

DETAILED PROCEDURE OF TECHNICAL SAFETY AUDIT



Guwahati Metropolitan Development Authority
Bhangagarh, Guwahati-781005



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PUBLIC NOTICE FOR TECHNICAL SAFETY AUDIT

This is for information of all concerned that Section 58.20 (iii) of the Building Byelaws requires that all public and apartment building of height above 12 m required records of construction at plinth level, 1st storey, middle storey in case of multistory building and last storey in addition to other tests, reports on construction the details of which and procedure, formats etc. are available in Chapter VI of the Building Byelaws which may also be seen in our website www.gmda.co.in.

Authority now proposes to check randomly some such buildings to examine if this provision is complied with and if not will conduct its own assessment through our appointed firm and the expenditure will be realized from the defaulting parties with immediate effect. The details of expenditure that the defaulting parties/developers may have to be incurred are being made available in our website along with the other detailed procedure of the audit within 48 hours of publication of this notice. The parties/builders are free to conduct the examination by themselves also as per the detailed procedure made available in our website and submit the result to Authority. However the self-assessment is required to be completed within one month from updating the detailed procedure in our website.

All concerned of these buildings are also required to keep the documents/test report etc. required at site and should make available these documents and all other information related to the construction to the firm engaged by Authority and staffs of the Authority as and when they visit the site for inspection. The report and corrective measures, if required will be made available to the concerned parties for necessary corrective measures from their end.

Any willful obstruction or refusal to make available documents for inspection by our appointed firms/staffs of GMDA may invite subsequent action from GMDA.

Sd/-
(Dr. M. Angamuthu, IAS)
Chief Executive Officer
Guwahati Metropolitan Dev. Authority
Bhangagarh, Guwahati-5

DETAILED PROCEDURE OF TECHNICAL SAFETY AUDIT

SCOPE OF TECHNICAL SAFETY AUDIT

Technical Safety Audit will be conducted in two phases as given below:

The Technical Safety Audit will be done for Existing and under construction building, above (G+2) within Guwahati Metropolitan area in following manners.

Buildings forwarded for Technical Audit from time to time provided that if private parties/developers/owners approach the concerned Firm/Institution for such audit they will do the technical audit and submit a report to GMDA also.

(1) PHASE - I

The Technical Audit is a purely technical achievement where technically sound personal/ Experienced Civil Engineer of EREC TEAM will conduct the audit with a few handheld equipments in following steps :

Step-I: Keen observations shall be done for RVS only by Erec Team Member (ETM). During Rapid Visual Screening (RVS) period, photographs also have to be taken for further analysis & identification of the building. The visible defects/ damages, disorder and any infirmity have to be keenly observed and list out. Laptop will be used as record media for collected data and photographs.

Step-II: The NDT equipment Schmidt Hammer is to be applied if required to check the quality of concrete used in the building.

Step-III: Built-up area and height of the building shall be measured and recorded.

Step-IV: Design of structure (if available) and/or building permission will be verified with the compliance of actual structure of the building by the ETM.

Step-V: For under construction building, quality of materials used has to be checked and Inform to builder to check the progress work to get the earthquake resistance standard/ safety so that, if any anomaly found, retrofitting can be done immediately. Subsequently, the records submitted to the concern authority i/e 1st party.

Step-VI: The technical report (Phase-1) will be prepared within 7 (seven) days from the date of completion of field works and submit the same to the 1st party.

This Phase-I study will cover following:

(i) Technical Audit as per model Performa for technical audit enclosed at Annexure-VII of all buildings under construction.

(ii) Structural inspection report as per Annexure-VIII of all completed buildings.

(iii) The above requirements to be supported with-

- (a) Photograph of the building as completed/under construction as on date of inspection.
- (b) A detailed inspection report along with plan showing the construction carried out in site plan of the plot.
- (iv) In addition to above the Rapid Visual Screening of building as per format at **Annexure-X** or any other method also can be used.
- (v) Recommendation based on above study for each building.
 - (a) Recommendation will mainly focused on the structural safety assessment of each building examined and suggest corrective/ remedial measures, if any.
 - (b) It will also recommend if further NDT is recommended and reasons for which the NDT recommended and such test is required to be conducted.
 - (c) If however as per the Phase-I study, no further structural assessment and audit is recommended for any building the same also be pointed out by concern experts.
- (vi) Report should consist of (1) Field data (Software operated), (2) Few photographs, (3) Analysis and expert view. All report and documents shall be in English with 3 (three) hard copies and 1 (one) soft copy.

