MINUTES OF THE WEEKLY REVIEW MEETING ON PROGRESS OF NATIONAL SEISMIC RISK MITIGATION PROGRAMME (NSRMP) HELD ON 31.08.2020 AT 3 PM IN THE CHAMBER OF THE SPL. SECRETARY & PROJECT DIRECTOR, NDMA.

The Weekly Review meeting on progress of National Seismic Risk Mitigation Programme (NSRMP) was held on 31st August, 2020 at 3 PM under the Chairmanship of Dr. Pradeep Kumar, Spl. Secretary & Project Director, NDMA. The meeting was attended by Officials from NDMA, and the Consultant. List of participants is attached at **Annexure-I**.

2. The ATRs on previous weekly review meetings dated 10.08.2020 and 24.08.2020 were deliberated. Other relevant matters such as PMU & PMC structures, and mobilization of Structural Engineering Specialists and State Coordinators to function from their respective States/UT were also discussed.

3. The compliance status on the decisions taken in the previous weekly review meetings dated 10.08.2020 and 24.08.2020, and further decisions taken involving views/suggestions of participants are as follows:

A. Compliance status on the decisions taken in the previous weekly review meetings

Sl. No.	Decisions	Current Status	Compliance Status
Weekly Review Meeting dated 10.08.2020			
I.	**General**		
i.	Fortnightly Progress Report should be in the prescribed format. It should also include: (a) Deployment of State Coordinators and Structural Engineering Specialists in their respective State/UT. (b) Sub-component wise Experts/Domain Specialists detailing time devoted, type of activities specifying works/discussion held and location of works done.	• Fortnight report for the period 1-15 August 2020 is not furnished in prescribed format with requisite details. • Fortnight report as per the prescribed format with all requisite details for the period 16-31 August 2020 to be submitted by 3rd September 2020.	Not Complied
ii.	All Reports/Documents	Agreed by Consultant. To be complied	-

Sl. No.	Decisions	Current Status	Compliance Status
	submitted by the Consultant should be invariably ink signed.	further.	
iii.	Whenever Consultant makes request for facilitation from PMU for seeking data/information from outside Organizations/ Agencies/Institutions, the same must be accompanied by specific format/questionnaire in which data/information is required.	• Consultant to share list of questionnaires in specific format pertaining to Component A2 for data/information required from Fire & Emergency Services, Gujarat; and Fire, Civil Defence & Home Guards, MHA.	Not Complied
iv.	State Coordinators must set-up meeting with respective Nodal Officer in the State/UT on fortnightly basis with sub-component wise agenda. PMU to be intimated with specific agenda of the fortnightly meeting.	• State Coordinators have not yet set-up any meeting with respective Nodal Officer in the State/UT. • Consultant to ensure that the fortnightly meeting is set up with respective Nodal Officer in the State/UT by State Coordinators with sub-component wise agenda. PMU to be intimated with specific agenda of every fortnightly meeting.	Not Complied
v.	Consultant's Team Leader to visit States/UTs in rotation. Team Leader informed that he will be visiting for meeting in Leh, UT of Ladakh, followed by UT of J&K.	• The Team Leader has not yet visited States/UTs for meeting. • Consultant's correspondence to States/UTs in this regard should also be endorsed to PMU, NDMA.	Not Complied
vi.	Change/Swapping of Key personnel: Request in this regard must contain details such as reason for change, confirmation that the person will undertake field visits without any apprehension, etc. In the absence of these details, the request will not be entertained.	• The Consultant also needs to obtain NOC from respective State Nodal Officer for replacement of State Coordinators (Key Expert).	Not Complied
vii	State Coordinators and Structural Engineering Specialists must be mobilized to their respective States/UTs. Consultant to confirm that State Coordinators and Structural Engineering Specialists are deployed in their respective States/UTs at the earliest.	• State Coordinators and Structural Engineering Specialists have not been mobilized yet to their respective States/UTs. • Consultant to confirm in this regard at the earliest.	Not Complied

Sl. No.	Decisions	Current Status	Compliance Status
II.	**Component A1**		
i.	Consultant to confirm algorithm/ methodology/ multi-parameter based approach for design of Earthquake Early Warning Dissemination System (EEWDS).	• As per Consultant's response/confirmation on design of EEWDS: (i) The proposed EEW system will be able to estimate size and location of earthquake within the identified region (*instrumented area and beyond to some extent*) of the array. But the earthquakes having epicentre outside the identified region (instrumented area) can't be located accurately. (ii) The proposed algorithm will be able to locate the depth in real time. (iii) The proposed EEW system will not be able to estimate intensity of ground motion in real time. However, as more earthquakes will be recorded by dense instrumentation to be installed under the project, the proposed instrumentation will be ready for PLUM approach after few years. Accordingly, the EEWDS can be upgraded. (iv) Real time estimation of intensity will be done using wavefield approach called PLUM. (v) Multi-parametric approach described by Bhardwaj et al. (2016) is a research work and it is not in practice anywhere in the world. Hence a multi-parameter based EEW algorithm can't be developed for implementation under the project.	-
ii.	DPRs will include details of both On-site & Regional EEWDS.	Agreed by Consultant.	-
iii.	Consultant to share duly ink-signed document related to On-site EEWDS locations for UT of Ladakh, UT of J&K, Assam, Uttarakhand and Himachal Pradesh at the earliest and further for other States/UTs.	• Consultant has not submitted documents related to On-site EEWDS locations. • Consultant to expedite submission of documents related to On-site EEWDS locations for UT of Ladakh, UT of J&K, Assam, Uttarakhand and Himachal Pradesh at the earliest and	Not Complied

Sl. No.	Decisions	Current Status	Compliance Status
		further for other States/UTs.	
iv.	Consultant to submit PPT on Progress of Component A1 of NSRMP at the earliest.	PPT on Progress of Component A1 of NSRMP to be submitted.	Not Complied
III.	**Component A2**		
i.	Consultant to submit compliance report w.r.t. Minutes of meeting dated 09.07.2020 on Component A2 of NSRMP.	• Consultant has not yet submitted compliance report w.r.t. minutes of meeting dated 09.07.2020 on Component A2 of NSRMP.	Not Complied
ii.	Consultant to share with PMU the specific format and details of data/information required for Component A2 from the relevant Agencies, viz.; Fire & Emergency Services, Gujarat and Fire, Civil Defence & Home Guards, MHA.	Shared on 03rd September 2020.	Complied
IV.	**Component B**		
i.	Priority list to be finalized for specified structures under Component B1 & B2. Minutes of meeting dated 02nd January 2020 on Component B to be referred to. The Consultant to ensure submission of finalized priority list of critical buildings/infrastructure under Component B, duly ink-signed by State Nodal Officer, Team Leader and State Coordinator by 20th August 2020.	• The duly signed priority list of critical buildings/infrastructure under Component B has not been submitted yet. • Consultant to expedite submission of the duly signed priority list for all 9 States/UTs at the earliest.	Not Complied
ii.	Consultant to submit revised Approach Paper on Construction of TDU under Component B3 of NSRMP. Compliance of meeting dated 06th August 2020 on B3 to be ensured.	Submitted by Consultant.	Complied
iii.	Due Diligence by the Structural Engineering Specialists is essentially required at the level of RVS. It is observed that RVS is	• As intimated by the Team Leader, RVS is being carried out in some States by survey team but in absence of the respective State Coordinator and Structural Engineering	Not Complied

