

### Government of Nepal National reconstruction authority Singhadurbar, Kathmandu

# 2<sup>nd</sup> inspectio INSPECTION MANUAL

1<sup>st</sup> inspection

**Final inspection** 

## Houses that has been built under HOUSING RECONSTRUCTION PROGRAMME

for

December, 2016

# **INSPECTION MANUAL**

## for Houses that has been built under HOUSING RECONSTRUCTION PROGRAMME



## Government of Nepal National Reconstruction Authority

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## Background

On the basis of Grant distribution guidelines 2015, for the reconstruction of houses that were damaged by the earthquake of April 25, 2015, **Technical Inspection Guidelines** has been prepared which consists of the procedure of the grant distribution along with several number of forms for inspection application, inspection check sheet, correction/retrofitting order/inspection forms and so on. To facilitate the inspector and technical assistant team to check and use those forms Inspection guidelines has been prepared. The main objective of the Inspection guidelines is to provide information to the inspector about the minimum requirement, methodology to check the MRs. Moreover, depending upon the site condition it also provide number of methods and technology that can be incorporated to make the non-compliant houses into compliant.



**Technical Inspection Guidelines** 

## Definition

#### a. Technical Assistance Team means

The Engineers , Sub-engineers, Assistant Sub-Engineers or Trained masons who are mobilized by MOUD-DLPIU or other Partner Organizations for the purpose of providing technical support to the house owners/beneficiaries to construct the houses regarding earthquake safety and other right measures in VDC/Municipalities.

#### b. Inspection Team means

The team of Engineers, sub-engineers or Assistant Sub-engineers' team mobilized by MOUD-DLPIU in VDC/Municipalities to inspect and certify whether the ongoing construction of the houses are according to the National Building Code or Approved Minimum requirements

#### c. Inspection Supervision Team means

The team of supervisor engineer from MOUD-DLPIU to provide necessary guidance to the Inspection team and to re-inspect already inspected housed.

#### d. Third Party Monitoring Team

The engineers or technical team appointed from NRA or related donor agencies to check the overall quality of the reconstruction and the activities of Technical Assistance Team, Inspection team and Inspection Supervision Team.

#### e. Grant Agreement

The agreement between beneficiary and VDC/Municipality to receive the grant support for housing reconstruction based on grant distribution guidelines.

#### f. Plinth Band

The RCC, timber, Bamboo or other approved construction material band which is kept after the completion of the foundation covering the complete part of the wall should be understood as plinth band. Locally, it is also called DPC Band. After the completion of this level, technical inspection-1 is done.

#### g. Roof Level

The RCC, timber, Bamboo or other approved construction material band which is kept before keeping the beam for the construction of roof should be understood as roof level. After the completion of this band, technical inspection-2 should be done. For single story houses, technical inspection-2 is done after the construction of roof band. For two and more than two story houses, the technical inspection-2 is done before the floor construction of the first floor.

#### h. Construction Completion

The status of the completion of the construction according to the approved design/drawings. After the completion of the construction Technical Inspection-3 is done and Construction Completion Certificate is provided.

#### i. Earthquake resilient structure

The earthquake resilient houses constructed according to Nepal National Building code or Minimum Requirement formulated for reconstruction purpose or retrofitted according to the approved guidelines or code.

## Procedure

Part-A: Procedure to get approval of the drawings.

- 1. The House to be constructed has to be earthquake resilient
- 2. Selection of Design for reconstruction

1.1 While using the resource from Government, donors, NGO and INGOs, personal, institute for housing reconstruction, retrofitting and maintenance the house should be earthquake resilient and according to the building code.

2.1 The beneficiary should select the building during the period of enrollment camp and it should be mentioned in the PA.

2.2 The design that they have selected could be the design approved by NRA or the earthquake resilient design prepared by the beneficiaries themselves for the reconstruction. The design prepared by the beneficiaries should be within the building act 2055, but these buildings should be earthquake resistant and should follow national building code.

> (a) Category "A": Modern building to be built, based on the international state-of-the-art, also in pursuance of the building codes to be followed in developed countries.

> (b) Category "B": Buildings with plinth area of more than One Thousand square feet, with more than Three floors including the ground floor or with structural span of more than 4.5 meters.

> (c) Category "C": Buildings with plinth area of up to One Thousand square feet, with up to Three floors including the ground floor or with structural span of up to 4.5 meters.

(d) Category "D": Small houses, sheds made of baked or unbaked brick, stone, clay, bamboo, grass etc., except those set forth in clauses (a), (b) and (c)

3. Selected design has to be filled in fixed format 3.1 Under the housing reconstruction program, the beneficiaries should fill up the building typology that they are willing to construct during the enrollment camp using the form provided in annex 3. If the form was not filled during the enrollment camp then the detail description of the building should be filled during the period of inspection.

4. Drawing approval process for reconstruction 4.1 If the building typology is within the design catalogue approved by the NRA, then re approval from the VDC is not necessary

4.2 If design submitted design is under the point mentioned in no 2, but need to be constructed in municipality, the design must be re approved by following simple building permit procedure.

5. Certification of the design of the design is other than approved designs that then during the period of the first inspection the inspector should certify that the building is earthquake resistant.

Part B: Inspection procedure up to plinth level.

6.2 For these inspection the beneficiaries can fill the application form provided in annex 4.1 and the inspector should certify the site filling the form provided in annex 5.

7. Technical 7.1 After signing the grant distribution agreement for those who got approval for the reconstruction can ask for the technical Assistance support to construct the foundation by filling up the application be can form provided in annex 4.1. Similarly, the concerned VDC or requested municipality should inform the beneficiaries about the arrival during date of the Technical Assistance team to the site. The VDC or construction of municipality should send the technical assistance team in the foundation same assigned date.

7.2 The technical assistance team can give the feedback of the under constructed foundation, He/she should fill the form provided in annex 4.3 and it shall be the duty of House owner to follow the instruction.

7.3 If the beneficiaries is planning to construct the house in existing foundation he/she should start the construction only after suggestion from the Technical assistance team and approval from the Inspection team.

- 8. Apply for second plinth level, the beneficiaries should apply for the second installment. For that he/she should fill up the form provided in annex 4.2
- 9. Inspect and Certify the of inspection and assign the inspection team. The inspection team should use the form provided in annex 6 for the certification. One copy of that certification should be given to the beneficiaries and other copy to VDC/ municipality
- 10. Correction<br/>order<br/>necessary for<br/>foundation10.1 If the inspection team found that the construction is not<br/>within the minimum requirement, then he/she should give the<br/>correction order by filling up the form provided in annex 7

10.2 After completing the foundation and plinth level by adopting the corrective measures, the beneficiaries should get the construction certified by the inspection team.

11. Approval necessary for different design
11.1 If the beneficiaries want to construct the building other than the building that they have s during the period of enrollment camp, then they should give the application to the VDC/municipality using the form provided in annex 8. Similarly the VDC/ Municipality should also give the permission to construct the building by completing the procedure mentioned in point 4

11.2 But if some beneficiaries has started the construction without giving application, then he/she should follow the procedure mentioned in point 10 and get certification by the inspection team

12. House owner<br/>must be clear<br/>about the<br/>construction12.1 After completing the construction up to plinth level by<br/>following the point mentioned in no 10, the beneficiaries should be<br/>clear about the complete construction of the earthquake resistant<br/>building<br/>above

12.2 For this, the inspection team should provide the knowledge of the earthquake resistant construction to the house owner. To construct the earthquake resistant building the beneficiaries can get the technical guidance by the technical assistance team.

construction

certification

and

of that

foundation

13. In case of technical problems advice can be taken from Inspection supervision team and Technical Standardization Committee

MOUD-DLPIU

13.1 If the inspection team cannot judge and certify the building for the during inspection he/she should inform the Inspection Supervision team in DLPIU by filling the form provided in annex 6. If the building needs to be corrected then the inspection supervision team should give the correction order by filling up the form provided in annex 7, if the building can be certified then they should fill up the form provided in annex 6.

13.2 If the inspection supervision team of DLPIU cannot certify or recommend the correction then such type of buildings should be submitted to MOUD CLPIU and if CLPIU cannot decide then it should be sent to "Technical Standardization Committee" and should be decided

14. The technical inspection form provided in annex 6 for the certification of the technical inspection, copy of one form should be provided to the MOUD DLPIU for technical approval should be 14.2 MOUD DLPIU should check the details of documents of

14.2 MOUD DLPIU should check the details of documents of the annex 6 certification, make a list of the beneficiaries using annex 11, send it to MOFALD-DLPIU (or DDC) and recommend for the second installment

14.3 MOUD-DLPIU should assign the Inspection Supervision team for the inspection of the quality of the construction and progress of the work upon necessity

15. Disbursement of Second Tranche and Deposit in Bank Account
 15.1 The respective MOFALD-DLPIU will send the letter to the DTCO based on the recommendation from MOUD-DLPIU and VDC/Municipality to disburse the second installment amount to the beneficiaries account and the second installment amount will be deposited into bank account based on the recommendation from DTCO.

15.2 The beneficiary house owner can withdraw the amount as per necessity of construction of the house

#### Part C: Inspection procedure above plinth level.

- 16. Based on certification construction above plinth level can be done
- 17. Technical assistance can be taken for construction above plinth level

16.1 The beneficiaries can construct the houses under the provided certification based on annex 6. The further construction should not be carried out unless the beneficiaries get the certification. But the beneficiaries can start the construction before achieving the second installment.

17.1The beneficiaries can apply for the technical assistance for the further construction. He/she should give the application form using the form provided in annex 4.1. Similarly, the respective VDC/municipality should also assign the technical inspection team for the guidance on the basis of priority.

17.2 For the construction of the house the beneficiaries should use the trained mason and carpenters.

18. Technical Inspection and certification after the construction of roof level of one story house and first floor of multistory house

19. Correction order also can be given for the construction up to roof level of one story and first floor of multistory house. 18.1 After completion of the roof band of one story and the first floor of the multistory house, the beneficiaries should apply for the inspection of the house and third installment using the form provided in annex 4.2

18.2 VDC/ Municipality shall inform the date of the prioritized visit of the inspection team to the house owner for inspection

18.3 Inspection Team should use the form in Annex-10 to certify the house if the constructed house is according to earthquake resilient design and approved design

19.1 If correction has to be made, annex- 7 form is to be used by Technical Assistance Team informing about the things to be corrected.