(2) PHASE-II

After recommendation of Technical Safety Audit and structural inspection in phase-I Non-Destructive Testing service may have to be done for checking overall quality & safety of buildings with the help of NDT equipments. Accordingly, the data shall be sorting & analyze for proper identification of weakest points and safety level of the building that Retrofitting can be done as the remedial measures taken by the owner of the building. However the consultancy of retrofitting is not covered within the scope of this proposal.

In case of under constructed building, the Technical audit shall be in phase manner. The NDT equipments are also applicable in this type of audit.

- (i) The function and features of usable NDT equipments in both new and existing building are summarized as follows.
 - a) **Pile Integrity Test:** Pile Integrity Testing (PIT) is a Non-Destructive Testing equipment shall be used for Technical Audit of foundation of the building specially for pile foundation whereas the parameters like Length of the Pile, Quality of pile, any Crack, break, voids inside the pile etc. can be determined.
 - b) **Rebar Detection:** The compact, lightweight Profometer 5+ rebar detection equipment shall be used to detect the position of Rebar (Reinforcement), Concrete Coverage, Span and diameter of rebar.

- c) **Corrosion Analyzing:** The Canin+, the corrosion analyzing instrument shall be used for assessment of conductivity of concrete and presence of corrosion of steel inside concrete.
- d) **Ultrasonic Crack detector:** Tico- is an ultrasonic instrument shall be used to detect the uniformity of concrete, cavities, cracks and defects, the modulus of elasticity and compressive strength.
- e) **Compressive Strength of Concrete (Quality Test):** The Schmidt Hammer (Digi-Schmidt) is one of the modern & sophisticated non-destructive Testing equipment shall be used to determine the compressive strength of any type of concrete. It is also the prime equipment for evaluating the quality of concrete.

(ii) **Basic Technical Requirement and Specification**

- a) **Nature of Technical Safety Audit:** Nature of audit will be the technical safety audit of all Ground+2 R.C.C. buildings and above both completed and under construction allowed by GMDA and GMC from year 2002.
- b) To use up-to-date technical machinery and know how without damaging existing buildings
- c) The firms/institutions should have technical knowledge, adequate qualified technical manpower and equipment for conducting such safety audit.

The consultant may also suggest and engage any other method as may be suitable to arrive at a definite conclusion with prior approval of Second Party.

Recommendation based on the NDT and testing report should consist of the report of over all quality of the building indicating the weakest points for safety and prospective remedial or retrofitting measures for sound condition. All report and documents shall be in English with 3 (three) hard copies and 1 (one) soft copy.

- (iii) **Test data Collection and record:** Before testing the work piece (RCC Building), the test point shall be prepared by rubbing and cleaning that actual data can be obtain by applying the NDT equipments. The test data shall be properly collected by equipment automatically and subsequently manually recorded. Further, the data shall be sorted and categorized for preparation of Technical audit report.
- (iv) **Technical Audit Report:** A Structural Inspection report (Phase - II) shall be prepared performing the Non Destructive Testing of the building. This report consist of categorized Test data, Photographs of the building along with the expert view (suggestion) and shall be submitted to GMDA (First Party).

(3) **Quality Assurance Plan:**

The firms should have to ensure quality of assurance in his work. A team from GMDA will continually check the work and may suggest additional requirement/information as per checking, if required.

Selected Firms:

- (1) Authority has selected **Environmental Research and Evaluation Centre (EREC), MPG Complex, R-2, Rupnagar, Guwahati-781032, Contact Nos. 090850-66613, 098640-66613, 098640-32550, Email mpguw2@rediffmail.com** through a transparent bidding process for the work.