Sl. No.	Decisions	Current Status	Compliance Status
	being done in Himachal Pradesh, UT of J&K, UT of Ladakh in absence of the respective State Coordinator and Structural Engineering Specialist. RVS report will not be accepted if RVS activities are carried out in absence of State Coordinator and Structural Engineering Specialist of respective State/UT. Further, RVS Reports must be submitted to the State/UT Govt. for their approval before forwarding it to PMU.	Specialist. • RVS outcome should be detailed out in the report.	
iv.	Comprehensive RVS report duly signed by the Nodal Officer of the State Government, State Coordinator and Structural Engineering Specialist to be submitted by the Consultant.	Yet to be submitted.	Not Complied
v.	Model DPR both for Steel & RCC structures [one from Hilly area and another from Plain area] under Component B2 to be submitted by 21st September 2020.	To be submitted.	-
vi.	Design of Bridge both for Steel & RCC structures to be shared with PMU/World Bank by 28th August 2020.	Yet to be submitted.	Not Complied
vii	Revised Model DPRs for RCC & Masonry structure to be submitted by 17th August 2020.	Submitted.	Complied
viii.	Model DPR on ATC and Heritage buildings to be submitted by 10th September 2020.	To be submitted.	-
ix.	Consultant to submit time-schedule indicating respective Experts for submission of Typology/Technology wise Design/DPR.	Yet to be submitted.	Not Complied

Sl. No.	Decisions	Current Status	Compliance Status
V.	**Component C**		
i.	Consultant to submit revised Approach Papers on 7 sub-activities under Component C (C1-C7). Consultant to furnish details of consultations such as with whom, when, where and what discussions were made and its outcome.	Yet to be submitted.	Not Complied
VI.	**Component D**		
i.	Procurement & Financial Manual to be submitted by Consultant.	Yet to be submitted.	Not Complied
ii.	Project Information Document (PID), a sub-system of PAD to be submitted by the Consultant.	Yet to be submitted.	Not Complied
iii.	Consultant to submit compliance report on minutes of meeting dated 20.03.2020 on procurement & financial management aspect of NSRMP.	Submitted. Agreed by the Consultant but Action Points are to be complied.	Not Complied
iv.	Consultant to submit draft Approach Paper on structure of PMU & SPIU by 20th August 2020.	Submitted.	Complied
Weekly Review Meeting dated 24.08.2020			
i.	The Key Experts (State Coordinators and Engineering Specialist), if working from home, need to furnish daily report about works attended to from Home. These daily reports would form part of Fortnightly Progress Report.	• As intimated by Team Leader, daily logs are being maintained. • These daily reports would form part of future Fortnightly Progress Reports.	Not Complied
ii.	The Fortnightly Progress Report should mention timelines for sub-activities under Component-C	• To be incorporated in the next Fortnightly Progress Report.	Not Complied
iii.	State Coordinators and Structural Engineering Specialists must be mobilized to their respective	• As intimated by Team Leader, the issue is being pursued in view of Covid 19 situation. Mobility is being	Not Complied

Sl. No.	Decisions	Current Status	Compliance Status
	States/UTs, immediately. Consultant to confirm that State Coordinators and structural Engineering Specialists are deployed in their respective States/UTs at the earliest.	planned for Uttarakhand and Ladakh. Mobilization in other states is being planned depending on permission issues from States. • Consultant has requested for replacement of State Co-ordinators of Uttarakhand and Assam.	
iv.	Revised timeline will be w.r.t. the date on which State Coordinators and Structural Engineering Specialists are mobilized in their respective States/UTs for field works.	Consultant is yet to confirm status of mobilization of State Coordinators and Structural Engineering Specialists in their respective States/UTs.	Not Complied
v.	Consultant to submit ATR of previous weekly review meetings. The ATR of the weekly review meeting held on 10th August 2020 to be submitted by 26th August 2020.	Submitted.	Complied
II.	**PMU & PMC structure**		
i.	The project (NCRMP) will be funded 50% by NDMA (Mitigation Fund) and remaining 50% from the Government (World Bank). The PMU structure at NDMA and in the States should be conceptualised accordingly. The PMU at State level to be referred to as SPIU.	To be incorporated in the detailed Operations manual.	-
ii.	The PMU/SPIU may have only the Core staff with a PMC reporting to it. The Core Staffing pattern to be detailed out with ToRs.	The concept is incorporated in the revised Approach Paper.	-
iii.	The PMC's mandate/responsibilities will encompass the entire gamut of Project activities and, accordingly, would inter-alia include inviting EoI/RFP/Bids; Bid evaluation, contract/construction supervision, Knowledge Partner for	The concept is incorporated in the revised Approach Paper.	-

Sl. No.	Decisions	Current Status	Compliance Status
	technologically complex sub-projects, TPQA activities , O&M for relevant sub-projects, cost-benefit analysis/Benefit Monitoring and Evaluation of the Project (Mid-term, End-term), etc. The PMC will accordingly have domain experts/ specialists.		
iv.	ToR for hiring the PMC and ToR for each Specialist/Expert within the PMC to be prepared.	This aspect will be incorporated in the Operations manual and will be submitted to NDMA.	Not Complied
v.	It should clearly spell out which activities/sub-components will be bid out by the PMU (NDMA) and which ones by SPIU.	This aspect has been incorporated in the Approach paper. This will be further detailed out and incorporated in the Operations manual and will be submitted to NDMA.	-
vi.	The Approach Paper to be submitted by 28th August 2020.	• Consultant to avail services of Project Management Expert for structure of PMU and SPIU. • PMU and PMC responsibilities to be delineated. • The Approach Paper should capture component-wise activities of PMU, and staffing of PMU and PMC. • Consultant to prepare ToRs for hiring PMC.	Not Complied