19.2 The concerned house owner beneficiary shall take a help from the technical assistance team and correct and apply to the VDC/ Municipality using the annex 4.2 form

19.3 The Inspection Team shall inspect the house using Annex-10 on the assigned date.

19.4 If the DLPIU engineer cannot decide immediately and are confused in the decision then the inspection should be done from the one step up Inspection Supervision team using the annex-10 form for certification and annex-7 form for correction and inform the house owner.

continued

20. Certification, 20.1 After the process in point 18 and 19 the Inspection Team should Recommendation provide one copy of the certificate to the house owner and the other and **Disbursement** copy to VDC/ Municipality of Third Tranche 20.2 One copy of the Forms based on Annex 10 certified by Inspection Team or Inspection Supervision Team shall be sent from concerned VDC or Municipality office for technical approval to Ministry of Urban Development District Project Implementation Unit MoUD-DLPIU. 20.3 MOUD DLPIU should check the details of documents of the annex 10 certification, make a list of the beneficiaries using annex 11, send it to MOFALD-DLPIU (or DDC) and recommend for the second installment 20.4 MOFALD-DLPIU shall recommend and disburse the grant in the accounts of beneficiaries through DTCO. 21.1 Ministry of Urban Development District Project Implementation 21. Field Inspection Unit-MoUD-DLPIU can do field inspection if necessary by Inspection during in roof level of one story and supervision team on the basis of description based on annex-11 first floor level of forwarded form concerned VDC or Municipality multistory house 21.2 During the supervision by Inspection Supervision team if they find that the building is not constructed on the basis of approved drawing and requirement then the team can cancel the certification and can stop the grant. Construction 22.1 After receiving the certification letter in accordance with point no 22. above the roof 20 by respective beneficiary house owner can construct the roof of one level of single story storey building or floor of multi-storey building as per approved design. In accordance with the certification letter construction of roof or and first floor level of multistory construction of floor can be done before receiving the third tranche. building can be

22.2 But According to point no 20 deployed supervision team of Ministry of Urban Development, District Project Implementation Unit (MoUD-DLPIU) or as specified in bottom Part (f) deployed third-party monitoring Authority will inspect the house, if during the inspection or supervision any constructed house of beneficiary house owner is found to be unsafe or not as approved design then the tranche amount will be pending and the respective beneficiary will have to correct as specified by that team.

#### Part D: Process of Inspection of housing reconstruction completion

23. Apply for getting the completion certificate after completing the roof of one story house 23.1 For construction of one storey house respective house owner should constructed the roof as mentioned in certification as Annex-10 by the inspection team ,after that house owner should fill the application form as Annex 4.2 for construction completion certificate and submit to the respective VDC or municipality office

23.2 Respective VDC or municipality office should prioritize the application and manage the time to inspect by the inspection team

24. Certify the house<br/>after the completion of<br/>roof of one story house24.1 The inspection team should inspect and fill the form as<br/>specified in Annex-12 and if the constructed house is found<br/>to be as approved design and earthquake resilient then it is<br/>recommended for "House reconstruction completion<br/>certificate"

24.2 Based on the recommendation Inspection supervision team can supervise as needed and provide "House reconstruction completion certificate" as annex-13.

25. Correction order can be given if any correction has to be done in the completed house

26. Apply for the inspection and certification of the multistory house after completing the roof of ground floor and base of first floor

25.1 According to above point no (23) inspection teams or inspection supervision team will observes the house but if the house is not reconstructed according to approved design, Ministry of Urban Development, District Project Implementation Unit (MoUD-DLPIU) inspection teams, or Inspection Supervision team will fill the from in accordance to Annex-7 and mention the things that needs to be improved and provide to beneficiary house owner

25.2 The respective beneficiary house owner can take the help of technical team and improve as suggested then again as mentioned above in Annex-11form is filled and submitted to the VDC or municipality office, while VDC or municipality will also follow the same procedure immediately and inspect the house if the house is found to be repaired as suggested then as mentioned in Annex-13 "House reconstruction completion certificate" should be provided.

26.1 The house owners who construct multiple story houses should construct the houses based on the approved design and apply to the VDC using the form in annex 4.2 to request for certification and approval of construction above it. The VDC/ Municipality shall prioritize and send the Inspection Team for inspection

26.2 If the construction is according to the approved design and safe the certification should be provided using Annex-11and if it is to be corrected annex-7 form is used.

27.Building completion certificate after the completion of multistory house construction 27.1 In case of multistory construction, the procedure on the point 24 needs to be followed and after all the construction is complete, the process on the point 26 is followed and VDC/ Municipality can provide the construction completion certificate

27.2 During construction of upper story the house owner can take the technical assistance applying to the VDC using the form in Annex- 4.1 and VDC/ Municipality shall send the Technical Assistance team based on the priority on the assigned date.

27.3 Based on that completion certificate only, the concerned house owner can receive the recommendation for support through different organizations.

#### Part- (E): Inspection Process for Retrofitting/ Maintenance

| 28. Application for<br>retrofitting/mainten<br>ance and<br>certification        | 28.1 The house owners who do the retrofitting/ maintenance should fill up the application form attached in the annex 4.2 and apply to the VDC/ Municipality   |  |  |
|---|---|--|--|
|   | 28.2 the VDC/ Municipality shall manage the Inspection Team in priority on the assigned date  |  |  |
|   | 28.3 The Inspection Team should visit the site and recommend for<br>the certification and based on that the technical supervision team<br>shall visit the site and provide the certification.   |  |  |
| 29. Correction order can be given   | 29.1 If house is not repaired or retrofitted based on approved standards after inspection in clause number 27, inspection team of MOUD-DLPIU will give instructions by filling form of ANNEX-7  |  |  |
|   | 29.2 After improvement on previously done retrofit/repair as per instruction, concerned house owner will get Certificate of completion retrofit/repair as according to clause 28  |  |  |
|   | 29.3 Only after this certificate, concerned house owner will get the recommendation or facilities provided by VDC or Municipality or Concerned Government Agencies.   |  |  |
| 30. Technical<br>assistance can be<br>taken for<br>retrofitting/mainten<br>ance | 30.1 If any earthquake victim house owners give application to concerned VDC or Municipality after realizing the need of repair or retrofit, concerned VDC or Municipality should provide technical support and related advices by mobilizing Technical Assistance Team |  |  |
|   | 30.2 If house owner give application according to ANNEX-4.2 after doing retrofit/repair as per advice of technical assistance team, retrofit/repair completion certificate should be provided after fulfilling procedure of clause 29.                                  |  |  |

27.Building completion certificate after the completion of multistory house construction 27.1 In case of multistory construction, the procedure on the point 24 needs to be followed and after all the construction is complete, the process on the point 26 is followed and VDC/ Municipality can provide the construction completion certificate

27.2 During construction of upper story the house owner can take the technical assistance applying to the VDC using the form in Annex- 4.1 and VDC/ Municipality shall send the Technical Assistance team based on the priority on the assigned date.

27.3 Based on that completion certificate only, the concerned house owner can receive the recommendation for support through different organizations.

#### Part- (E): Inspection Process for Retrofitting/ Maintenance

| 28. Application for<br>retrofitting/mainten<br>ance and<br>certification        | 28.1 The house owners who do the retrofitting/ maintenance should fill up the application form attached in the annex 4.2 and apply to the VDC/ Municipality   |  |  |
|---|---|--|--|
|   | 28.2 the VDC/ Municipality shall manage the Inspection Team in priority on the assigned date  |  |  |
|   | 28.3 The Inspection Team should visit the site and recommend for<br>the certification and based on that the technical supervision team<br>shall visit the site and provide the certification.   |  |  |
| 29. Correction order can be given   | 29.1 If house is not repaired or retrofitted based on approved standards after inspection in clause number 27, inspection team of MOUD-DLPIU will give instructions by filling form of ANNEX-7  |  |  |
|   | 29.2 After improvement on previously done retrofit/repair as per instruction, concerned house owner will get Certificate of completion retrofit/repair as according to clause 28  |  |  |
|   | 29.3 Only after this certificate, concerned house owner will get the recommendation or facilities provided by VDC or Municipality or Concerned Government Agencies.   |  |  |
| 30. Technical<br>assistance can be<br>taken for<br>retrofitting/mainten<br>ance | 30.1 If any earthquake victim house owners give application to concerned VDC or Municipality after realizing the need of repair or retrofit, concerned VDC or Municipality should provide technical support and related advices by mobilizing Technical Assistance Team |  |  |
|   | 30.2 If house owner give application according to ANNEX-4.2 after doing retrofit/repair as per advice of technical assistance team, retrofit/repair completion certificate should be provided after fulfilling procedure of clause 29.                                  |  |  |

#### Part- (F): Process of Third Party Technical Monitoring

31. Technical Monitoring through Third party for Reconstruction/ Retrofitting 31.1 For monitoring of reconstruct/retrofit or repair of private houses within specified time after fulfilling above mentioned clauses, NRA will manage monitoring of at least 5% of reconstruct/retrofit/repair required houses forming third party technical monitoring team. In which one percentage of the house will be same from Foundation to Completion and four percent house will done through random sampling.

31.2 The technical monitoring as mentioned in point 31.1, team can monitor reconstruction/Retrofitting or repair work anytime and concern house owner, VDC or municipality, offices, and other related government agency, concern person and other organization should support the monitoring team.

31.3 The formation process and monitoring procedure of the technical monitoring as mentioned in point 30 will be as per specified by NRA. The technical assistant team, technical inspection team, Technical supervision team and other related agency and person must make necessary improvement in private housing reconstruction work as per the recommendation of above mentioned technical monitoring team.

31.4 Authority will manage a third party monitoring team in coordination with donor agency or organizations who helped in private housing reconstruction and through them the concern donor agency or organization can monitor to know the situation of their own service operation

#### Part G: Process of inspecting the houses that are reconstructed before PA

**32.** Inspection of the houses which were constructed before PA

32.1 Reconstruction of the houses that have been done prior to private housing reconstruction grant agreement, inspection of the houses will be done from the same level of construction that have been completed. For this purpose, respective beneficiary house owner should fill the form for the same level and leave an application to related VDC or municipality office for inspection.

33. Certification or correction order for houses constructed before PA 33.1 Based on the application as mentioned in Point No. 34, inspection team will inspect the construction work at all levels. For relevant level, specified form must be certified and based on the specified form the team must give direction to the house owner of respective beneficiary regarding the improvement of the house

33.2 Also after the correction of the house by the respective beneficiary house owner, on the basis of application given to VDC, a inspection team and if required inspection supervision team concluded that specified improvement have been done, then this team must certify the reconstruction up to the relevant level. 33.3 Based on Point no 35.1 arrangement will be made on prescribed grant only on the basis of certification as given by the inspection team or inspection supervision team.

34. Grant will be provided based on the level of completion for houses already constructed before PA 34.1 Based on Point no 33 arrangement will be made on prescribed grant only on the basis of certification as given by the inspection team or inspection supervision team.