Details of rates of the firm accepted by the Authority may be seen at **Annexure-XI & XII**. Provided that in case of individual party/owner/developer approach the Firm directly for such audit the payment will then be made by these parties directly to the Firm.

- (2) Provided that individual parties/owner/developer may conduct the technical safety audit through IIT, Guwahati, Assam Engineering College and Assam Engineering Institute, Chandmari who are already authorized by GMDA for 3rd party checking of Structural Designs/Structural Design Basic Report (SDBR). However, fee for the Technical Safety Audit will be borne by the concerned developer/owner.
- (3) The fee can also be negotiated considering the complexity and magnitude by the client and the firm/institution between them.

These institutions are however free to conduct the audit as per their own format but the recommendations should be in the form as per the requirement given by us for phase-I & II as the case may be.

ANNEXURE- VII
(For buildings under construction)

MODEL PROFORMA FOR TECHNICAL AUDIT REPORT

1. Design

		COMMENTS
1.1	Design / Drawings available	Y/N
	Design Category	Y/N
1.2	Type Design?	Design to be
	Specific design?	collected to refer to Design Consultant / H.O.
1.3	Drawings prepared / checked by competent Authority ?	Y/N
	Design Drawings / details	Y/N
1.4	Structural detailed included	
	Earthquake / cyclone resistant features included?	
1.5	Design verified / vetted by Dept. / Govt. approved agency / competent authority?	Y/N
1.6	Design changes approved by Dept. / Govt. approved agency / competent authority?	Y/N

2. Foundation

2.1	Foundation used	Existing/New
2.2.1	If existing foundation used	
2.2.1	Depth of foundation below ground	: <50cm/50-70/>70cm
2.2.2	Type of foundation	: Isolated/Combined/Raft/Piled etc.
2.2.3	Thickness of masonry (above ground)	:
2.2.4	Mortar used and Mix of cement mortar	: Cement-Sand/Lime and 1:4/1:6/Leaner
2.2.5	Grade of concrete (M20)	: Y/N
2.2.6	Height up to Plinth	: _____ cm
2.2.7	If stone masonry	
2.2.7.1	Through Stones	: Yes/No, if Yes Adequate / Inadequate
2.2.7.2	Corner Stones	: Yes/No, if Yes Adequate/Inadequate
2.3	If new foundation used	
2.3.1	Depth of foundation below ground	: _____ <50/50-70/>70cm
2.3.2	Type of foundation	: Isolated/Combined/Raft/Piled etc.
2.3.3	Thickness of Masonry above plinth	: _____
2.3.4	Mortar used and Mix of cement mortar	(1:4): Cement - sand/lime/mud and Y/N
2.3.5	Grade of concrete (M20)	: Y/N
2.3.6	Height up to Plinth	: <60/>60cm

- 2.3.7 If stone masonry
 - 2.3.7.1 Through Stones : Yes/No, if Yes
Adequate/Inadequate
 - 2.3.7.2 Corner Stones : Yes/No, if Yes
Adequate/Inadequate
- Vertical reinforcement in foundation : Yes/No

3 Walling

- 3.1 Type of masonry : Brick/PCC Blocks/ Stone
- 3.2 Mortar used : Cement - Sand/Lime
- 3.3 Mix of cement mortar : 1:4/1:6/Leaner
- 3.4 Thickness of wall : >23cm/23cm/23cm
- 3.5 Mixing of mortar : OK/Not OK
- 3.6 Joint Property filled : OK/NOT OK
- 3.7 Wetting of bricks : Good/ Medium/ Poor
- 3.8 If stone masonry
 - 3.8.1 Through Stones : Yes/No
 - 3.8.2 Corner Stones : Yes/No
- 3.9 Overall workmanship : Good / Medium / Poor

4 Roofing

- 4.1 Type of roof : Flat/Sloping
- 4.2 If sloped : A.C. sheet/ G.I. sheet /Morbid
tiles
- 4.3 Purlins : Angle-Iron / Timber / NA
- 4.4 Truss type : _____
- 4.5 Anchorage with wall : Adequate/ Inadequate/ NA