B. General

i. Consultant to confirm that how many State Coordinators have moved to their respective States/UTs.

ii. Activities/works related to NSRMP carried out in States/UTs without physical presence of State Coordinators will not be considered.

iii. The State Coordinator of Assam to be on VC in the next Weekly Review Meeting.

iv. Consultant's Team Leader to visit Guwahati (Assam) and set up meeting with State Nodal Officer. The State Coordinator, Assam State to accompany the Team Leader.

v. A PMU letter to be sent to State on the matter of replacement of State Coordinators/NOC.

vi. It is intimated by the Team Leader that as none of the State Coordinators is in their respective States/UTs. Consultant to confirm status of State Coordinators of remaining seven States other than Uttarakhand and Assam.

vii. Geo-tagging to be ensured for the structures to be retrofitted.

viii. Consultant to design a display board indicating seismic severity with colour coded (RED/YELLOW/GREEN) tag marking the location coordinates (latitudes & longitudes). Design of display board to be shared with PMU, NDMA for approval. The approved board to be displayed on buildings to be retrofitted taking into account seismic severity of the building after doing the proper RVS.

ix. Every building/infrastructure undergoing RVS to be numbered.

x. All RVS to be reported in the prescribed format, as prepared by Prof. Arya under GoI-UNDP Disaster Risk Management Programme (Copy already shared with the Team Leader, also enclosed)

4. The meeting ended with a note of thanks to the Chair and all the participants.

(Rajendra Piplonia)
Project Manager
NCRMP, NDMA

Annexure-I

MINUTES OF THE WEEKLY REVIEW MEETING ON PROGRESS OF NATIONAL SEISMIC RISK MITIGATION PROGRAMME (NSRMP) HELD ON 31.08.2020 AT 3 PM IN THE CHAMBER OF THE SPL. SECRETARY & PROJECT DIRECTOR, NDMA.

Sl. No.	Name of Officials with Designation	Organisation
1	Sh. Samir Kumar Dy. Project Director	NDMA, New Delhi
2	Dr. Sanjay K Sharma Env. Specialist	NDMA, New Delhi
3	Dr. Amit Kumar Team Leader	DDF-AKDN JV

RAPID VISUAL SCREENING OF RCC BUILDINGS

by:-

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Chairman, BIS Committee CED 39
National Seismic Advisor (EVR)
Ministry of Home Affairs

Prepared Under GOI – UNDP Disaster Risk Management Programme

Rapid Visual Screening of Reinforce Concrete Buildings

A.1 RVS Procedure, Objectives and Scope

The Rapid Visual Screening method is designed to be implemented without performing any structural calculations. The procedure utilises a *damageability grading system* that requires the evaluator to (1) identify the primary structural lateral load-resisting system, and (2) identify building attributes that modify the seismic performance expected for this lateral load-resisting system along with non-structural components. The inspection, data collection and decision-making process typically occurs at the building site, and is expected to take couple of hours for a building, depending on its size.

The screening is based on Code based Seismic Intensity, Building Type and Damageability Grade as observed in past earthquake and covered in MSK/European macro-intensity

A.2 Uses of RVS Results

The main uses of this procedure in relation to seismic upgrading of existing buildings are:

i. To identify if a particular building requires further evaluation for assessment of its seismic vulnerability.
ii. To assess the seismic damageability (structural vulnerability) of the building and seismic rehabilitation needs.
iii. To identify simplified retrofitting requirements for the building (to collapse prevention level) where further evaluations are not considered necessary or not found feasible.

A.3 Seismic Hazard in India

As per IS 1893:2002 (Part 1), India has been divided into 4 seismic hazard zones (*see* Fig.A.1). The details of different seismic zones are given below:

Zone II Low seismic hazard (damage during earthquake may be of MSK Intensity VI or lower)
Zone III Moderate seismic hazard (maximum damage during earthquake may be upto MSK Intensity VII)
Zone IV High seismic hazard (maximum damage during earthquake may be upto MSK Intensity VIII)
Zone V Very high seismic hazard (maximum damage during earthquake may be of MSK Intensity IX or greater)

When a particular damage Intensity occurs, different building types experience different levels of damage depending on their inherent characteristics. For carrying out the Rapid Visual Screening, all four hazard zones have been considered.

A.4 Building Types Considered in RVS Procedure

A wide variety of construction types and building materials are used in urban and rural areas of India. These include local materials such as mud, straw and wood, semi-engineered materials such as burnt brick and stone masonry and engineered materials such as concrete and steel. The seismic vulnerability of the different building types depends on the choice of building materials and construction technology adopted. The building vulnerability is generally highest with the use of local materials without engineering inputs and lowest with the use of engineered materials and skills.

The basic vulnerability class of a building type is based on the average expected seismic performance for that building type. All buildings have been divided into type A to type F based on the European Macroseismic Scale (EMS-98) recommendations. The buildings in type A have the highest seismic vulnerability while the buildings in type F have the lowest seismic vulnerability. A building of a given type, however, may have its vulnerability different from the basic class defined for that type depending on the condition of the building, presence of earthquake resistance features, architectural features, number of storeys etc. It is therefore possible to have a damageability range for each building type considering the different factors affecting its likely performance. Some variations in building type are therefore defined as A, B, B+ etc.

The RVS procedure presented here has considered different building types, based on the building materials and construction types that are most commonly found in India. RCC buildings are presented in Tables A.1. The likely damages to buildings have been categorized in different Grades depending on the seismic impact on the strength of the building.

A.5 Grades of Damageability

`Five grades of damageability from G1 to G5 are specified in MSK and European Intensity Scale as described in Table A.2:

A.6 Relationship of Seismic Intensity, Building Type & Damage Grades

Table A.3 provides guidance regarding likely performance of the building in the event of design-level earthquake intensity postulated in the seismic zone. This information has been used in the survey forms to decide if there is necessity of further evaluation of the building using higher level procedures. It can also be used to identify need for retrofitting, and to recommend simple retrofitting techniques for ordinary buildings where more detailed evaluation is not feasible.

The Indicative quantities ***Few***, ***Many*** and ***Most*** as defined in European Intensity Scales are as follows:

Few: Less than (15±5) %; *Many*: Between (15±5) to (55±5) %;

Most: Between (55±5) to100%

As per MSK Intensity scale the average values of these terms may be taken as

Few: 5-15% *Many*: 50% *Most*: 75%

Table A.3 is generally based on MSK descriptions.