#### Part H: Management and use of information system

35. Management and Use 35.1 According to law mentioned above in various bullets to provide technical assistance in the rebuilding of private accommodation or technical inspection, supervision and monitoring of financial assistance, if possible, available information technology to use, and for this management information systems(MIS) shall be developed

35.2 According to the system the recommendations made by correspondence will also be recognized But in the case where there is no possibility to use information technology and information management system, through paperwork process (hard copy) shall not hinder the performance of its functions

#### Part I: The amendment in Guidelines

36. Guidelines can be amended 36.1 In the course of the implementation of this procedure, if any amendment is required, Executive Committee of the Authority may amend.

## Timing of execution of inspection





## Timing of execution of inspection





## Guidelines for Inspection form

## Sample of inspection sheet 1 Guidelines for Inspection form

Annex-3.2.a: Form: Inspection Sheet of Stone Masonry with Mud Mortar for First Inspection

| Ministry of Urban Development<br>Central Level Project Implementation Unit       Form No.       Grand Agreement I         3. 2. a :       -       -       -         Inspection Sheet of<br>Stone Masonry with Mud Mortar for First Inspection         Information of House Owner/Beneficiary         Name:       Date of Inspection       D       -       M         Address:       Date of Inspection       D       -       M       M         Address:       Date of Inspection       D       -       M       M         SECTION-I: DESCRIPTION PROVIDED IN THE APPLICATION TO SURVEY THE HOUSE         If free design by house owner       Technique and Construction material       1.1         Fill construction by loogy from P.A form       Construction of roaf and materials       2.1         Trained Masons used       LYES, INO       Soil type       IHard, IMedium,         Section I: DETAILED TECHNICAL INSPECTION         MR       Category       Description       Comply to MRs         VES       NO       Soil type       IHard, IMedium,         Individe susceptible Area         Incated       Steep Slope > 20°       Imadei Area       Imadei Area         Iocated       away from       Not more than one plus habitable attic  | No.                                  |
|--|--------------------------------------|
| Central Level Project Implementation Unit       3. 2. a :       -       -       -         Inspection Sheet of<br>Stone Masonry with Mud Mortar for First Inspection         Information of House Owner/Beneficiary       Date of Inspection       D       -       M       -         Address:       Date of Inspection       D       D       -       M       -         Address:       V0C/Municipality       ward       tole       Lead pick No         SECTION-I: DESCRIPTION PROVIDED IN THE APPLICATION TO SURVEY THE HOUSE         If use fix design from design catalogue,       Technique and Construction material       1.1         If ree design by house owner       Technique and Construction material       1.1         Technical Assistant       LYES,       INO       Organization       Gool,       INGO (         Trained Masons used       YES,       INO       Solid type       HHard,       Medium,         SECTION-II: DETAILED TECHNICAL INSPECTION       Scoreption       Comply to MRs       YES       NO         1       Site       See Slope > 20°  |                                      |
| Inspection Sheet of<br>Stone Masonry with Mud Mortar for First Inspection           Information of House Owner/Beneficiary         Date of Inspection         D         M           Name:         Date of Inspection         D         D         M           Address:         Date of Inspection         D         D         M         -           SECTION-I: DESCRIPTION PROVIDED IN THE APPLICATION TO SURVEY THE HOUSE         Und get No         SMM-           If use fix design throm design catalogue,         Technique and Construction material         1.1           Fill construction typology from P.A form         Construction of roof and materials         2.1           Technical Assistant         YES,         INO         Organization         Gool,         INGO (           Trained Masons used         YES,         INO         Soil type         Hard,         IMedium,           SECTION-II: DETAILED TECHNICAL INSPECTION         Geological fault or Ruptured Area         D         Comply to MRs           No.         Category         Geological fault or Ruptured Area         D         D           I site         Site selection         Steep Slope > 20°         D         D         D           1         Site         Site sologe > 20°         D         D         D         Comply to MRs   | · Y Y Y Y<br>1.1<br>□Soft<br>Remarks |
| Stone Masonry with Mud Mortar for First Inspection         Information of House Owner/Beneficiary       Date of Inspection       D       D       -       M         Name:       Date of Inspection       D       D       -       M       ·         Address:       Date of Inspection       D       D       -       M       ·         Address:       Date of Inspection       D       D       -       M       ·         Address:       Date of Inspection       D       D       -       M       ·         Address:       Design No.       SMM-         If tree design from design catalogue,       Design No.       SMM-         If free design from design of modesign catalogue,       Construction of roof and materials       2.1         Technical Assistant       LYES,       NO       Organization       GoN,       NNGO (         Trained Masons used       LYES,       NO       Soil type       Hard,       IMedium,         SECTION-II: DETAILED TECHNICAL INSPECTION       Comply to MRs       No.       Comply to MRs       O         No.       Category       Description       Comply to MRs       O       O       Image: Category       Image: Category       Image: Category       Image: Category<  | . Y Y Y Y<br>1.1<br>                 |
| Date of Inspection         Name:       Date of Inspection       D       D       M         Address:       Date of Inspection       D       D       -       M       ·         Address:       Date of Inspection       D       D       -       M       ·         Address:       District       V00/Municipality       ward       tale       Land plot No         Section-I: DESCRIPTION PROVIDED IN THE APPLICATION TO SURVEY THE HOUSE         If use fix design from design catalogue,       Design No.       SMMM         If free design from design catalogue,       Technique and Construction material       1.1         Elitoonstruction typology from PA form       Construction of roof and materials       2.1         Technical Assistant       LYES,       INO       Organization       GodN,       INGO (         Trained Masons used       LYES,       INO       Soil type       IHard,       IMedium,         Section- II: DETAILED TECHNICAL INSPECTION       Comply to MRs       Consply to MRs       Image: Steep Slope > 20°       Image   |                                      |
| Mame:       Date of Inspection       D       -       M       M         Address:       Date of Inspection       D       -       M       M         Address:       Date of Inspection       D       -       M       M         Address:       Description       Design No.       SMM         If recention design catalogue,       Design No.       SMM         If recention design of modesign catalogue,       Design No.       SMM         If free design by house owner       Technique and Construction material       1.1         Fill construction typology from P.A form       Construction of roof and materials       2.1         Section:       ONO       Organization       GoN,       NGO (         Site       Section:       O       Solid type       Hard,       Medium,         Steep Slope > 20°       Image: Comply to MRs       YES       NO         No.       Category       Description       Comply to MRs       YES       NO         I andside susceptible Area       Image: Comply to MRs       YES       NO       Image: Comply to MRs       YES       NO         1 and side susceptible Area       Image: Comply to MRs       YES       NO       Image: Comply to MRs         2 an of Wall  | 1.1<br>Soft Remarks                  |
| Name:       Date of mspection       Display of mspection         Address:       Detrict       VOC/Muniapelity       ward       tole       Land plot No         SECTION-I: DESCRIPTION PROVIDED IN THE APPLICATION TO SURVEY THE HOUSE         If use fix design from design catalogue,       Design No.       SMM-         If free design by house owner       Technique and Construction material       1.1         Fill construction typology from P.A form       Construction of roof and materials       2.1         Trained Masons used       YES,       INO       Organization       GoN,       INGO (         SECTION-II: DETAILED TECHNICAL INSPECTION       Soil type       Hard,       Medium,         SECTION-II: DETAILED TECHNICAL INSPECTION       Geological fault or Ruptured Area       Image: Comply to MRs         No.       Category       Description       Comply to MRs         Steep Slope > 20°       Image: Comply to MRs       Image: Comply to MRs         No.       Geological fault or Ruptured Area       Image: Comply to MRs         Steep Slope > 20°       Image: Comply to MRs       Image: Comply to MRs         VEX.fall Area       Image: Comply to Mark and Water logged Area       Im   | 1.1<br>Soft Remarks                  |
| Neuross.       Destrict       VDC/Municipality       ward       tole       Lund plot No         SECTION-I: DESCRIPTION PROVIDED IN THE APPLICATION TO SURVEY THE HOUSE         If use fix design from design catalogue,       Design No.       SMM-         If free design by house owner       Technique and Construction material       1.1         Fill construction typology from P.A form       Construction of roof and materials       2.1         Trained Masons used       IYES,       INO       Organization       GoN,       INGO {         Trained Masons used       IYES,       INO       Soil type       IHard,       IMeclium,         SECTION- II: DETAILED TECHNICAL INSPECTION       Soil type       IHard,       IMeclium,         Steep Slope > 20°  | 1.1<br>)<br>Soft<br>Remarks          |
| SECTION-I: DESCRIPTION PROVIDED IN THE APPLICATION TO SURVEY THE HOUSE         If use fix design from design catalogue,       Design No.       SMM-         If rece design by house owner       Technique and Construction material       1.3         Fill construction typology from P.A form       Construction of roof and materials       2.1         Technical Assistant       IYES,       INO       Organization       GoN,       INGO {         Trained Masons used       IYES,       INO       Solit type       IHard,       IMedium,         Section-II: DETAILED TECHNICAL INSPECTION         MR       Category       Description       Comply to MRs         No.       Category       Description       YES       NO         I site selection located away from       Geological fault or Ruptured Area       Image: Comply to MRs       Image: Comply to MRs         No.       Shape of House       No. of storey       River bank and Water logged Area       Image: Comply times than one plus habitable attic       Image: Comply times than one storey.       Image: Comply times than one storey.         2       Shape of House       Not more than 12.5ims thickness of wall and not more than I       Image: Comply times thickness of wall and not more than I       Image: Comply times thickness of wall and not more than I       Image: Compore than 12.5ims thickness.50 mm(2''), length/Breadth.5   | 1.1<br>)<br>Soft<br>Remarks          |
| If use fix design from design catalogue,       Design No.       SMM-         If free design by house owner       Technique and Construction material       1.1         Fill construction typology from P.A form       Construction of roof and materials       2.1         Technical Assistant       IYES,       INO       Organization       GoN,       INGO (         Trained Masons used       IYES,       INO       Soil type       IHard,       IMedium,         SECTION-II: DETAILED TECHNICAL INSPECTION       Sector       Image: Comply to MRs       YES       NO         MR       Category       Description       Comply to MRs       YES       NO         Site       Selection       Geological fault or Ruptured Area       Image: Comply to MRs       YES       NO         Indiside susceptible Area       Image: Comply to MRs       Steep Slope > 20°       Image: Comply to MRs       YES       NO         Indiside susceptible Area       Image: Comply to MRs       Image: Comply to MRs       Image: Comply to MRs       Image: Comply to MRs         No. of storey       Description       Geological fault or Ruptured Area       Image: Comply to MRs       Image: Comply to MRs       Image: Comply to MRs         Not more than 12       Image: Comply to MRs       Geological fault or Ruptured Area       Image: Comply to MRs<   | 1.1<br>)<br>Soft<br>Remarks          |
| If free design by house owner       Technique and Construction material       1.1         Fill construction typology from P.A form       Construction of roof and materials       2.1         Technical Assistant       IYES, INO       Organization       GoN, INGO (         Trained Masons used       IYES, INO       Soil type       IHard, IMedium,         SECTION-II: DETAILED TECHNICAL INSPECTION       Comply to MRs         MR       Category       Description       Comply to MRs         Site       Selection       Geological fault or Ruptured Area       Image: Comply to MRs         Site       selection       Icaded away from       Geological fault or Ruptured Area       Image: Comply to MRs         No.       Site       Steep Slope > 20°       Image: Comply to MRs       Image: Comply to MRs         Indicated       Rock-fail Area       Image: Comply to MRs       Image: Comply to MRs       Image: Comply to MRs         Indicated       Rock-fail Area       Image: Comply to MRs       Image: Comply to MRs       Image: Comply to MRs         Indicated       Rock-fail Area       Image: Comply to MRs       Image: Comply to MRs       Image: Comply to MRs         Indicated       Rock-fail Area       Image: Comply to MRs       Image: Comply to MRs       Image: Comply to MRs       Image: Comply to MRs       Image: C   | )<br>Soft<br>Remarks                 |
| Fill construction typology from P.A form       Construction of roof and materials       2.1         Technical Assistant       IYES, INO       Organization       GoN, INGO {         Trained Masons used       IYES, INO       Soil type       Hard, IMedium,         SECTION-II: DETAILED TECHNICAL INSPECTION       Comply to MRs         MR       Category       Description       Comply to MRs         YES       NO       Second Area       Image: I   | )<br>Soft<br>Remarks                 |
| Trained Masons used       LYES,       LNO       Organization       LGON,       LNOO (         Trained Masons used       LYES,       NO       Soil type       Hard,       Medium,         SECTION-II: DETAILED TECHNICAL INSPECTION       Comply to MRs         MR       Category       Description       Comply to MRs         MR       Category       Geological fault or Ruptured Area   | Soft<br>Remarks                      |
| Mained Misson's dsed       Enco       Solitype       Enrational product of the solity of the solit   | Remarks                              |
| MR<br>No.       Category       Description       Comply to MRs         1       Site<br>selection<br>located<br>away from       Geological fault or Ruptured Area   | Remarks                              |
| No.     Category     Description     Vest Null       1     Site<br>selection<br>located<br>away from     Geological fault or Ruptured Area   | Remarks                              |
| 1       Site<br>selection<br>located<br>away from       Geological fault or Ruptured Area  |                                      |
| 1       Site<br>selection<br>located<br>away from       Steep Slope > 20° <ul> <li>Landslide susceptible Area</li> <li>River bank and Water logged Area</li> <li>River bank and Water logged Area</li> <li>Liquefaction susceptible Area</li> <li>Liquefaction susceptible Area</li> <li>Rock-fall Area</li> <li>Liquefaction susceptible Area</li> <li>Rock-fall Area</li></ul>   |                                      |
| 1       Site<br>selection<br>located<br>away from       Landslide susceptible Area       Image: Constraint of the selection of   |                                      |
| 1       Site<br>selection<br>located<br>away from       River bank and Water logged Area       Image: Constraint of the sector of the s  |                                      |
| Selection       Rock-fall Area       Image: Constraint of the selection of t  |                                      |
| away from       Liquefaction susceptible Area  |                                      |
| 2       No. of storey       RC band       Not more than one plus habitable attic       Immediate   |                                      |
| 2     Shape of<br>House     No. of storey     Ite band<br>Timber band     Not more than one storey.     Image: Span of Wall       Span of Wall     Span of Wall     Not more than 12 times thickness of wall and not more than<br>4.5m. (14'9')     Image: Span of Wall     Image: Span of Wall       Proportion     Simple and regular shape as square and rectangular     Image: Span of Wall     Image: Span of Wall       Proportion     Simple and regular shape as square and rectangular     Image: Span of Wall       Stone     Avoid round, easily breakable soft stone<br>Size: Thickness>50mm(2''), length/Breadth>150mm(6'')     Image: Span of Wall       Mud mortar     Free from organic materials, pebbles,     Image: Span of Wall  | <u> </u>                             |
| 2       Shape of House       Span of Wall       Not more than 12 times thickness of wall and not more than 1       Image: Constraint of the state   |                                      |
| 2     House     Size of room     Not more than 13.5sq.m (145'4"sq.ft)  |                                      |
| Proportion     Simple and regular shape as square and rectangular     □       The length is not more than 3 times of its width     □       Stone     Avoid round, easily breakable soft stone<br>Size: Thickness>50mm(2"),length/Breadth>150mm(6")     □       Mud mortar     Free from organic materials, pebbles,  |                                      |
| Proportion     The length is not more than 3 times of its width     Image: Comparison of the length is not more than 3 times of its width       Stone     Avoid round, easily breakable soft stone<br>Size: Thickness>50mm(2"),length/Breadth>150mm(6")     Image: Comparison of the length is not more than 3 times of its width       Muid mortar     Free from organic materials, pebbles,     Image: Comparison of the length is not more than 3 times of its width     Image: Comparison of the length is not more than 3 times of its width  |                                      |
| Stone     Avoid round, easily breakable soft stone<br>Size: Thickness>50mm(2"),length/Breadth>150mm(6")     Image: Comparison of the state sta                                 |                                      |
| Mud mortar Free from organic materials, pebbles,   |                                      |
|  | 1                                    |
| Mortar hard materials.   |                                      |
| 3 Materials Cement mortar  |                                      |
| Concrete     M15grade (1 cement: 2 sand: 4 aggregate)     Image: Concrete  |                                      |
| Rebar         fy = 415 Mpa /500 Mpa         Image: Control of the second   |                                      |
| Timber Hard wood   | <u> </u>                             |
| Continuous strip footing   |                                      |
| 4 Foundation Depth below GL 750mm(2/67),Medium≥750mm(2/67),Hard≥750mm(2/67)  |                                      |
| Base wildth  |                                      |
| Started right from the foundation  | <u> </u>                             |
| 5 Vertical Reinforcement Placed at all corners, junctions of walls and openings (3") x 100mm (4") for corner. Two member of 75mm (3") x 100mm (4") for corner.   |                                      |
| Apphorpage 60 times diameter of reinforgement  |                                      |
| Height from GL Not less than 300mm(1') from GL   |                                      |
| Thickness 150mm (6") for medium and soft soil. 75mm(3") for hard soil  |                                      |
| Width Not less than wall thickness/350mm   | 1                                    |
| 6 Plinth Reinforcement Reinfor |                                      |