5 Materials

- 5.1 Cement
 - 5.1.1 Source : Authorized Dealer/ Market
 - 5.1.2 Type of cement : OPC/PPC/PSC
 - 5.1.3 If OPC : Grade (33/ 43/ 53)
- 5.2 Sand
 - 5.2.1 Type of sand : River sand / Stone dust
 - 5.2.2 Presence of deleterious materials : Mild / Moderate/ High
- 5.3 Coarse Aggregates
 - 5.3.1 Type coarse Aggregates : Gravel/ Crushed Stone
 - 5.3.2 Presence of deleterious material : Mild/ Moderate / High
- 5.4 P.C.C. Blocks (Applicable for onsite production)
 - 5.4.1 Type of P.C.C. Blocks : Solid blocks/Hollow blocks

- 5.4.2 Ratio of concrete in blocks : _____
- 5.4.3 Interlocking feature : Yes/No
- 5.4.4 Course aggregates used : Natural/ Crushed stone
- 5.5 Bricks Blocks, Stone etc.
 - 5.5.1 Strength (field assessment) : Low/Medium/High
 - 5.5.2 Dimensional accuracy : Yes/No
- 5.6 Concrete
 - 5.6.1 Mix of concrete : M20/Design Mix
 - 5.6.2 Batching : Weigh batching/Volume batching
 - 5.6.3 Compaction : Vibrators/Thappies and rods
 - 5.6.4 Workability : Low / Medium / High
 - 5.6.5 Availability of water : Optimum/Sufficient / Insufficient
 - 5.6.6 Curing : Satisfactory/Unsatisfactory.
- 5.7 Reinforcing Steel
 - 5.7.1 Type of Steel : Plain mild steel/HYSD bars
 - 5.7.2 Source : Authorised Dealer/Market
 - 5.7.3 Whether IS marked : Yes/No
 - 5.7.4 Conditions of bars : Clean/Corroded
 - 5.7.5 Fixing of reinforcement as per drawing : Yes/No
 - 5.7.6 Suitable cover : Yes/No
 - 5.7.7 Spacing of bars : Regular/Irregular
 - 5.7.8 Overlaps as per specifications : Yes/ No
- 5.8 Form Work
 - 5.8.1 Type of Form Work : Timber / Plyboard/ Steel
 - 5.8.2 Use of mould oil : Yes/No
 - 5.8.3 Leakage of cement slurry : Observed/Not observed
- 5.9 Source
 - 5.9.1 Cement
 - 5.9.2 Sand
 - 5.9.3 Coarse Agg.
 - 5.9.4 Bricks
 - 5.9.5 PCC blocks.
- 6 Seismic resistance features
 - 6.1 Masonry Structures
 - 6.1.1 Provision of bands at Provided Adequate
 - 6.1.1.1 Plinth level Yes/No Yes/No
 - 6.1.1.2 Sill level Yes/No Yes/No
 - 6.1.1.3 Lintel level Yes/No Yes/No
 - 6.1.1.4 Roof level (if applicable) Yes/No Yes/No
 - 6.1.2 If sloped Roof, whether seismic bands are provide at
 - 6.1.2.1 Gable wall top Yes/No Yes/No

6.1.2.2 Eaves level	Yes/No	Yes/No
6.1.3 Provision of vertical steel in masonry at	Provided	Adequate
6.1.3.1 Each corner	Yes/No	Yes/No
6.1.3.2 Each T-junction	Yes/No	Yes/No
6.1.3.3 Each door joint	Yes/No	Yes/No
6.1.3.4 Around each window	Yes/No	Yes/No
6.1.4 Openings		
6.1.4.1 Total width of openings		: <50%/50*-60%/>60% (* -42% for double storey)
6.1.4.2 Clearance from corner		: OK/Not OK
6.1.4.3 Pier width between two openings		: OK/Not OK

6.2 Framed Structures

6.2.1 Ductile detailing		
6.2.1.1 Spacing of stirrup		: OK/Not OK
6.2.1.2 Sizes of members		: OK/Not OK
6.2.1.3 End anchorage		: OK/Not OK
6.2.1.4 Lapping (length, location etc.)		: OK/Not OK
6.2.1.5 Angle of stirrup hook		: 90 / 135 degrees

