC)
8. Dr. Myo Thant (Secretary, MGS)

[2]Seismic Evaluation of Existing Buildings (ASCE/SEI 31-03)

[3]The Applied Technology Council (ATC), with funding from the Federal Emergency Management Agency (FEMA) in the US, developed the FEMA 154 Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook in 1998 and updated in 2002 and more recently in 2015.

II. INSTRUCTIONS OF FILLING DATA COLLECTION FORM LEVEL I

Level 1 Data Collection Form can be seen in Appendix A. This form can be performed by a wide range of individuals, including civil engineers, structural engineers, architects, design professionals, building officials, construction contractors, facility mangers, firefighters, or other individuals with a general background in building design or construction. The screeners fill out the forms and determine the scores to get seismic performance of the building. The collected data/ information have to be put in respective table format. There are five different types of Level 1 Data Collection Form, representing different seismicity regions; *Very High, High, Moderately High, Moderate and Low*. The basis scores and score modifiers vary with seismicity regions. Refer to Table (1) below to choose respective Seismicity Region of the Surveyed Area. For S_s Value, refer to Figure (4) and Figure (5) for S_1 Value. In Table (2), S_s and S_1 for selected cities and towns in Myanmar are described with numeric value. After the respected Seismicity Region has chosen, the screener can start the process by following the instructions described in later sections.

Table (1) Seismicity Region Determination from MCER Spectral Acceleration Response

Seismicity Region	Spectral Acceleration Response, S_s (Short-period or 0.2 seconds)	Spectral Acceleration Response, S_1 (Long-period or 1.0 second)
Low	$S_s < 0.25$ g	$S_1 < 0.10$ g
Moderate	$0.25 \text{ g} \le S_s < 0.50$ g	$0.10 \text{ g} \le S_1 < 0.20$ g
Moderately High	$0.50 \text{ g} \le S_s < 1.00$ g	$0.20 \text{ g} \le S_1 < 0.40$ g
High	$1.00 \text{ g} \le S_s < 1.50$ g	$0.40 \text{ g} \le S_1 < 0.60$ g
Very High	$S_s \ge 1.50$ g	$S_1 \ge 0.60$ g
Note: g = acceleration of gravity in horizontal direction		

In level 1 screening form, it includes six parts; *(1) Building Identification, (2) Building Information, (3) Comments, (4) Photographs and Sketch parts, (5) Basic Score, Modifiers and Final Score parts, and (6) Extent of Review, Other Hazards and Action Required parts*. The following steps will help you completing Level 1 Data Collection Form.

2.1 Building Identification

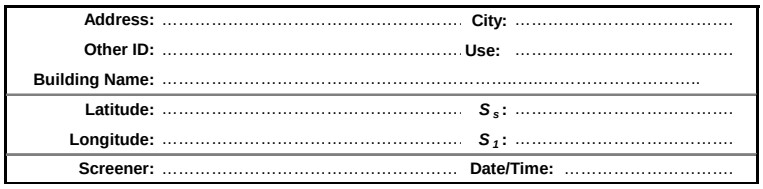

Figure (3) "Building Identification" Portion of Level 1 Data Collection Form

Level 1 Data Collection Form starts with Building Identification part. Building Identification is primarily important for this survey as the later information will be utilized in hazard assessment and mitigation measures for this building, broadly for this region where the building is located.

Address: Specify where the building is located including the street name and block name. It is suggested to include the full range of address numbers for the building, for example "No 1~5".

City: Fill in the city name where the building is situated.

Other ID: This information can be filled in by the house owner. The ID can be Block ID or House ID.

Use: Fill in the occupancy types of the building.

Building Name: Mention the name of the building so that it can be easily known. In some cases, the building has its own name describing the occupancy type.

Latitude: Describe the location of the building in latitude.

Longitude: Mention the longitude of the building.

S_s: Mention the site-specific ground motion S_s value. Refer to Table (2) for detailed values.