## Guidelines for Inspection form Sample of inspection sheet 2

Annex-3.2.a: Form: Inspection Sheet of Stone Masonry with Mud Mortar for First Inspection

a) After the detail description of the under constructed house, is it satisfactory to give permit for the further construction. Yes , No

If it is satisfactory, then please provide Inspection certificate based on Annex-2, if not please order for correction based on Annex-4

b) If found unsatisfactory, what are the things that need to be improve:

1..... 2..... 3.... 4....

Others:

1. At least four number of photographs with their number

| 2. T | entative. | drawings | of building: |
|------|-----------|----------|--------------|

| c) | I agreed the above result of inspection conducted by the inspector. | Yes 🗌 , No 🗌    |
|----|---|-----------------|
|    | House owner/Beneficiaries or representative: Name:                  | Signature:      |
|    | Relationship with house owner (In case of representative):          | Date:           |
|    |   |                 |
|    | Inspected by: Name:   | Signature:      |
|    | Approved by: Name:  | Signature:      |
|    | Note:<br>• Different forms are available for different              | building types. |

Use appropriate form

## Methodology to fill inspection form

All dimension should be in mm.

- Black ball pen should be used while filling form.
- ✤Grant Agreement No. is number given during Participation Agreement.
- Design No. is number given in Participation Agreement form ie.
  - 1.1 1.1 Stone masonry with mud mortar
  - 1.2 
    ☐ Stone masonry with cement mortar
- ✤ If free design by houseowner, Technique and Construction material-Construction Typology should be filled from P.A form.
- ◆ Technical assistance- If consultation or Supervision is done with Technical Asistance while construction then tick in yes otherwise tick in No.
- ◆ Organization- If Technical Asistance with whom consultation is done is from GON then tick ☑ in GON otherwise tick ☑ in NGO and specify the name of NGO.
- ◆ Trained Mason While Constructing if Trained Masons were used then tick 
  in Yes otherwise tick 
  in No.
- Soil Type Tick ✓ on the soil type that is identified before construction.
- ♦ Check Box- Tick Inspection if comply to MRs otherwise tick in No check box.

◆ After the detail description, how to judge - After the detail description in above Check box if any of item is found to be non comply with MRs then tick in No otherwise tick in Yes.

 If found unsatisfactory , comments –Things that are needed to be improved should be noted ie.

-Shape and size of house

-No. of bars if inspection is done before casting concrete

Others- Sample of photographs to be provided as shown in next page.

-Tentative Drawings of building should be sketch in case of load bearing as shown in next page and approved drawing from respective municipality should be checked in case of RCC building.

◆ Acceptation and signature – House owner should tick ☑ on yes if he/she accept the above result of inspection conducted by the inspector otherwise should tick ☑ on No and signature should be doned.

## Sample of tentative drawing of building



Note:

- Tentative plan and section of the drawings should be drafted.
- All the dimension of building must be clearly mentioned in the drawings.
- The unit of the drawings should be in mm.

### **Guidelines for Inspection form**

## Sample of Photographs



At least four number of photographs for each inspection with their number



## 1. Site selection

### Minimum Requirements for all building

| No. | Category       | Sub-category                | Description                                    |
|-----|----------------|-----------------------------|--|
| 1.  |                |                             | Geological fault or rupture areas              |
|     |                |                             | Landslide susceptible areas                    |
|     |                | Site should be<br>away from | Steep Slope > 20° (1:3, Vertical : Horizontal) |
|     | Site selection |                             | Filled areas                                   |
|     |                | ,                           | Liquefaction susceptible Area                  |
|     |                |                             | River bank and Water logged Area               |
|     |                |                             | Rock fall Area                                 |

A building shall not be constructed if any of the following conditions exist. If it is in these areas, consult with expert.

### 1.1 Geological faults or rupture areas:

It can be identified by the site observation and site survey.