6.3 Any testing carried out by Owner/Engg. Supervisor on

Testing done Testing results

6.3.1 Water	Yes/No	OK/Not OK
6.3.2 Cement	Yes/No	OK/Not OK
6.3.3 Bricks/PCC blocks/Stones	Yes/No	OK/Not OK
6.3.4 Aggregate	Yes/No	OK/Not OK
6.3.5 Mortar	Yes/No	OK/Not OK
6.3.6 Concrete	Yes/No	OK/Not OK
6.3.7 Reinforcement	Yes/No	OK/Not OK

ANNEXURE- VIII

(For completed buildings)

STRUCTURAL INSPECTION REPORT

(This form has to be completed by registered Structural Designer after his site Inspection and verification regarding compliance of all recommendation by the owner, which in the opinion of the registered structural designer are necessary for safety of the structure)

I. Description by title and location of the property including T.P.No., F.P.No. etc.

II. Name of the present owner :

III. Description of the structure :

Class I or Class II (Briefly describe the property in general and the structure in particular)

(a) Function	(b) Framed construction							
	Residence (with or without shops)	Apartments (with or without shops)	Office Bldg.	Shopping Centre	School, College	Hostel	Auditoria	Factory
1	2	3	4	5	6	7	8	9
A. Load bearing masonry wall construction								
B. Framed structure Construction								
Construction and structural materials	Critical load bearing element	Brick	RCC	Stone	Timber	Steel		
	Roof Floor	RCC	Timber	RBC	Steel	Jackarch		

IV. Year of construction

Year of subsequent additions or rectification's (Please describe briefly the nature of additions or rectification's). :

V. Date of last inspection report filed : Last filed by whom:
(This does not apply to the first report).

VI. Soil on which building is founded :

- i) Any change subsequent to construction :
- ii) Nearby open excavation :
- iii) Nearby collection of water :

- iv) proximity of drain :
- v) underground water-tank :
- vi) R.W. Pipes out-lets :
- vii) Settlements :

- VII. The Super-structure (R.C.C. Frame structure)
- i) Crack in beam or column nature and extent of crack:
probable causes.
 - ii) Cover spell :
 - iii) Exposure of reinforcement
 - iv) subsequent damage by user for taking pipes, conduits, hanging, fans or any other fixtures, etc.: :
 - vi) Crack in slab :
 - vii) Spalling of concrete or plaster of slab :
 - viii) Corrosion of reinforcement :
 - ix) Loads in excess of design loads :

- VIII The Super-Structure (Steel Structure)
- i) Paintings :
 - ii) Corrosion :
 - iii) Joint, nuts, bolts, rivets, welds, gusset plates :
 - iv) Bending or buckling of members :
 - v) Base plate connections with columns or pedestals :
 - vi) Loading :

- IX. The Super-Structure (Load bearing masonry structure)
Cracks in masonry walls)
(Please describe some of the major cracks, their nature, :
extent and location, with a sketch, if necessary.

- X. Recommendations if any :
This is to certify that the above is a correct representation of facts as given to me by the owner and as determined by me after Site Inspection to the best of my ability and judgment.

The recommendations made by me to ensure adequate safety of the structure are compiled with by the owner to my entire satisfaction.

(Signature of the Registered Structural Engineer)

Date: _____

Name of the registered structural Engineer:

Registration No.

Address:

ANNEXURE-X

Rapid Visual Screening of Indian Buildings for Potential Seismic Hazards

Seismic Zone - V

	Building Name: _____
	Use: _____
	Address: _____

	Pin: _____
	Other Identifiers: _____
	No. of Stories: _____
	Year Built: _____
	Total Floor Area (sq.m.): _____
	PHOTOGRAPH

Plan to Scale

OCCUPANCY	SITE	FALLING HAZARD
Resi: Ord/Imp. School	Max. Number of Persons	High W.T. (within 8 m)
Health Assembly Office	0-10 11-0 1-100 > 100	Liquefiable (if sandy soil)
Commercial Historic	Residents _____	Land Slide Prone
Emer. Service Industrial	Floating _____	
		Chimneys Parapets Cladding Other
		<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

Probable Maximum Grade of Damage

Building Type	Masonry Building				RC or Steel Frame Building				URM infill	Wood
	A, A+	B, B+	C, C+	D	C, C+	D	E, E+	F		
Damage grade in Zone V										

Note: +sign indicates higher strength hence somewhat lower damage expected than stated. Also average damage in one building type in the area may be lower by one grade point than the probable maximum indicated. Surveyor will identify the Building Type, encircle it, also the corresponding damage grade and tick mark the Recommendation.