S_1: Specify the S_1 value as per table (5) where the building is located. Refer to Figure (2) and (3) for detailed values of S_s and S_1.

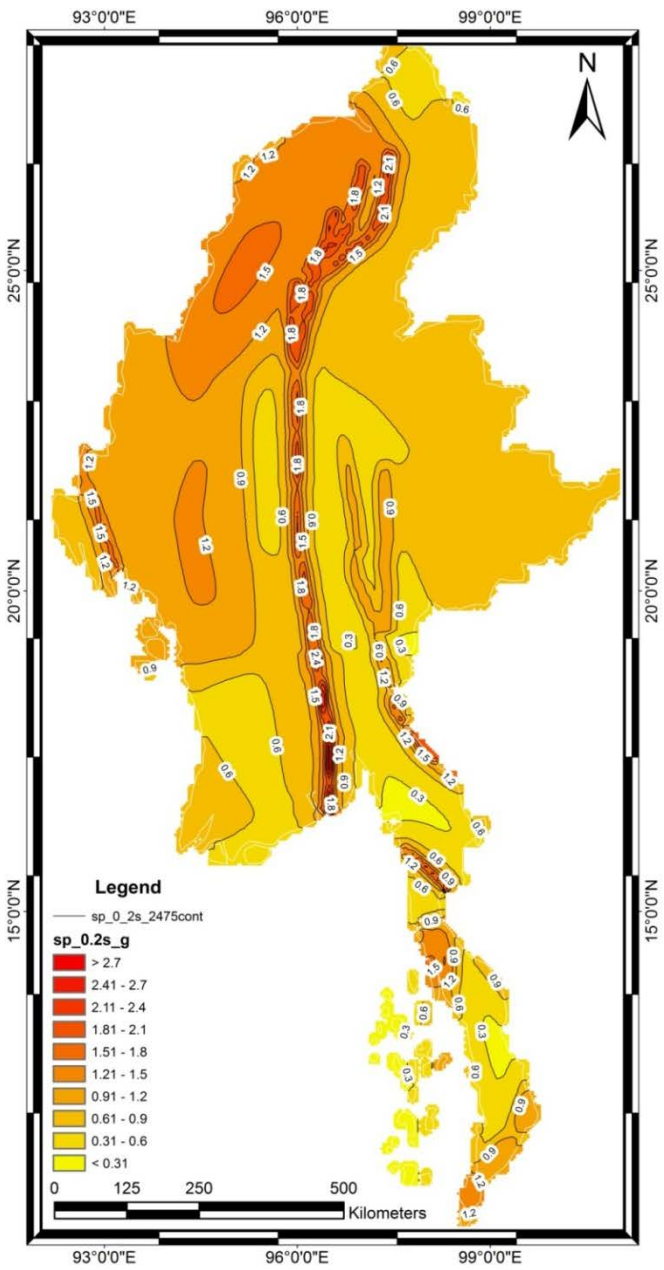

Figure (4) Maximum Considered Earthquake Ground Motion for 0.2 Sec Spectral Response Acceleration at 2% Probability in 50 Years with 5% Critical Damping, Site Class B