### **1.2** Landslide susceptible areas:

Site Observation and site survey is done to know the site history, possibility of the disaster and identification the suitability of the land for the construction.

Note: If the detail soil investigation report of landslide is not available, the building should be at least 15m away from the toe and crust of the slope.



### 1. Site selection

### 1.3 Steep slope:

The slope of land can be identified by the measurement.

- a) Materials to be used for rope and line level: Wooden pegs 2pcs or staff, line level, hammer, measuring tape, string
- b) Steps:



- 1) Wooden pegs (A and B) are digged in both side of slope land at a horizontal distance of 2.5m using hammer.
- 2) Place string at the ground level of wooden peg A and tighten the string at wooden peg B.
- 3) Placed the spirit level at the middle of string and adjust it.
- 4) Now ,Measure the distance between two pegs and measure its different height. Slope, $\Delta = tan^{-1}(\frac{h}{2\pi})$

using pipe: Instead of using string and line level, small filled water hose can be used. Here, the two end of the water hose is kept at the base of peg A and B. The end of the hose kept in peg B is uplifted until the bleeding of water is stopped. The water level is measured from the base of peg B to find the height (h). The gradient of the land is identified using same technique described in step 4.



### 1.4 Filled area:

It can be identified by the observation and questionnaires survey to the house owner and neighbor. Incase if there is doubt on filled soil ,the surrounding ground level and texture of soil is checked.

#### Procedure:

Dig trench of 1m if plastic, small pieces of cotton or other materials, difference in soil are found then the site should be considered as filled soil.

Note: In case of Filled Land, the soil should be tamped and the depth of foundation should be 0.6m (2 ft) below the original ground level.



### 1.5 Liquefaction susceptible area :

It can be identified by different technique. Among that soil test can be implemented in the field. Liquefaction usually occurs in saturated soil. The saturation of the soil can be identified by the observation and test.

Procedure:

A handful of soil is squeezed, if some (muddy) water will run between the fingers then the soil is considered as saturated soil.



Liquefaction susceptible Area

Note: If the building is to be built in a land susceptible to liquefaction, tie beam is necessary to be provided for Category "C "type buildings. For buildings with category "A" and "B" up to 3 stories, calculation showing no overturning effect is necessary and foundation tie band is a must. For other buildings detail soil investigation is required.

### 1.6 River bank and water logged area:

It can be identified by the observation.

Note: If the site is located in the River bank and Water logged area its distance from the main river, small river and stream should be >30m (98.42 ft), >30m (98.42 ft) >20m (65.62 ft) respectively.



### 1.7 Rock-fall areas:

It can be identified by observation and questionaries' survey of the site history.



### 1. Site selection











W= Base width
X= min. 2T OR 1.0m
whichever is more
H≤0.3m
Φ= max. 20°
V≤1.0m without provision
of retaining wall

#### Foundation in slope profile

The land should be flat. If the site is in slope land, the construction shall be done by excavating the land in different level (Length 1 m (3.28 ft) and Height 0.3048m (1 ft)). If the site is steep then retaining wall should be constructed.

## 2. Shape and size

### Minimum Requirements for Masonry structure

| No. | Category                      | Sub-category                 |         | Description  |  |
|-----|-------------------------------|------------------------------|---------|--|--|
|     |                               | No. of<br>storey             | SMM/BMM | RC band  | Not more than one plus habitable attic.  |
|     |                               |                              |         | Timber band  | Not more than one storey.  |
|     |                               |                              | SMC/BMC | Not more than two plus attic   |  |
|     | 2. Shape and size of building | Clear span of wall           |         | Not more than 12 times thickness of wall and not more than 4.5m.   |  |
|     |                               | Shape and size Size of room  |         | Not more than 13.5sq.m.  |  |
| 2.  |                               | f building<br>Height of wall |         | Floor height shall not be more than 3.0m.<br>In case of attic floor, maximum height from floor level to ridge<br>level shall be 1.8m and maximum height from floor level to eave<br>level shall be 1.0m. |  |
|     |                               | Prop                         | ortion  | Simple and regular sha<br>The length of house sh<br>Avoid setbacks.  | aped as square and rectangular.<br>nall not be more than 3 times of its width. |

### 2.1 No. of storey:

It can be checked by the observation and measurement. In case of BMM and SMM, if the additional storey has been constructed the written document provided by the expert should be checked.

### 2.2 Clear span of wall:

It can be identified by measurement. Incase of BMM and SMM, First the thickness of the wall is measured and as mentioned in the minimum requirement the calculation is done. The clear span of room is measured to check the calculated value.

### 2.3 Size of room:

The length and breadth of the inner wall is measured to calculate the area of the room whereas to check the proportion the exterior length and width of the wall is measured.

### 2.4 Height of wall:

Measurement is done to check the floor height, height from the floor to eave and ridge level.

### 2. Shape and size

## Masonry structure


## **3. Materials** Minimum Requirements for all building

| No. | Category  | Sub-c    | ategory         | Descript  | ion   |  |
|-----|-----------|----------|-----------------|---|---|--|
|     |           | Stone    |                 | Avoid use of rounded, subrounded, easily breakable soft stone and<br>boulder stones in its natural shape. River stone shall be dressed.<br>Size of stone shall not be smaller than 50mm in thickness and 150mm<br>in length or breadth. |   |  |
|     |           | Brick    |                 | Overburnt, underburnt and deformed bricks shall not be used.<br>Shall have minimum crushing strength of 3.5 Mpa for construction.   |   |  |
|     |           | Mortar   |                 | Mud mortar  | Free from organic materials, pebbles,<br>hard materials.  |  |
| 3.  | Materials |          |                 | Cement mortar   | Cement sand mortar shall not be leaner<br>than 1:6 (1 part cement and 6 parts sand<br>by volume) for masonry. |  |
|     |           | Concrete | SMM/BMM         | It shall not be leaner than M15 grade concrete, or mix ratio 1:2:4.   |   |  |
|     |           |          | SMC/BMC/<br>RCC | It shall not be leaner than M   | 20grade concrete, or mix ratio of 1:1.5:3.  |  |
|     |           | Re       | ebar            | High strength deformed bars with fy = 415 Mpa /500 Mpa.   |   |  |
|     |           | Tir      | nber            | Well seasoned hard wood without knots shall be used for structural<br>purpose.<br>Timber treatment such as use of coal tar or any other preservative can  |   |  |

#### 3.1 Stone

- Dropping of stone from a height of 1m on the hard ground.
- ➢ Good quality stone doesn't break.
- Bad quality stone will break into pieces.



#### 3.2 Brick

- The colour of a good brick should be copper red. A yellowish tint and dark blackish blue colour on brick indicates that it is under burnt and over burnt respectively.
- Place two bricks in T shaped and drop it on the hard ground from the height of 1m.
- ➤ A high quality of brick doesn't break.
- Bad quality brick will break into pieces.





#### 3. Materials

#### 3.3 Mortar:

The mortar should not be easily scrapped away when struck by chisel or key. The scratch tester cannot be used until at least 7 days after construction and preferably 28 days after completion, this limits the application for use in quality control applications.



#### **3.4 Concrete:**

- Crack on the surface of concrete. (Crack in the concrete occurs due to excessive ratio of water and improper curing)
- Cover of concrete. (Cover of concrete is insufficient if the rebar is exposed)
- Surface of the concrete.(High quality of concrete surface is clean and smooth. Hole is created in surface of concrete due to excessive ratio of water and insufficient proportion of materials)

There are several technique to check the strength of the concrete. Among that the tapping method (non destructive technique) is simple and fast technique which can be adopted in the site. Steps:

- 1) On the concrete to be tested a smooth surface about 0.1m×0.1 m is chosen and cleaned with a wire brush.
- 2) Then a hammer 300-400 gms in mass is struck against the concrete from elbow height directly or through a metal worker's chisel placed at right angles to the tested surface.
- 3) Ten blows of average force are made at different points on the specimen. (The size of the mark left by the hammer or the chisel and the sound of the hammer stroke are indicative of the strength of concrete.) The strength of the concrete is identified with reference to

the data provided in the following table

| Strength of         |   | Test results  |  |  |
|---------------------|---|---|--|--|
| concrete<br>(N/mm²) | Blow of hammer upon<br>concrete surface                           | Blow of hammer upon chisel<br>placed at right angles to<br>concrete surface | Scratching by chisel                     |  |
| Below 6.0           | Sound toneless deep dent with<br>crumbling edges                  | Blow of hammer upon chisel<br>placed at right angles to<br>concrete surface | Concrete cuts easily and crumbles        |  |
| 6-10                | Sound slightly toneless. Dent has smooth edges, concrete crumbles | Chisel is easily driven into concrete                                       | Visible scratches 1-<br>1.5mm deep       |  |
| 10-20               | Sound clear whitish mark remains                                  | Thin scales split off round the mark  | Visible scratches no<br>deeper than 1 mm |  |
| Over 20             | Sound ringing metallic mark visible                               | Mark is not very deep   | Barely visible scratches                 |  |
| Source: http://ww   | w.engineeringcivil.com/visual-inspectio                           | n-of-concrete-structure.html  |  |  |

#### 3. Materials

#### 3.5 Rebar

- It can be checked by observation. Heavily rusted rebar should not be used.
- After rubbing the steel bar, if stain is present on fingers, but if the flakes doesn't come off then the rust is acceptable.
- The thickness of rebar is checked by using vernier caliper. Ductility of rebar can be checked by bending it at 90° and if small cracks are found ductility is insufficient.



Vernier Caliper



Heavily rusted rebar

#### 3.6 Timber

Wood can readily be identified as a hardwood or softwood by the following procedure:

- The colour of hardwood is dark brown and light brown in softwood.
- When the thumb nail is pressed against hardwood it will not leave a mark but when it is pressed in softwood and pull it along a surface it leaves a scratch mark. Deeper the mark, the softer the wood.
- Timber treatment can be identified by the observation or questionnaires survey with the house owner and mason.
- In general babul, black siris, Dhaman, Shisam, Jaman, Mesua, Oak, Sain, Sal, Sandan, Sisso, Teak, Khair is considered as hard wood.



When pressed by tip of nail leave a mark (Soft wood)



When pressed by tip of nail doesn't leave a mark (Hard wood)

Source: http://www.instructables.com/id/Hard-Wood-or-Soft-Wood%3F/

#### 3. Materials

#### Sand

Following are the properties of good sand.

- It should be chemically inert.
- In should be clean and coarse. It should be free from any organic or vegetable matter.
- It shouldn't contain salts which attract moisture from the atmosphere.

#### Sand Testing Technique

Following tests can be done to ascertain the quality of sand.