A.7 RVS Survey Forms – Special Points

The RVS survey forms are developed here for all the seismic zones II to V based on the probable earthquake Intensities, building types and damageability grades as described above. Some special cases included therein are described below:

1) Importance of Building/Structure

As per IS: 1893-2002, an important factor I is defined for enhancing the seismic strength of buildings & structures, as follows:

***Important buildings**:** Hospitals, Schools, monumental structures; emergency buildings like telephone exchange, television, radio stations, railway stations, fire stations, large community halls like cinemas, assembly halls and subway stations, power stations, Important Industrial establishments, VIP residences & Residences of Important Emergency person.

**Any building having more than 100 Occupants may be treated as Important for purpose of RVS.*

For these important buildings the value of I is specified as 1.5, by which the design seismic force is increased by a factor of 1.5. Now the seismic zone factors for zone II to V are as follows.

Zone	***II***	***III***	***IV***	***V***
Zone Factor	0.10	0.16	0.24	0.36

It is seen that one Unit change in Seismic Zone Intensity increases the Zone Factor 1.5 times.

Hence to deal with the damageability of Important buildings in any zone, they should be checked for one Unit higher zone. The assessment forms are designed accordingly.

2) Special Hazards

There are some special hazardous conditions to be considered:

I. *Liquefiable condition:* Normal loose sands submerged under high water table are susceptible to liquefaction under moderate to high ground accelerations; building founded on such soils will require special evaluation and treatment.

II. *Land Slide Prone Area:* If the building is situated on a hill slope which is prone to land slide/ land slip or rock-fall under monsoon and/or earthquake, special evaluation of the site and treatment of the building will be needed.

III. Irregular Buildings:

Irregularities in buildings are defined in **Cl.7.1 of IS: 1893 – 2002** under the following sub- heads:

i. *Plan Irregularities: These are defined in Table 4 of the Code as follows*:

a) Torsion Irregularity

b) Re-entrant Corners

c) Diaphragm Discontinuity

d) Out of Plane Offsets

e) Non – Parallel Systems

The Geometric Irregularities in building plans which can be easily identified are shown in Fig.A.2

These irregularities enhance the overall damage (increased grade of damage e.g. at re-entrant corners). Such a building may be recommended for detailed evaluation.

ii. *Vertical Irregularities:* The following vertical irregularities may be seen in masonry buildings (*see* Fig. A.3).

a) Mass Irregularity

b) Vertical Geometric Irregularity

c) In-Plane Discontinuity in vertical Elements Resisting Lateral Forces.

If any of these irregularities are noticed, the building should be recommended for detailed evaluation.

IV. Falling Hazard: Where such hazards are present, particularly in Zones IV & V, recommendations should make reference to these in the survey report as indicated.

V. Type of Foundation Soil: IS 1893-2002 defines three soil types hard/stiff, medium & soft. No effect of these is seen in the design spectra of short period buildings, T< 0.4 second, covering all masonry buildings, hence the effect may be considered not so significant.

Table A.1: Reinforced Concrete Frame Buildings (RCF) and Steel Frames (SF)

Frame Type	Description
C	a) RC Beam Post buildings without ERD or WRD, built in non-engineered way. b) SF without bracings having hinge joints;. c) RCF of ordinary design for gravity loads without ERD or WRD. d) SF of ordinary design without ERD or WRD
C+	a) MR-RCF/MR-SF of ordinary design without ERD or WRD. b) Do, with unreinforced masonry infill. c) Flat slab framed structure. d) Prefabricated framed structure.
D	a) MR-RCF with ordinary ERD without special details as per IS: 13920, with ordinary infill walls (such walls may fail earlier similar to C in masonry buildings. b) MR-SF with ordinary ERD without special details as per Plastic Design Hand Book SP:6(6)-1972.
E	a) MR-RCF with high level of ERD as per IS: 1893-2002 & special details as per IS: 13920. b) MR-SF with high level of ERD as per IS: 1893-2002 & special details as per Plastic Design Hand Book. SP:6(6)-1972
E+	a) MR-RCF as at E with well designed infills walls. b) MR-SF as at E with well designed braces
F	a) MR-RCF as at E with well designed & detailed RC shear walls. b) MR-SF as at E with well designed & detailed steel braces & cladding. c) MR-RCF/MR-SF with well designed base isolation.

Notes: RCF = Reinforced concrete column- beam frame system
SF = Steel column- beam frame system
ERD = Earthquake Resistant Design
WRD = Wind Resistant Design
MR = Moment Resistant jointed frame

IMPORTANT NOTE:

Buildings having severe vertical irregularity e.g. open plinth, stilt floor called soft storey & those having floating columns resting on horizontal cantilever beams are not covered in the above table & will require special evaluation.

Table A.2: *Grades of Damageability of RCC Buildings*

Classification of damage to buildings of reinforced concrete
Grade 1: Negligible to slight damage (no structural damage, slight non-structural damage) Fine cracks in plaster over frame members or in walls at the base. Fine cracks in partitions & infills.
Grade 2: Moderate damage (Slight structural damage, moderate non-structural damage) Cracks in columns & beams of frames & in structural walls. Cracks in partition & infill walls; fall of brittle cladding & plaster. Falling mortar from the joints of wall panels.
Grade 3: Substantial to heavy damage (moderate structural damage, heavy non-structural damage) Cracks in columns & beam column joints of frames at the base & at joints of coupled walls. Spalling of concrete cover, buckling of reinforced rods. Large cracks in partition & infill walls, failure of individual infill panels.
Grade 4: Very heavy damage (heavy structural damage, very heavy non-structural damage) Large cracks in structural elements with compression failure of concrete & fracture of rebar's; bond failure of beam reinforcing bars; tilting of columns. Collapse of a few columns or of a single upper floor.
Grade 5: Destruction (very heavy structural damage) Collapse of ground floor parts (e.g. Wings) of the building.