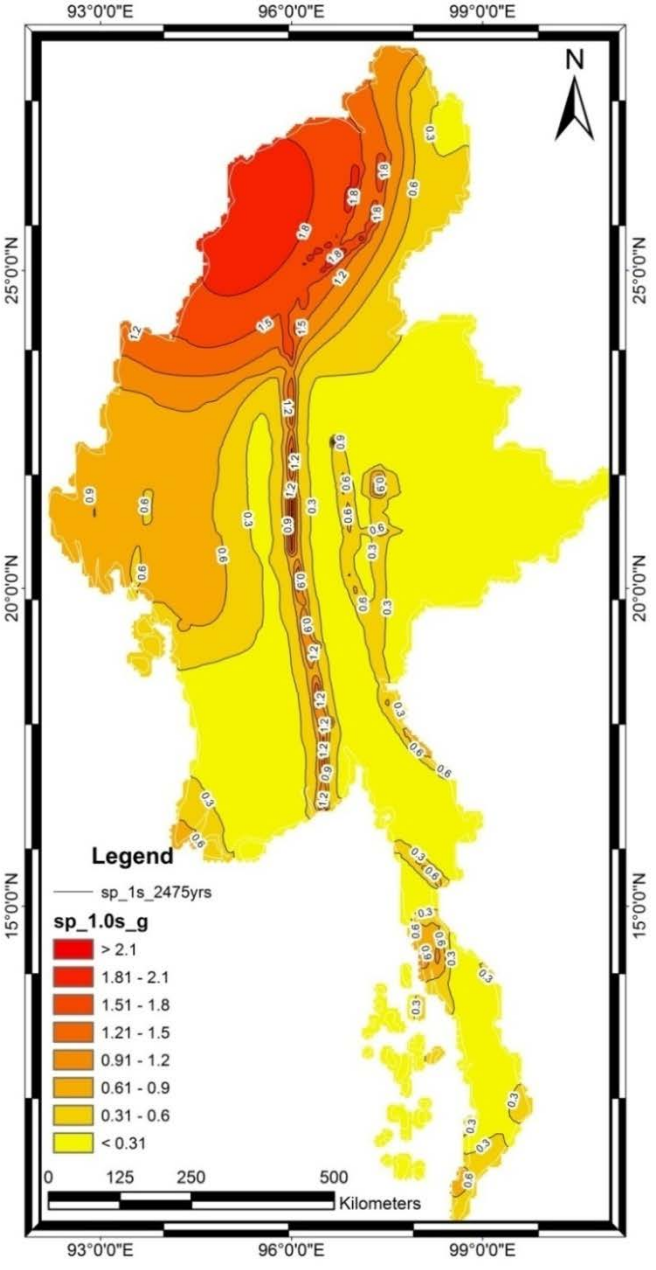

Figure (5) Maximum Considered Earthquake Ground Motion for 1 Sec Spectral Response Acceleration at 2% Probability in 50 Years with 5% Critical Damping, Site Class B

Screener: Name of the person who did survey and fill in the form. This information is also important that the person can have more information of the surveyed building. We can recall memory for some uncertain things in the form later.

Date/ Time: Mention the date and time at which the building is inspected and surveyed.

Table (2) S_s and S_1 Value for City/ Town

Sr. No.	City/ Town	S_s	S_1	Remarks
1	Bagan	1.55	0.62	
2	Bago (Pegu)	1.07	0.43	
3	Bhamo	0.66	0.26	
4	Coco Islands (Great Coco Island)	1.18	0.47	
5	Dawei (Tavoy)	0.25	0.10	
6	Hakha	1.87	0.75	
7	Hpa-An (Pa-An)	0.74	0.30	
8	Kengtung	1.32	0.52	
9	Kyaukpyu (Kyaukphyu)	0.84	0.33	
10	Labutta	0.64	0.26	
11	Lashio	0.48	0.19	
12	Loikaw	1.41	0.56	
13	Magwe	1.45	0.58	
14	Mandalay	2.01	0.80	
15	Mawlamyine (Mawlamyaing)	0.74	0.30	
16	Meiktila	2.07	0.83	
17	Monywa	1.72	0.69	
18	Myitkyina	1.70	0.68	
19	Naypyitaw	1.32	0.53	
20	Pakokku	1.54	0.61	
21	Pathein (Bassein)	0.87	0.35	
22	Putao	2.05	0.82	
23	Pyay (prome)	0.80	0.32	
24	Pyinmana	1.32	0.53	
25	Sagaing	2.12	0.85	
26	Shwebo	2.25	0.90	
27	Sittwe (Akyab)	1.26	0.50	
28	Taungoo	1.20	0.48	
29	Taunggyi	1.69	0.68	
30	Thandwe (Sandoway)	0.88	0.35	
31	Yangon (Rangoon)	0.77	0.31	

2.2 Building Information