- Visibility test
- Check the sand for impurities such as organic materials. (mud, leaves, roots, etc)
- Field test

Silt content test

- Step: 1) Place the sample of sand into a cylinder or glass.
  - 2) Add clean water to the cylinder or glass till it covers the sand.
  - 3) Add some salt into the water.
  - 4) Shake the mixture vigorously.
  - 5) Allow the contents to settle for three hours.
  - 6) Measure the height of distinct layer formed at the top.
  - 7) This should be less than 8% of the volume of sand tested.
  - For detecting the presence of organic impurities in sand, the solution of sodium hydroxide or caustic soda is directly added to sand and it is stirred. If the colour of solution changes to brown, it indicates the presence of organic matter.
  - > The sand is actually tasted and from its taste, the presence of salt is known.
  - The sand is taken from a heap and is rubbed against the fingers. If fingers are stained, it indicates that sand contains earthy matter.
  - The colour of sand will indicate the purty of sand. The size and sharpness of grain may be examined by touching and observing with eyes.

#### **Coarse aggregate**

The coarse aggregate to be used should be hard, durable and clean. The aggregate should be completely free from lumps of cray or organic and vegetable matter, fine dust etc. National occurring stone aggregates and gravel, and brick aggregate are commonly used as coarse aggregates.





## 4a. Foundation

#### Minimum Requirements for Masonry structure

| No. | Category   | Sub-Categ  | ory         | Description   |  |  |  |
|-----|------------|------------|-------------|---|--|--|--|
|     |            | General    |             | t shall be countinous strip footing of uniform width at same level<br>throughout the foundation in flat area.<br>* If the building has to be constructed in existing foundation consult<br>with expert. |  |  |  |
|     |            | Depth of   | SMM/<br>BMM | lt shall not be le  | Il not be less than 750mm for one storey |  |  |
|     |            | below GL   | SMC/B<br>MC | .It shall not be le<br>storey.  | ess than 800mm f                         | or one storey, 900mm for two               |  |
|     |            |            |             | Soft soil   | Ν  | lot less than 800mm                        |  |
|     |            |            | SMM         | Medium soil   | Ν  | lot less than 750mm                        |  |
|     |            |            |             | Hard soil   | Ν  | lot less than 750mm                        |  |
|     |            |            |             | Soft soil   | N  | Not less than 750mm<br>Not less than 650mm |  |
|     |            |            | BMM         | Medium soil   | N  |  |  |
| 4   | Foundation | Base width |             | Hard soil   | N  | lot less than 550mm                        |  |
|     | roundation |            | SMC         | No. of Storey   |  | Type of soil                               |  |
|     |            |            |             | One storey  | Soft soil                                | Not less than 800mm                        |  |
|     |            |            |             |   | Medium soil                              | Not less than 600mm                        |  |
|     |            |            |             |   | Hard soil                                | Not less than 600mm                        |  |
|     |            |            |             |   | Soft soil                                | Not recommended                            |  |
|     |            |            |             | Two storey  | Medium soil                              | Not less than 800mm                        |  |
|     |            |            |             |   | Hard soil                                | Not less than 600mm                        |  |
|     |            |            |             |   | Soft soil                                | Not less than 650mm                        |  |
|     |            |            |             | One storey  | Medium soil                              | Not less than 550mm                        |  |
|     |            |            | DMC         |   | Hard soil                                | Not less than 550mm                        |  |
|     |            |            | BIVIC       |   | Soft soil                                | Not less than 900mm                        |  |
|     |            |            |             | Two storey  | Medium soil                              | Not less than 650mm                        |  |
|     |            |            |             | ,   | Hard soil                                | Not less than 550mm                        |  |

#### 4.1a Foundation type:

It can be identified by the questionnaires survey to the house owner or mason.

#### Soil Testing Technique

It can be identified by measurement. First, the typology of the soil and number of storey (planned) should be checked to identify the base width. The soil can be identified by the following procedure.

- Steps 1) A trench of 1cu.m. (1mX1mX1m) is excavated.
  - 2) The excavated soil is re-filled in the trench. The typology of the soil is identified with respect to the result provided in the following table:

| Type of soil | Results   |
|--------------|---|
| Soft soil    | Insufficient to re-fill the trench  |
| Medium soil  | Completely re-fill the trench   |
| Hard soil    | Volume of soil expands<br>(Excess soil is found after the trench is completely filled.) |



#### 4a. Foundation

#### Masonry structure

#### 4.2a Depth of foundation:

The photographs captured during the construction of the foundation (if available) is observed and checked. Or the foundation is excavated and measured.



W= Base width X= min. 2T OR 1.0m whichever is more H≤0.3m Φ= max. 20° V≤1.0m without provision of retaining wall

The land should be flat. If the site is in slope land, the construction shall be done by excavating the land in different level (Length 1 m (3.28 ft) and Height 0.3048m (1 ft). If the site is steep then retaining wall should be constructed.

Source:NBC 203

#### 4.3a Base width:

After determining the typology of the soil Base width can be identified by following procedure:

Here, the small part of the foundation of one side is excavated and measured (say x) then it is multiplied by 2 to calculate the width of the foundation (2x).



## 5a. Vertical member

#### Minimum Requirements for Masonry structure

| No | Category           | Sub-category  | Description  |  |  |  |  |
|----|--------------------|---------------|--|--|--|--|--|
|    |                    | General       | Shall be started right from the foundation and continue up to the roof<br>band.<br>Place vertical member at all corners, junctions of walls and adjacent to all<br>doors and windows. Steel or timber can be used as vertical member.    |  |  |  |  |
|    |                    |               | RC   | Timber                                     |  |  |  |
| 5  | Vertical<br>member | Reinforcement | At corners and junctions vertical reinforcing<br>bar shall be 12mm for one storey, and 16mm<br>for two storey . They shall be covered with<br>concrete or 1:4 mortar in cavities made<br>around them during the masonry<br>construction. | Hard wood.<br>One member of 75mm x         |  |  |  |
|    |                    | Anchorage     | Should be started right from the foundation<br>and continue up to the band.<br>In case of using existing foundation, it shall<br>be anchored to plinth band.<br>The anchorage length shall be 60 times<br>diameter of the bar.           | Two member of 75mm x<br>100mm for openings |  |  |  |

#### 5.1a General:

The installment of vertical reinforcement is checked by the observation.



Fig: Vernier Caliper

#### 5.2a Reinforcement:

- Vernier Caliper is used to check the diameter of rebar.
- The typology of the wood can be checked by the process described in materials

#### 5.3a Anchorage:

The anchorage length of the vertical member can be inspected by the observation of the photographs, if it is not available then by the questionnaires survey with the house owner or mason.

#### 5. Vertical member

# Masonry structure













## 6a. Plinth Minimum Requirements for Masonry structure

| No | Category | Sub-category  | Description  |                         |  |  |  |
|----|----------|---------------|--|-------------------------|--|--|--|
|    |          | General       | The level of plinth shall not be less than 300mm f   | rom ground level.       |  |  |  |
|    |          | Thickness     | The thickness of band shall be 150mm for medium and soft soil, 75mm band<br>can be used for hard soil. |                         |  |  |  |
|    |          | Width         | It shall not be less than wall thickness.  |                         |  |  |  |
| 6  | Plinth   |               | RC band  | Timber band             |  |  |  |
|    |          | Reinforcement | Main reinforcement shall be 4-12 dia.2-12 dia.   | Main wooden member,     |  |  |  |
|    |          |               | rebars in case of 150mm and 75mm   | 2-75mmx38mm shall be    |  |  |  |
|    |          |               | height.respectively. Use 6mm dia. stirrups at  | properly connected with |  |  |  |
|    |          |               | 150mm centres. Bars shall have a clear cover of  | batten                  |  |  |  |
|    |          |               | 25mm concrete.   | 75mmX38mm@500c/c.       |  |  |  |

#### 6.1a General:

The level of the Plinth can be identified by the measurement from the ground level.

#### 6.2a Thickness/size:

R.C. band: To identify the thickness of plinth band, first the typology of the soil is identified using the process described in foundation After the identification of soil the band thickness is checked by the measurement.

Timber band: The size of the main wooden member, batten can be identified by measurement. Similarly, the spacing of the batten can also checked by the measurement whereas the connection can be checked by the observation.

#### 6.3 a Width:

It can be checked by measurement.

#### 6.4a Reinforcement:

The reinforcement provided in the R.C band can be identified by the photographs captured during the construction. If it is not available then it can be identified by the questionnaires survey with the house owner and mason.

#### 6a. Plinth











## 7a. Walls

#### Minimum Requirements for Masonry structure

| No. | Category | Sub-ca         | tegory | Description   |
|-----|----------|----------------|--------|---|
|     |          | General        |        | Masonry shall not be laid staggered or straggled in order to avoid<br>continuous vertical joints. At corners or wall junctions, through<br>vertical joints shall be avoided by properly laying the masonry. It<br>shall be interlocked.                       |
|     |          |                | SMM    | Not less than 350 to 450mm for one storey.  |
|     |          |                | BMM    | Not less than 350mm.  |
|     |          | Thickness      | SMC    | Not less than 450 mm.   |
|     | Walls    |                | вмс    | It shall not be less than 230mm for one-storey, 350 and 230mm for ground floor and first floor of two-storey respectively.  |
| 7   |          | Through stones |        | Through-stone of a length equal to the full wall thickness shall be<br>used in every 600 mm height at not more than 1.2 m apart<br>horizontally.  |
|     |          | Joints         |        | Mortar joints shall not be more than 20mm and less than 10mm in thickness.  |
|     |          | Buttresses     |        | Buttresses shall be provided if wall length is longer than above<br>mentioned. Spacing of buttress shall not be more than 3m.<br>Minimum base width shall be equal to one sixth of wall height.<br>Minimum top width shall be equal to thickness of the wall. |
|     |          | Gable          | e wall | Provide light gables like wood, CGI sheet etc.  |

#### 7.1a General:

The layout of the wall (stone or brick masonry) can be checked by the observation and measurement. The type and the quality of stone or Brick used in the construction should be checked as per the procedure mentioned in materials. Similarly, the plumb bob should be used to check verticality of the masonry wall.

#### 7.2a Thickness:

It can be identified by measurement. Incase of SMC and BMC, the thickness is measured after the observation of number of storey.

#### 7a. Walls

#### 7.3a Through stone:

It can be identified by measurement and observation. Through stone should be measured in every 600mm lift and not more than 1.2m apart horizontally.





#### 7.4a Joints:

It can be identified by measurement



#### 7.5a Buttresses:

The requirement of the Buttresses wall is identified by measurement of the total length of the wall. If found to be needed it can be checked by the observation and measurement.