* **The grades of damage in steel and wood buildings will also be based on non-structural and structural damage classification (shown in bold print in Table 4). Non-structural damage to infills would be the same as indicated for masonry building in the above table. Structural damage grade in steel & wooden elements still needs to be defined.**

Table A.3: *Damageability Grades of RCC Buildings*

RCF/SF/BUILDING	Type of Building	Zone II MSK VI or less	Zone III MSK VII	Zone IV MSK VIII	Zone V MSK IX or More
	C and C+	*Few* of grade 1 (rest no damage)	*Few* of grade 2 (rest of grade 1,0)	*Many* of grade 2 *Few* of grade 3 (rest of grade 1)	*Many* of grade 3 *Few* of grade 4 (rest of grade 2)
	D	-	*Few* of grade 1	*Few* of grade 2	*Many* of grade 2 *Few* of grade 3 (rest of grade 1)
	E and E+	-	-	-	*Few* of grade 2 (rest of grade 1 or 0)
	F	-	-	-	*Few* of grade 1

NOTE:

NOTE:

1. **As per MSK scale, few, Many and Most may be taken as: Few: 15%, Many: 50% and Most: 75%.**
2. **Buildings having vertical irregularity (see note under table 3) may under go severe damage in seismic zones III, IV & V if not specifically designed. Hence they will require special evaluation. Also buildings sited in liquefiable or landslide prone areas will require special evaluation for seismic safety.**
3. **Buildings having plan irregularity may under go a damage of one grade higher in zones III, IV & V. The sur veyor may recommend re-evakuation.**

