E-TENDER

FOR

Construction of Demonstration Housing Project (G+3) for use as accommodation for Contractual Safai Karamchari and Community Centre on Design & Build basis using Emerging technology including on site Infrastructure Work at Guwahati, Assam

(Bid No. BMT/S/2021/DHP-ASSAM)

BUILDING MATERIALS & TECHNOLOGY PROMOTION COUNCIL
Ministry of Housing & Urban Affairs, Govt. of India
Core-5A, First Floor, India Habitat Centre
Lodhi Road, New Delhi-110003
Phone: +91-11-24636705; Fax: +91-11-24642849;
E-mail: info@bmtpc.org; Website: www.bmtpc.org

INDEX

It is certified that this bid document contains 262 pages.

Part-1

Instructions to Bidders

Building Materials & Technology Promotion Council
Ministry of Housing & Urban Affairs, Government of India
Core-5A, 1st Floor, India Habitat Centre, Lodhi Road, New Delhi
Phone: +91-11-24636705, Fax: +91-11-24642849
Website: www.bmtpc.org Email:info@bmtpc.org

1. TENDERNOTICE

BMTPC invites online E-Tenders in Two-Bid system from reputed, experienced, technically and financially sound. Technology / system providers (single business entity) and Joint Venture/ consortia of firms / companies (hereafter called Agency) for Construction of Demonstration Housing Project (G+3) for use as accommodation for Contractual Safai Karamchari and Community Centre on Design & Build basis using emerging technology listed at ANNEXURE – I including onsite infrastructure work at Guwahati, Assam.

Location	Estimated Project Cost put to bid (Rs. inLakhs)	Tender Fee (in Rs.) (Non-refundable)	EMD	Stipulated period of completion of work	Uploading online bid Document	Last Date for online Submission of Tender	Technical bid opening
					Date	Date/Time	Date/Time
Guwahati, Assam	929.18	5000	Bid security declaration	10.5 Months	01-06-2021	22-06-2021 / 1500 hrs	23-06-2021 / 1500 hrs

1. The Tender document for the work can be seen and downloaded from CPP Portal (https://eprocure.gov.in/eprocure/app). This Tender Document is also available on BMTPC website www.bmtpc.org.
2. The intending bidder must read the terms and conditions of tender carefully. He should only submit his bid if he considers himself eligible and he is in possession of all the documents required.
3. Pre-Bid meeting will be held on 09-06-2021 at 1500 hrs in Conference Room, Building Materials & Technology Promotion Council, Core-5A, 1st Floor, India Habitat Centre, Lodhi Road, New Delhi.
4. Conditional Tender shall not be accepted.
5. Those bidders not registered on the website of eprocure.gov.in, are required to get registered before submitting the Bid online. If needed they can be imparted training on online bidding process as per details available on the website.
6. The intending bidder must have valid digital signature to submit the bid.
7. Hard copy of online submitted Technical Bid alongwith all documents, proof of online deposited tender fees, Bid Security Declaration shall be submitted to Executive Director, Building Materials & Technology Promotion Council, Core-5A, 1st Floor, India Habitat Centre, Lodhi Road, New Delhi- 110003 by Courier/post/Hand Delivery on or before 22-06-2021 by 1500 hrs.
8. Corrigendum/ Addendum/ Minutes of Pre-bid Meeting, if any, would appear on the CPP Portal (https://eprocure.gov.in/eprocure/app) and website of BMTPC (www.bmtpc.org) and shall not be published in any “News Paper”.
9. The Executive Director, BMTPC reserves the right to accept or reject any or all tenders without assigning any reason thereof. This Tender notice shall form a part of contract document.

Executive Director, BMTPC

2. DETAILED TENDER NOTICE

BMTPC invites online E-Tenders in Two-Bid system from reputed, experienced, technically and financially sound Technology/system providers (single business entity) and Joint Venture/ consortia of firms / companies (hereafter called Agency) for construction of Construction of Demonstration Housing Project (G+3) for use as accommodation for Contractual Safai Karamchari and Community Centre on Design & Build basis using emerging technology listed at **ANNEXURE – I** including onsite infrastructure work at Guwahati, Assam as detailed below:

In case, one proposed unique technology is not suitable for the site as per structural and local geo-climatic requirement, the bidder/s may use hybrid construction system other than conventional system (In situ RCC framed structure) subject to proof of its structural integrity, fire safety, thermal performance and fulfilment of other functional requirements of the buildings. The bidder/s required to submit a detailed note on specifications and code of practice and how the particular technology can be effectively used in proposed DHP.