#### 7.6a Gable wall:

The materials used in the gable wall can be identified by the observation.

## 8a. Doors and Windows Minimum Requirements for Masonry structure

| No. | Category            | Sub-category |         | Description  |
|-----|---------------------|--------------|---------|--|
|     | Doors /<br>windows. | General      |         | Keep lintel level same for all doors and windows.<br>Openings are to be located away from inside corners by a clear<br>distance equal to at least 1/4 of the height of the opening, but not<br>less than 600 mm. |
| 8   |                     | Total length | smm/bmm | The total length of openings in a wall is not to exceed 30 % of the length of the wall between consecutive cross-walls in single-storey construction.  |
|     |                     |              | SMC/BMC | The total length of openings in a wall is not to exceed 50 % of the length of the wall between consecutive cross-walls in single-storey construction, 42 % in two-storey construction.                           |
|     |                     | Distance     |         | The horizontal distance between two openings is to be not less<br>than one half of the height of the shorter opening, but not less<br>than 600 mm.   |

#### 8.1a General:

The lintel level of the doors and windows is identified by the observation whereas its location is checked by measurement.

#### 8.2a Total length:

First the typology of the masonry and number of storey is identified by the observation and the following formula is used to check its length.

#### 8.3a Distance:

It can be identified by measurement.



#### Note:

- ✤ b1+ b2 < 0.3 length 1 for one storey.</p>
- b6+ b7 < 0.3 length 2, for one storey.</p>
- ♦ b4≥0.5 h2 but not less than 600mm.
- ✤ b5≥0.25 h1 but not less than 600mm.



#### Note:

- ♦ b1+ b2+ b3 ≤0.5 L1 for one storey, 0.42 L1 for two storey.
- ♦ b6+b7 ≤0.5 L2 for one storey, 0.42 L2 for two storey
- ♦ b4≥ 0.5h2 but not less than 600mm
- ♦  $b5 \ge 0.25 h1$  but not less than 600mm

### Methodology of technical inspection 8a. Doors and Windows

#### Masonry structure



## 9a. Horizontal band

#### Minimum Requirements for Masonry structure

| No | Category           | Sub-category   | Description  |   |  |  |
|----|--------------------|--|--|---|--|--|
|    |                    | General  | Horizontal bands shall be provided throughd sill, lintel, and roof level.  | out the entire wall at plinth,  |  |  |
|    |                    |  | RC band  | Timber band   |  |  |
|    |                    | Sill band  | A continuous sill band shall be provided<br>through all walls at the bottom level of<br>opening (specially windows) except for<br>doors. The minimum thickness is 75mm.  |   |  |  |
|    |                    | Lintel band  | A continuous lintel band shall be provided<br>through all walls at the top level of<br>opening.<br>Where opening width do not exceed 1.25m<br>and masonry height above opening do not<br>exceed 0.9m, 75mm lintel is sufficient. For<br>opening width upto 2m and masonry height<br>above opening upto1.2m, 150mm lintel<br>band is necessary. | Main wooden member,<br>2-75mmX38mm shall be<br>placed along with wall and   |  |  |
| 9  | Horizontal<br>band | Stitch band  | At corners and junctions, stitches( dowels)<br>shall be provided addition at a vertical<br>spacing of 500-700mm. The minimum<br>length is 1.2m.<br>The minimum thickness is 75mm.  | properly connected with<br>batten, 50mmX38mm @<br>500c/c.<br>* Stitch (Mid band) shall be   |  |  |
|    |                    | Roof band  | It shall be provided at the top-level of walls,<br>so as to integrate them properly at their<br>ends and fix them into the walls. The<br>minimumthickness is 75mm.   | continuous.   |  |  |
|    |                    | Main reinforcement shall be 4-12 dia<br>dia. rebars in case of 150mm and 75<br>Reinforcement Use 6mm dia. stirrups at 150mm cen<br>For stitch band main reinforcement s<br>2-8 dia.rebars. | Main reinforcement shall be 4-12 dia.2-12<br>dia. rebars in case of 150mm and 75mm<br>Use 6mm dia. stirrups at 150mm centres.<br>For stitch band main reinforcement shall be<br>2-8 dia.rebars.  |   |  |  |
|    |                    | Connection   | Overlap lengthshall be 60 times diameter of<br>the bar.<br>Eg. Lengh shall be 480mm for 8mm bars,<br>600mm for 10mm bars, 720mm for 12mm<br>bars and 960mm for 16mm bars   | Main wooden member shall<br>be properly connected with<br>4 nails and batten with 2<br>nails.<br>5mm wooden nail or<br>3.15mm galvanized steel<br>nail can be used. |  |  |

9a. Horizontal band

#### Masonry structure

#### 9.1a General:

It can be identified by the observation

#### 9.2a Sill/lintel/stitch/Roof band:

The thickness of the horizontal band can be identified by measurement. Incase of R.C. band the thickness of Sill, stitch and Roof band can be identified by the measurement. whereas incase of lintel band, first the width of opening and height of masonry is measured and the required thickness according to minimum requirement is identified and its thickness is checked by measurement. Whereas in Wooden band, the thickness of band is checked by measurement and the typology of the wood can be identified by the procedure mentioned in materials.

#### 9.3a Reinforcement:

It can be identified by the photographs captured during the construction. If it is not available then it can be identified by the questionnaires survey with the house owner and mason.

#### 9.4a Connection:

Both for the R.C and timber band, the detail of connection can be identified by the questionnaires survey to the house owner and mason.



## 9a. Horizontal band Methodology of technical inspection

# **Masonry structure**



9a. Horizontal band

# **Masonry structure**





## **10a. Roof** Minimum Requirements for all buildings

| No. | Category | Sub-category | Description  |
|-----|----------|--------------|--|
|     |          | General      | Use light roof comprising wooden or steel truss covered with CGI sheets.   |
| 10  | Roof     | Connection   | All members of the timber truss or joints shall be properly connected.<br>Arrangements shall be done for connecting roof and wall. |
|     |          | Bracing      | For flexible diaphragm, diagonal bracings shall be considered.   |

#### 10.1a General:

Materials used in the roof can be checked by the observation.

#### 10.2a Connections:

It can be identified by observation

#### 10.3a Bracing:

It can be identified by observation



# 2. Shape and size

#### Minimum Requirements for RCC frame structure

| No. | Category          | Sub-category   | Description   |  |
|-----|-------------------|----------------|---|--|
|     |                   | No.of storey   | Not more than 3 Storey.   |  |
| 2.  |                   | No. of bay     | It shall be 2 to 6 no. of bays on both sides of building.   |  |
|     |                   | Length of bay  | Not more than 4.5m.   |  |
|     | Shape and size of | Size of room   | Ground floor area shall not be more than 1000sq.ft and area between the four pillar shall not be more than 13.5sq.m.  |  |
|     | building          | Height of wall | Not more than 11m. One storey height shall be upto 2.75m to 3.35m.  |  |
|     |                   | Proportion     | Simple and regular shaped as square and rectangular.<br>The length of house shall not be more than 3 times of its<br>width.<br>Height of building shall be simple. Avoid setbacks. Ground<br>floor shall not leave without laying walls if requires consult<br>with expert. |  |

#### 2.1 No. of storey:

It can be checked by observation.

#### 2.2 Clear span of wall:

It can be checked by observation.

#### 2.3 Size of room:

It can be checked by measurement

#### 2.4 Height of wall:

It can be checked by measurement.

#### 2.5 Proportion:

It can be checked by observation and measurement. If no external wall is provided in ground floor, then the documents provided by the experts should be checked.



Condition for detailed dimensions A  $\leq$  3XB a X b  $\leq$  13.5 sq.m. a,b  $\leq$  4.5m a,b  $\geq$  2.1m A or B  $\leq$  6bays



## 4b. Foundation

#### Minimum Requirements for RCC frame structure

| No. | Category   | Sub-Category                       | Description       |                  |                            |             |                  |
|-----|------------|------------------------------------|-------------------|------------------|----------------------------|-------------|------------------|
|     |            | General                            | constructi        | ion of Isolated  | foundation shall be in one | e level.    |                  |
|     |            | Depth of<br>foundation<br>below GL | Not less than 5'. |                  |                            |             |                  |
|     |            |                                    | Туре              | Soil Typology    | Width                      | Thickness   | reinforcement    |
|     |            |                                    |                   | Weak soil        | Not less than 2.2 X 2.2    | 300         | 11-12 mm         |
|     |            |                                    | Corpor            | Soft soil        | Not less than 1.5 X 1.5    | 300         | 7-12 mm          |
|     | Foundation |                                    | Comer             | Medium soil      | Not less than 1.25 X 1.25  | 300         | 6-12 mm          |
|     |            |                                    |                   | Hard soil        | Not less than 1.1 X 1.1    | 300         | 5-12 mm          |
|     |            | Base width                         | Front             | Weak soil        | Not less than 2.4 X 2.4    | 300         | 10-12 mm         |
| 4   |            |                                    |                   | Soft soil        | Not less than 1.65 X 1.65  | 300         | 8-12 mm          |
|     |            |                                    |                   | Medium soil      | Not less than 1.4 X 1.4    | 300         | 7-12 mm          |
|     |            |                                    |                   | Hard soil        | Not less than 1.2 X 1.2    | 300         | 6-12 mm          |
|     |            |                                    |                   | Weak soil        | Not less than 3 X 3        | 400         | 14-12 mm         |
|     |            |                                    | Middle            | Soft soil        | Not less than 2.1 X 2.1    | 400         | 10-12 mm         |
|     |            |                                    | Ivildule          | Medium soil      | Not less than 1.7 X 1.7    | 400         | 8-12 mm          |
|     |            |                                    |                   | Hard soil        | Not less than 1.5 X 1.5    | 400         | 7-12 mm          |
|     |            | Equindation tio                    | In founda         | tion isolated le | vel or on the upper part a | ll pillar's | solated shall be |
|     |            |                                    | join with 9       | 9"x9" tie beam   | (foundation).In those bear | n 4-12mi    | n                |
|     |            | DEalli                             | reinforcer        | nent shall be p  | provided.                  |             |                  |

## 4.1b General:

It can be checked by observation.

#### 4.2b Depth of foundation:

It can be checked by questionaries survey to the house owner and mason.



#### 4b. Foundation

#### **RCC frame structure**

#### 4.3b Base width:

The base width of the foundation vary upon the typology of soil. Hence, the soil typology should be identified before inspection. Here, first the typology of the soil is identified and the base width is checked by questionaries survey to the house owner and mason. Incase of the metropolitan and municipality, the structural drawings can also be checked.