ZONE V MM IX OR MORE
ZONE IV MM VIII
ZONE III MM VII
ZONE II MM VI OR LESS

AREAS UNDER THE ZONES

V	10.9 %
IV	17.3 %
III	30.4 %
TOTAL DAMAGEABLE AREA	
	~ 58.6 %

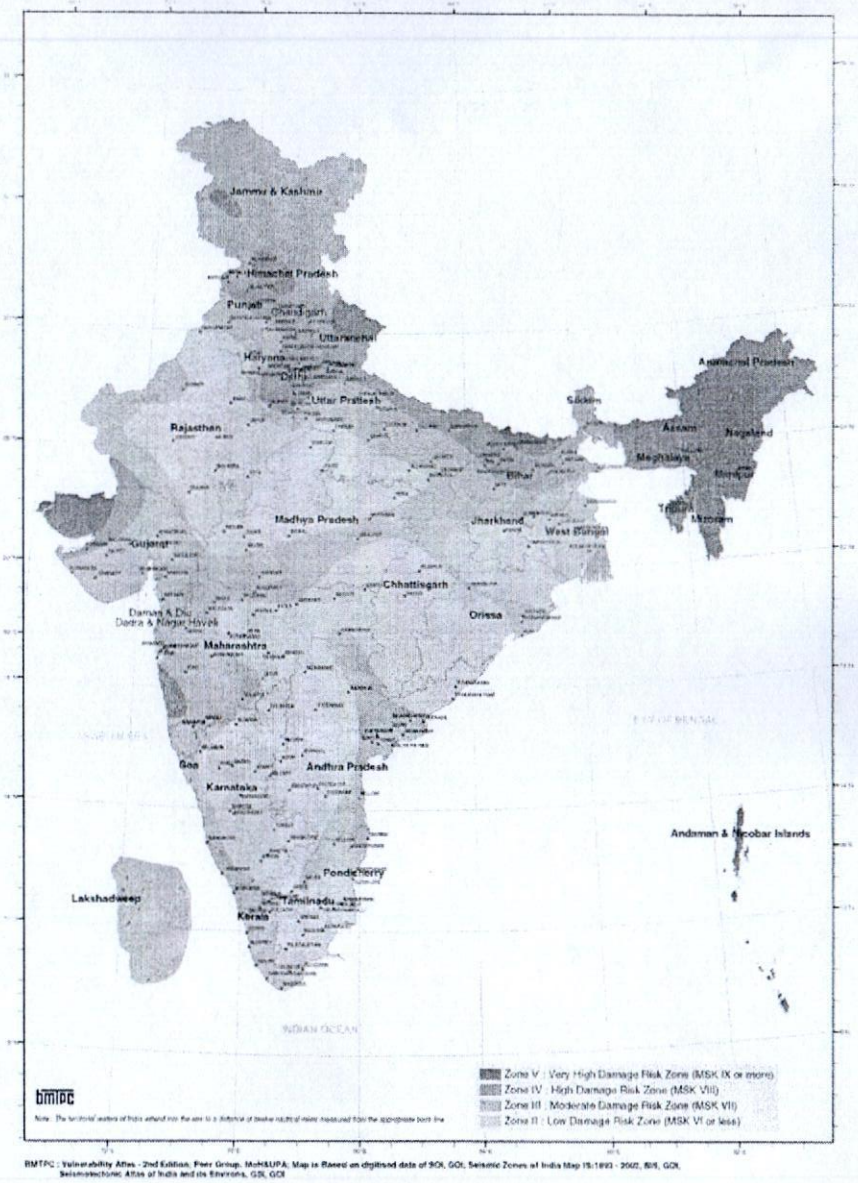


Fig. A.1 EARTHQUAKE HAZARD ZONES 2002

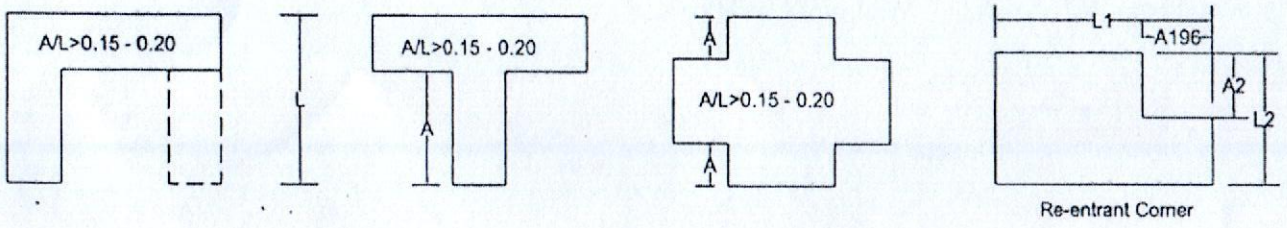
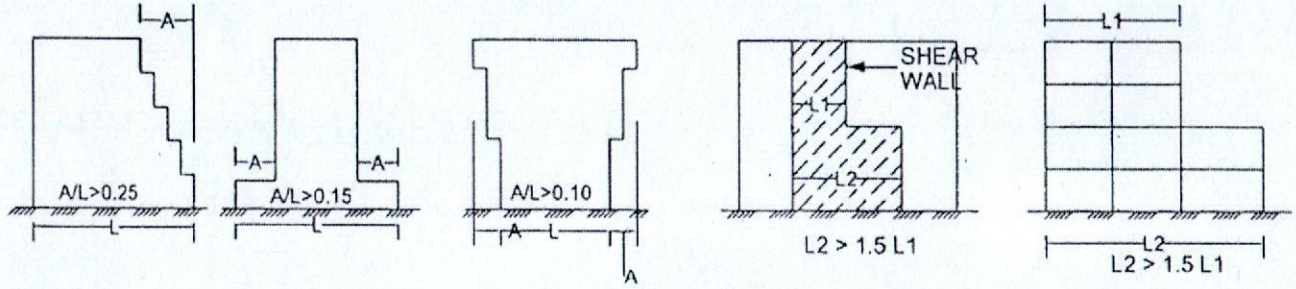
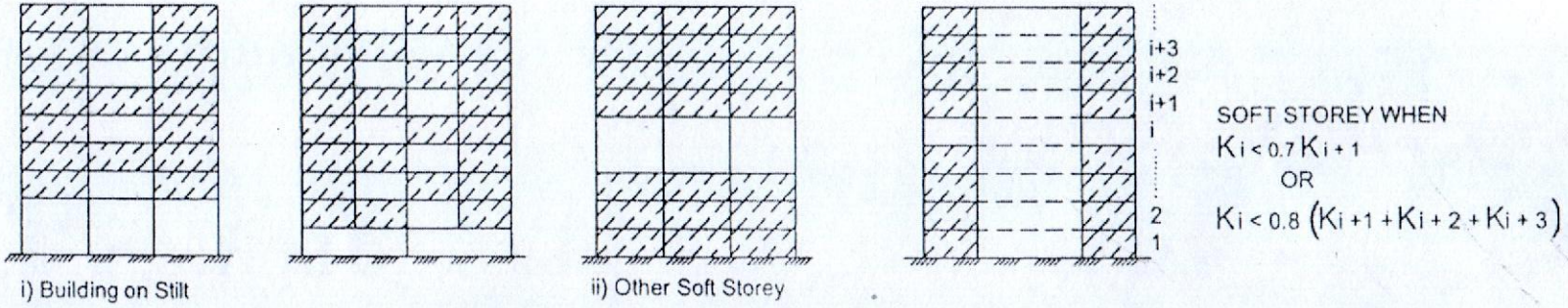


FIG. 2 PLAN IRREGULARITIES



a) Geometrical Irregularities

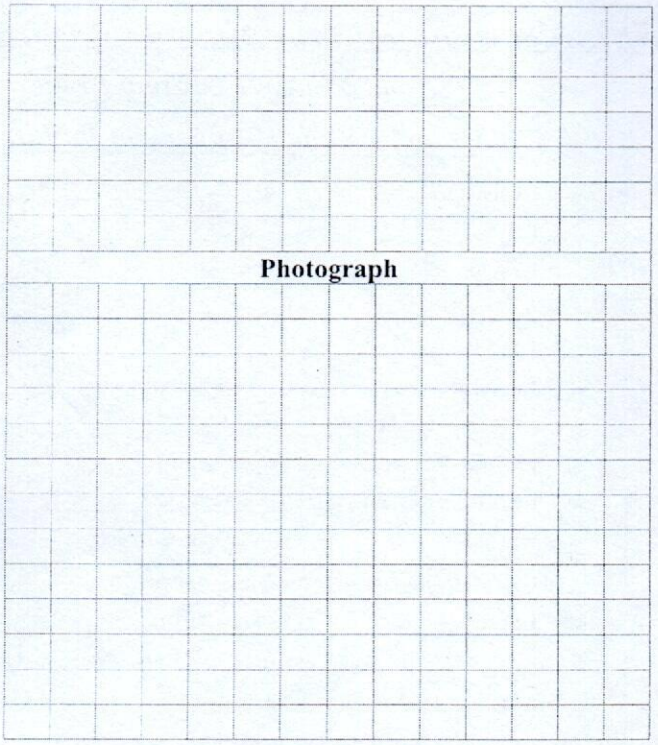


b) Storey Stiffness Irregularities

FIG.3 VERTICAL IRREGULARITIES

1 Rapid Visual Screening of RC/Steel Buildings for Seismic Hazards

Seismic Zone II Ordinary Building



Photograph

Sketch Plan with Length & Breadth

1.1 Building Name_____

1.2 Use_____

1.3 Address:_____

_____ Pin _____

1.4 Other Identifiers_____

1.5 No. of Stories_____ **1.6** Year of Const._____

1.7 Storey Ht: 1st _____, 2nd _____, 3rd _____ etc.

1.8 Total Covered Area; all floors (sq.m) _____

1.9 Ground Coverage (Sq.m):_____

1.10 Soil Type:_____ **1.11** Foundation Type:_____

1.12 Depth of Ground water table: _____

1.13 Bldg. Type: Frame ☐ Pre-cast ☐ Frame - Shear Wall ☐ Flat Slab Frame ☐

1.14 Thickness of infill wall: Exterior _____ Interior _____

1.15 Struct. Dwg./Calculations available: Yes / No (If yes,attach)

1.16 Extn. to the original bldg. Yes/ No (If.yes pl. indicate)

1.17 Location of Shear walls (if any)

1.18 Special Confining R/F in Beam/Column/joints:

1.19 Stair case: Separated ☐ Connected ☐ Enclosed ☐

2.0 OCCUPANCY	3.0 SPECIAL HAZARD	4.0 FALLING HAZARD
2.1 ***Important buildings:*** Hospitals, Schools, monumental structures; emergency buildings like telephone exchange, television, radio stations, railway stations, fire stations, large community halls like cinemas, assembly halls and subway stations, power stations, Important Industrial establishments, VIP residences & Residences of Important Emergency person. **Any building having more than 100 Occupants may be treated as* ***Important.*** ***2.2 Ordinary buildings:-*** Other buildings having occupants <100	**3.1** High Water Table (within 1m) & if sandy soil, then liquefiable site indicated. ☐ Yes ☐ No **3.2** Land Slide Prone Site ☐ Yes ☐ No **3.3** Severe Vertical Irregularity ☐ Yes ☐ No **3.4** Severe Plan Irregularity ☐ Yes ☐ No	**4.1** Chimneys ☐ **4.2** Parapets ☐ **4.3** Cladding ☐ **4.4** Others ☐

RECOMMENDED ACTION:-

☐ Ensure adequate maintenance.

☐ If any Special Hazard 3.0 found , re-evaluate for possible retrofitting.

5.0 Probable Damageability in Few/Many Buildings

Building Type	5.1 RC or Steel Frame/ wooden Buildings				5.2 URM Infill
Damage-ability in Zone II	C / C+	D	E,E+	F	
	G1 / G1	-	-	-	G1

Note: +sign indicates higher strength hence somewhat lower damage expected as stated. Also average damage in one building type in the area may be lower by one grade point than the probable damageability indicated.