Recommended Action:

<ol style="list-style-type: none"> 1) A, A+ or B, B+ : evaluate in detail for need of reconstruction or possible retrofitting to achieve type C or D. 2) C, C+ : evaluate in detail for need of retrofitting to achieve type D. 3) URM infill : evaluate for need of reconstruction or possible retrofitting to level D 	Surveyor's Signature: _____ Name: _____
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ANNEXURE-XI

SCHEDULE OF SUMMARY PRICE PROPOSAL

FOR PHASE-I

RATE SUBMITTED BY ENVIRONMENTAL RESEARCH & EVALUATION CENTRE (EREC), GUWAHATI

Sl. No.	Name of Activities	Unit (Per Sq.m. of building slab)	Amount (In `)	
			In figures	In words
1.	Technical Audit as per Annexure-VII (a) For buildings above G+2 up to a height of 15.8 m. from ground level (b) For buildings above height 15.8 m from ground level	(a) Upto 5000 sq.m.	9,000.00	Rupees Nine Thousand only
		(b) 5001-15000 sq.m.	18,000.00	Rupees Eighteen Thousand only
		(c) 15001-25000 sq.m	19,000.00	Rupees Nineteen Thousand only
		(d) Above 25000 sq.m.	20,000.00	Rupees Twenty Thousand only
2	Structural Inspection Report as per Annexure-VIII (a) For buildings above G+2 up to a height of 15.8 m. from ground level (b) For buildings above height 15.8 m from ground level	(a) Upto 5000 sq.m.	8,000.00	Rupees Eight Thousand only
		(b) 5001-15000 sq.m.	9,000.00	Rupees Nine Thousand only
		(c) 15001-25000 sq.m	10,000.00	Rupees Ten Thousand only
		(d) Above 25000 sq.m.	11,000.00	Rupees Eleven Thousand only

(Rates include service tax and other taxes as applicable)

ANNEXURE-XII

SCHEDULE OF SUMMARY PRICE PROPOSAL

FOR PHASE-II

RATE SUBMITTED BY ENVIRONMENTAL RESEARCH & EVALUATION CENTRE (EREC), GUWAHATI

Sl. No.	Name of Activities	Name of test required	Extent of Scope	Unit	Amount (In Rs.)	
					In figures	In words
1.	Pile	Pile Integrity Test	RCC reamed pile with or without bulb	Rs./Pile	1600.00	Rupees One Thousand Six Hundred only
2.	Foundation Structure	Hammer Test for Compressive test and quality of concrete. Checking of Reinforcement, alignment & compliance of design.	Pile cap, Strep footings, Tie beams up to plinth level	Rs./SqM.	300.00	Rupees Three Hundred only
3.	RCC structure from plinth to first floor	Hammer Test for Compressive test and quality of concrete. Checking of Reinforcement, alignment & compliance of design.	Columns, Beams, Slab, Staircase & Chajja	Rs./SqM.	250.00	Rupees Two Hundred Fifty only
4.	RCC structure from first floor to 5 th floor	Hammer Test for Compressive test and quality of concrete. Checking of Reinforcement, alignment & compliance of design.	Columns, Beams, Slab & Staircase	Rs./SqM.	200.00	Rupees Two Hundred only
5.	RCC structure from fifth floor to above	Hammer Test for Compressive test and quality of concrete. Checking of Reinforcement, alignment & compliance of design.	Columns, Beams, Slab & Staircase	Rs./SqM.	220.00	Rupees Two Hundred only

(Rates include service tax and other taxes as applicable)