#### Soil Testing Technique

It can be identified by measurement. First, the typology of the soil and number of storey (planned) should be checked to identify the base width. The soil can be identified by the following procedure.

- Steps 1) A trench of 1cu.m. (1mX1mX1m) is excavated.
  - 2) The excavated soil is re-filled in the trench. The typology of the soil is identified with respect to the result provided in the following table:

| Type of soil | Results   |  |  |
|--------------|---|--|--|
| Soft soil    | Insufficient to re-fill the trench  |  |  |
| Medium soil  | Completely re-fill the trench   |  |  |
| Hard soil    | Volume of soil expands<br>(Excess soil is found after the trench is completely filled.) |  |  |



#### 4.4b Foundation tie beam:

It can be identified by questionaries survey to the mason or the photographs (if available). The reinforcement of the tie beam should be as per the minimum requirement. Similarly, the structural drawings can also be checked incase of building constructed in metropolitan and municipality.



# 5b. Plinth(D.P.C)beam

#### Minimum Requirements for RCC frame structure

| No | Category | Sub-category  | Description   |
|----|----------|---------------|---|
|    | Plinth   | General       | Tie beam level shall be at least 450mm upper than ground level.           |
|    |          | Size          | At least 9"x9" tie beam shall be provided in D.P.C level.                 |
| 5  |          | Reinforcement | 4-12mm reinforcement shall be provided in these beam.                     |
| Э. |          | Stirrups      | In these beam, at least 8mm stirrups shall be provided in distance of 6". |

#### 5.1b General

It can be checked by measurement.

#### 5.2b Size

It can be checked by observation and measurement.

#### 5.3b Reinforcement:

It can be checked by observation. The observation should be carried out before the casting of the concrete. Vernier caliper can be used to check the diameter of reinforcement.

#### 5.4b Stirrups

It can be checked by observation before the casting of the concrete.

# 6b. Column

#### Minimum Requirements for RCC frame structure

| No | Category | Sub-category                | Description   |
|----|----------|-----------------------------|---|
|    | Pillar   | General                     | Columns shall be in one line. The distance between two columns shall not be more than 4.5m and it shall be joined by beam. The column should be larger than beam.   |
|    |          | Size                        | Not less than 12"X 12"  |
| 6. |          | Reinforcement               | 4-12mm and 4-16mm reinforcement shall be provided in these beam.  |
|    |          | Stirrups                    | In these beam, at least 8mm stirrups shall be provided at a distance of 6". In edges of joints and joints of reinforcement at least 8mm stirrups shall be provided at a distance of 4".while placing stirrups 135° of 3" long hook shall be provided. |
|    |          | Reinforcement<br>connection | While connecting 2' shall be left from the edge so that It shall<br>be placed in middle for reinforcement in column and it shall<br>not be more than 50%. It shall be 60 times lapping while<br>connection.   |

#### 6.1b General:

It can be checked by observation.

#### 6.2b Size:

It can be checked by observation.

#### 6.3b Reinforcement:

It can be checked by measurement

#### 6.4b Stirrups:

It can be checked by measurement.

#### 6.5b Reinforcement connection:

It can be checked by observation and measurement. If no external wall is provided in ground floor, then the documents provided by the experts should be checked.



## **7b. Beam** Minimum Requirements for RCC frame structure

| N<br>o | Category | Sub-<br>category                | Description   |  |               |              |
|--------|----------|---------------------------------|---|--|---------------|--------------|
|        |          | General                         | The joints of beam shall be placed in same position of column.it size shall be less than size of column.  |  |               |              |
|        |          | Size                            | The size  | The size of beam shall be provided 9"x14". |               |              |
|        |          | Reinforceme<br>nt               | Store length of beam Reinforcement(mm)  |  |               |              |
|        |          |                                 | У   |  | Bottom        | Тор          |
|        |          |                                 | Roof  | < 3 m                                      | (2-12)        | (2-12)       |
|        | Beam     |                                 |   | 3 m - 3.5 m                                | (2-12)        | (2-12)       |
|        |          |                                 |   | 3.5 m - 4 m                                | (2-12)        | (2-12)       |
|        |          |                                 |   | 4 m - 4.5 m                                | (2-12)        | 2-12+1-12(a) |
|        |          |                                 | Secon   | < 3 m                                      | (3-12)        | 2-12+1-12(a) |
|        |          |                                 | d   | 3 m - 3.5 m                                | (3-12)        | 2-12+1-16(a) |
| 7      |          |                                 |   | 3.5 m - 4 m                                | 2- 12+1-16(a) | 2-12+1-16(a) |
| /      |          |                                 |   | 4 m - 4.5 m                                | 2-12+1-16(a)  | 2-12+3-12(a) |
|        |          |                                 | First   | < 3 m                                      | (3-12)        | 2-16+1-12(a) |
|        |          |                                 |   | 3 m - 3.5 m                                | 2- 16+1-12(a) | 2-16+1-12(a) |
|        |          |                                 |   | 3.5 m - 4 m                                | 2- 16+1-12(a) | 2-16+1-16(a) |
|        |          |                                 |   | 4 m - 4.5 m                                | 2- 16+1-12(a) | 2-16+1-16(a) |
|        |          |                                 | a.Reinforcement is additional rebar. Top additional rebar shall be placed in edges and bottom shall be placed in middle.  |  |               |              |
|        |          | Stirrups                        | In these beam, at least 8mm stirrups shall be provided in distance of 6". In edges of joints and joints of reinforcement at least 8mm stirrups shall be provided in distance of 4".while placing stirrups 135° of 3" long hook shall be provided. |  |               |              |
|        |          | Reinforceme<br>nt<br>connection | In beam the top reinforcement should be connected at the mid<br>whereas bottom reinforcement should be connected after leaving 2'<br>gap from the edge.it shall not be more than 50%.It shall be 60 times<br>lapping while connection.            |  |               |              |

# Methodology of technical inspection 7b. Beam **RCC frame structure** 7.1b General: It can be identified by observation. Size of the Beam greater than column Stirrup detail Size of the Beam smaller than column

## 7.2b Size:

It can be identified by observation.

#### 7.3b Reinforcement:

It can be identified by the observation, but the observation of the construction should be done before the casting of the concrete. Similarly, the structural drawings provided can also be checked along with site observation incase of municipality and metropolitan

#### 7.4b Stirrups:

It can be identified by following the same procedure mentioned above to check the reinforcement.

7b. Beam

#### 7.5b Reinforcement connection:

It can be identified by the observation, but the observation of the construction should be done before the casting of the concrete. Similarly, the structural drawings provided can also be checked along with site observation incase of municipality and metropolitan



6b. Column, 7b. Beam

#### RCC frame structure



## **8b. Floor / Roof** Minimum Requirements for RCC frame structure

| No | Category     | Sub-category      | Description  |  |
|----|--------------|-------------------|--|--|
|    | 8 Floor/Roof | General           | Roof shall not be placed on different level and big gap shall not be placed.   |  |
| 8  |              | Size              | The thickness of reinforcement concrete roof shall be atleast 5".  |  |
|    |              | Reinforceme<br>nt | In these Reinforcement concrete roof, 8mm reinforcement shall be provided in distance of 6".Extra rebar or reinforcement shall be provided as per requirement. |  |
|    |              | Cover             | Roof reinforcement shall be covered with at least 15mm concrete.   |  |
|    |              | Projection        | Projection shall not made 1m from centre line of column.   |  |

#### 8.1b General:

It can be identified by observation.

#### 8.2b Size:

It can be identified by the measurement.



#### 8.3b Reinforcement:

It can be identified by the observation, but the observation of the construction should be done before the casting of the concrete. Similarly, the structural drawings provided can also be checked along with site observation incase of municipality and metropolitan.

#### 8.4b Cover:

It can be identified by the questionaries survey to mason.

#### 8.5b Projection:

It can be identified by the measurement.

# 9b. Beam and column joint

## Minimum Requirements for RCC frame structure

| No | Category                       | Sub-<br>category | Description   |
|----|--------------------------------|------------------|---|
| 9  | Beam<br>and<br>column<br>joint | General          | Beam shall be made smaller than column so that its reinforcement shall be entered to column reinforcement or rebar.   |
|    |                                | Connection       | The anchorage of reinforcement must be made upward for the bottom reinforcement and downward for the upper reinforcement. The anchorage length must be 60times diameter of reinforcement. |
|    |                                | Stirrups         | At least 2 nos. of stirrups shall be provided in beam and column joints.  |

#### 9.1b General:

It can be identified by the observation

#### 9.2b Connections:

It can be identified by the site observation before casting of the concrete.

#### 9.3b Stirrups:

It can be identified by the site observation before casting of the concrete.









## **10b. Non-structural wall** Minimum Requirements for RCC frame structure

|  | No | Category                    | Sub-category | Description  |
|--|----|-----------------------------|--------------|--|
|  | 10 | Non-<br>structura<br>I wall | General      | Masonry shall be laid equally on both direction. It shall not be whole<br>wall in one and opening in other. Masonry shall not be laid<br>staggered or straggled in order to avoid continuous vertical joints.<br>At corners or wall junctions, through vertical joints shall be avoided<br>by properly laying the masonry. |
|  |    |                             | Thickness    | The thickness of wall shall be provided 230 or 110mm.  |
|  |    |                             | joints       | Mortar joints thickness shall not be more than20mm and less than 10mm.   |
|  |    |                             | Openings     | while placing opening column shall not made shorter and attached with it.  |
|  |    |                             | Sill band    | A continuous sill band shall be provided through all walls at the<br>bottom level of opening (specially windows) except for doors. The<br>minimum thickness is 75mm and 2 nos of 8mm reinforcement shall<br>be provided.this reinforcement shall be connected with column.   |
|  |    |                             | Lintel band  | A continuous lintel band shall be provided through all walls at the<br>top level of opening. The minimum thickness is 75mm and 2 nos of<br>8mm reinforcement shall be provided.this reinforcement shall be<br>connected with column.   |

#### 10.1b General:

The layout of the wall can be checked by the observation and measurement. Whereas, the plumb bob can be used to check verticality of the masonry wall.

#### 10.2b Thickness:

It can be identified by observation and measurement.

#### 10.3b Joints:

It can be identified by observation

#### 10.4b Openings:

It can be identified by observation

#### 10.5b Sill band:

It can be identified by observation whereas the reinforcement provided in band can be identified by the questionaries survey with the houseowners and mason. Similarly, it can also be checked by the photographs captured (if available) during the construction

#### **RCC frame structure**

#### 10.6b Lintel band:

It can be identified by using the same procedure mentioned above to check sill band.



#### 10.B Non-structural wall

## RCC frame structure






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