Surveyor will identify the Building Type; encircle it, also the corresponding damage grade.

Surveyor's sign:_____

Name:_____

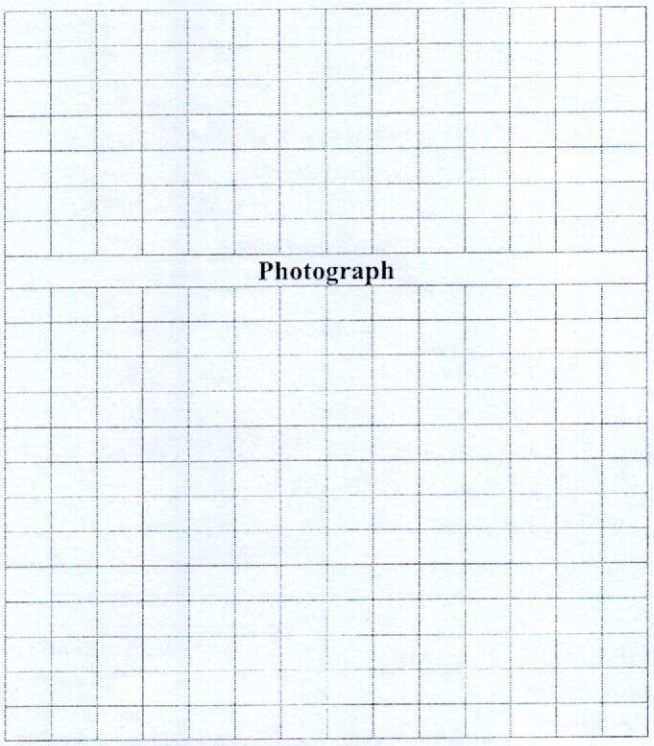
Executive Engineer's Sign:_____

Date of Survey:_____

2 Rapid Visual Screening of RC/Steel Buildings for Seismic Hazards

Seismic Zone III Ordinary Building

(Also for Zone II Important Building)



Photograph

Sketch Plan with Length & Breadth

1.1 Building Name _____

1.2 Use _____

1.3 Address: _____

_____ Pin _____

1.4 Other Identifiers _____

1.5 No. of Stories _____ **1.6** Year of Const. _____

1.7 Storey Ht.: 1st _____, 2nd _____, 3rd _____ .etc.

1.8 Total Covered Area; all floors (sq.m) _____

1.9 Ground Coverage (Sq.m): _____

1.10 Soil Type: _____ **1.11** Foundation Type: _____

1.12 Depth of Ground water table: _____

1.13 Bldg. Type: Frame ☐ Pre-cast ☐

Frame - Shear Wall ☐ Flat Slab Frame ☐

1.14 Thickness of infill wall: Exterior _____ Interior _____

1.15 Struct. Dwg./Calculations available: Yes / No (If yes,attach)

1.16 Extn. to the original bldg. Yes/ No (If.yes pl. indicate)

1.17 Location of Shear walls (if any)

1.18 Special Confining R/F in Beam/Column/joints:

1.19 Stair case: Separated ☐ Connected ☐ Enclosed ☐

2.0 OCCUPANCY	3.0 SPECIAL HAZARD	4.0 FALLING HAZARD
2.1 Important buildings: Hospitals, Schools, monumental structures; emergency buildings like telephone exchange, television, radio stations, railway stations, fire stations, large community halls like cinemas, assembly halls and subway stations, power stations, Important Industrial establishments, VIP residences & Residences of Important Emergency person. **Any building having more than 100 Occupants may be treated as* ***Important.*** ***2.2 Ordinary buildings:-*** Other buildings having occupants <100	**3.1** High Water Table (within 3m) & if sandy soil, then liquefiable site indicated. ☐ Yes ☐ No **3.2** Land Slide Prone Site ☐ Yes ☐ No **3.3** Severe Vertical Irregularity ☐ Yes ☐ No **3.4** Severe Plan Irregularity ☐ Yes ☐ No	**4.1** Chimneys ☐ **4.2** Parapets ☐ **4.3** Cladding ☐ **4.4** Others ☐

RECOMMENDED ACTION:-

☐ Ensure adequate maintenance.

☐ If any Special Hazard 3.0 found , re-evaluate for possible prevention/retrofitting.

☐ If any of the falling hazard is present, either remove it or strengthen against falling.

5.0 Probable Damageability in Few/Many Buildings

Building Type	5.1 RC or Steel Frame/ wooden Buildings				5.2 URM Infill
Damage- ability in Zone III	C / C+	D	E,E+	F	
	G2 / G1	G1	-	-	G2

Note: +sign indicates higher strength hence somewhat lower damage expected as stated. Also average damage in one building type in the area may be lower by one grade point than the probable damageability indicated.

Surveyor will identify the Building Type; encircle it, also the corresponding damage grade.

Surveyor's Sign : _____

Name: _____

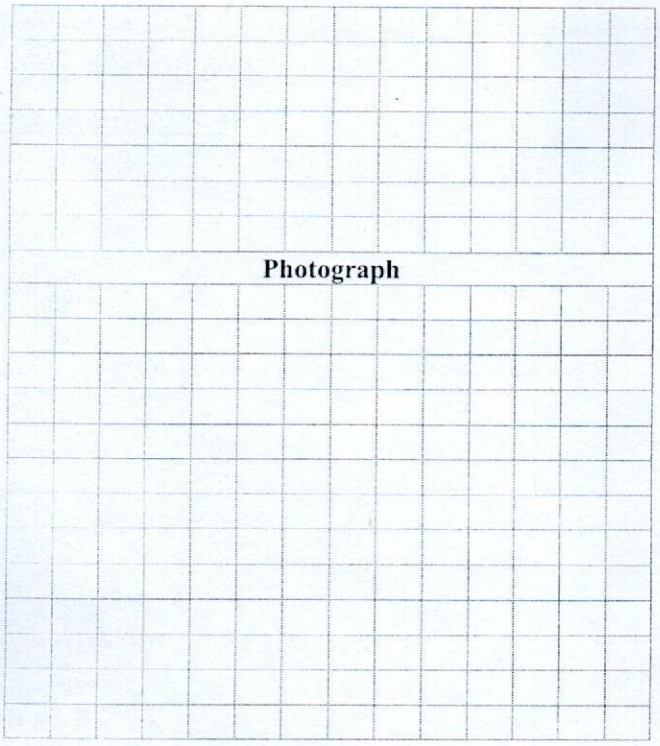
Executive Engineer's Sign: _____

Date of Survey: _____

3 Rapid Visual Screening of RC/Steel Buildings for Seismic Hazards

Seismic Zone IV Ordinary Building

(Also for Zone III Important Building)



Sketch Plan with Length & Breadth

1.1 Building Name_____

1.2 Use_____

1.3 Address:_____

_____ Pin _____

1.4 Other Identifiers_____

1.5 No. of Stories_____ **1.6** Year of Const._____

1.7 Storey Ht.: 1st _____, 2nd _____, 3rd _____ .etc.

1.8 Total Covered Area; all floors (sq.m) _____

1.9 Ground Coverage (Sq.m):_____

1.10 Soil Type:_____ **1.11** Foundation Type:_____

1.12 Depth of Ground water table: _____

1.13 Bldg. Type: Frame ☐ Pre-cast ☐

Frame - Shear Wall ☐ Flat Slab Frame ☐

1.14 Thickness of infill wall: Exterior _____ Interior _____

1.15 Struct. Dwg./Calculations available: Yes / No (If yes,attach)

1.16 Extn. to the original bldg. Yes/ No (If.yes pl. indicate)

1.17 Location of Shear walls (if any)

1.18 Special Confining R/F in Beam/Column/joints:

1.19 Stair case: Separated ☐ Connected ☐ Enclosed ☐

2.0 OCCUPANCY	3.0 SPECIAL HAZARD	4.0 FALLING HAZARD
2.1 Important buildings: Hospitals, Schools, monumental structures; emergency buildings like telephone exchange, television, radio stations, railway stations, fire stations, large community halls like cinemas, assembly halls and subway stations, power stations, Important Industrial establishments, VIP residences & Residences of Important Emergency person. **Any building having more than 100 Occupants may be treated as* ***Important.*** ***2.2 Ordinary buildings:-*** Other buildings having occupants <100	**3.1** High Water Table (within 5m) & if sandy soil, then liquefiable site indicated. ☐ Yes ☐ No **3.2** Land Slide Prone Site ☐ Yes ☐ No **3.3** Severe Vertical Irregularity ☐ Yes ☐ No **3.4** Severe Plan Irregularity ☐ Yes ☐ No	**4.1** Chimneys ☐ **4.2** Parapets ☐ **4.3** Cladding ☐ **4.4** Others ☐

RECOMMENDED ACTION:-

- ☐ C: evaluate in detail for need for retrofitting
- ☐ If any Special Hazard 3.0 found , re-evaluate for possible prevention/retrofitting.
- ☐ If any of the falling hazard is present, either remove it or strengthen against falling.
- ☐ URM infill : evaluate in detail for need of retrofitting

Surveyor's Sign :_____

Name:_____

Executive Engineer's Sign:_____

Date of Survey:_____

5.0 Probable Damageability in Few/Many Buildings

Building Type	5.1 RC or Steel Frame/ wooden Buildings				5.2 URM Infill
Damage-ability in Zone IV	C / C+	D	E,E+	F	
	G3 / G2	G2	-	-	G3

Note: +sign indicates higher strength hence somewhat lower damage expected as stated. Also average damage in one building type in the area may be lower by one grade point than the probable damageability indicated.

Surveyor will identify the Building Type; encircle it, also the corresponding damage grade.

4 Rapid Visual Screening of RC/Steel Buildings for Seismic Hazards

Seismic Zone V All Buildings

(Also for Zone IV Important Building)

Photograph

Sketch Plan with Length & Breadth

1.1 Building Name_____

1.2 Use_____

1.3 Address:_____

_____Pin _____

1.4 Other Identifiers_____

1.5 No. of Stories_____ 1.6 Year of Const._____

1.7 Storey Ht.: 1st _____, 2nd _____, 3rd _____ .etc.

1.8 Total Covered Area; all floors (sq.m) _____

1.9 Ground Coverage (Sq.m):_____

1.10 Soil Type:_____ 1.11 Foundation Type:_____

1.12 Depth of Ground water table: _____

1.13 Bldg. Type: Frame ☐ Pre-cast ☐

Frame - Shear Wall ☐ Flat Slab Frame ☐

1.14 Thickness of infill wall: Exterior _____ Interior _____

1.15 Struct. Dwg./Calculations available: Yes / No (If yes,attach)

1.16 Extn. to the original bldg. Yes/ No (If.yes pl. indicate)

1.17 Location of Shear walls (if any)

1.18 Special Confining R/F in Beam/Column/joints:

1.19 Stair case: Separated ☐ Connected ☐ Enclosed ☐

2.0 OCCUPANCY	3.0 SPECIAL HAZARD	4.0 FALLING HAZARD
*2.1 **Important buildings**:* Hospitals, Schools, monumental structures; emergency buildings like telephone exchange, television, radio stations, railway stations, fire stations, large community halls like cinemas, assembly halls and subway stations, power stations, Important Industrial establishments, VIP residences & Residences of Important Emergency person. **Any building having more than 100 Occupants may be treated as **Important**.* *2.2 **Ordinary buildings:-*** Other buildings having occupants <100	3.1 High Water Table (within 3m) & if sandy soil, then liquefiable site indicated. ☐ Yes ☐ No 3.2 Land Slide Prone Site ☐ Yes ☐ No 3.3 Severe Vertical Irregularity ☐ Yes ☐ No 3.4 Severe Plan Irregularity ☐ Yes ☐ No	4.1 Chimneys ☐ 4.2 Parapets ☐ 4.3 Cladding ☐ 4.4 Others ☐

RECOMMENDED ACTION:-

- ☐ C: evaluate in detail for need for retrofitting to achieve type E, E+.
- ☐ If any Special Hazard 3.0 found , re-evaluate for possible prevention/ retrofitting.
- ☐ If any of the falling hazard is present, either remove it or strengthen against fall.
- ☐ URM infill : evaluate for need of reconstruction or possible retrofitting to level D.

Surveyor's Sign :_____

Name:_____

Executive Engineer's Sign:_____

Date of Survey:_____

5.0 Probable Damageability in Few/Many Buildings

Building Type	5.1 RC or Steel Frame/ wooden Buildings				5.2 URM Infill
Damage-ability in Zone V	C / C+	D	E,E+	F	
	G4 / G3	G3	G2/G1	G1	G4

Note: +sign indicates higher strength hence somewhat lower damage expected as stated. Also average damage in one building type in the area may be lower by one grade point than the probable damageability indicated.

Surveyor will identify the Building Type; encircle it, also the corresponding damage grade.

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