1)	Bid document No.	**BMT/S/2021/DHP-ASSAM**
2)	Name of Work	Construction of Demonstration Housing Project (G+3) for use as Working accommodation for Contractual Safai Karamchari and Community Centre on Design & Build basis using emerging technology listed at **ANNEXURE – I** including onsite infrastructure work at Guwahati, Assam.
3)	Brief Scope of work	Design and Construction of Demonstration Housing Project and Community Centre as per the approved architectural and structural drawings using emerging technology listed at **ANNEXURE–I** including on site infrastructure work. To get the Design and Drawings of structure vetted by Technical / Research institutions of repute such as IITs, NITs, Govt. Engineering Colleges, CSIR Labs, Govt. Research Institutions. Arranging required material, machinery and manpower so as to complete the work in stipulated time. Maintenance of building and onsite infrastructure works during defect liability period of Five Years.
4)	Estimated cost put to tender	**Rs. 929.18**
5)	Tender fee (Non Refundable)	Rs. 5,000.00 to be deposited in the account of BMTPC through NEFT/ RTGS as per details given at **ANNEXURE - II**
6)	Earnest Money Deposit / Bid Security Declaration	Bid Security Declaration as per details given at **Appendix-II**
7)	Tender validity period	120 days.

8)	Period of completion	10.5 Months (1.5 months for Architectural planning & Structural designing, vetted structural design and taking statuary approvals from local authorities + 9 months for construction of building and onsite infrastructure works from the date of handing over the site and all statutory approvals)
9)	Last date & Time of online Submission of tender	22-06-2021 by 1500 hrs
10)	Date of Pre-Bid meeting &Venue	09-06-2021at 1500 hrs. Conference Room, Building Materials & Technology Promotion Council, Core-5A, 1st Floor, India Habitat Centre, Lodhi Road, New Delhi – 110003 or through virtual meeting.
11)	Last date, Time & Place for submission of Hard copy of online submitted Technical Bid along with all documents, proof of online deposited tender fees, Bid Security Declaration.	22-06-2021 by 1500 hrs Building Materials & Technology Promotion Council, Core-5A, 1st Floor, India Habitat Centre, Lodhi Road, New Delhi -110003.
12)	Time & date of online opening of technical bid	23-06-2021, 1500 hrs
13)	Time & date of online opening of financial bid of technically qualified bidders	To be intimated later
14)	Performance Guarantee	Performance Guarantee @3% of the tendered amount to be deposited in the account of BMTPC through NEFT/ RTGS as per details given at **ANNEXURE–II** or in the form of Bank Guarantee from any Indian Scheduled/Commercial Bank in prescribed format given at Annexure III (To be submitted at the time of agreement)
15)	Security Deposit (SD)	2.5% of the contract value shall be deducted from the each R.A. Bill till SD reaches 2.5% of the contract value. Bank Guarantee from any Indian Scheduled/Commercial Bank in prescribed format given at Annexure III can also be submitted.
16)	Networth Certificate	Minimum 15% of the estimate cost put to tender issued by the certified Chartered Accountant (on the format prescribed in form B
17)	Defect liability period	**5 (five) years** after issue of completion certificate
18)	Compensation for delay	As per Clauses of Contract
19)	Contact office	Executive Director, Building Materials & Technology Promotion Council, Core-5A, 1st Floor, India Habitat Centre, Lodhi Road, New Delhi - 110003.

3. INSTRUCTIONS FOR ONLINE BID SUBMISSION

1) All Bidders are requested to register themselves with the portal http://eprocure.gov.in and enrol their digital certificate with the user ID for participation in the bid.

2) The Bidders are requested to read following conditions in conjunction with various conditions, wherever applicable appearing with this bid invitation for e-Biding. The conditions mentioned here in under shall supersede and shall prevail over the conditions enumerated elsewhere in the bid document.

3) How to submit On-line Bids/Offers electronically against e-Biding?

Bidders are advised to read the following instructions for participating in the electronic bids directly through internet:

i. Late and delayed Bids/Offers after due date/time shall not be permitted in e-Biding system. No bid can be submitted after the last date and time of submission is over. The system time (Indian Standard Time [IST]) that will be displayed on e-biding web page shall be the time and no other time shall be taken into cognizance.
ii. Bidder/s are advised in their own interest to ensure that bids are uploaded in e-biding system well before the closing date and time of bid.
iii. No bid can be modified after the due date for submission of bids.
iv. No manual bids/offers along with electronic bids / offers shall be permitted.

4) What is a Digital Signature?

This is a unique digital code which can be transmitted electronically and primarily identifies a unique sender. The objective of digital signature is to guarantee that the individual sending the message is who he or she really claims to be just like the written signature. The Controller of Certifying Authorities of India (CCA) has authorized certain trusted Certifying Authorities (CA) who in turn allots on a regular basis Digital Signature Certificates (DSC)

5) Documents which are signed digitally are legally valid documents as per Indian IT Act (2000).

6) Why is a Digital Signature required?

In order to bid for e-bids all the vendors are required to obtain a legally valid Digital Certificate as per Indian IT Act from the licensed Certifying Authorities (CA) operating under the Root Certifying Authority of India (RCAI), Controller of Certifying Authorities (CCA) of India. The Digital Certificates is issued by CA in the name of a person authorized for filing Bids/Offers on behalf of his Company. A Bidder can submit their Bids/Offers on-line only after digitally signing the

bid/documents with the above allotted Digital Signature.

7) Bidders have to procure Digital Signature Certificate (Class 3 or 2 with signing key uses) from any of the certifying Authorities in India.

8) Submission of Documents

i. Bidders must submit on line offers by the date and time mentioned in the tender at the website address stated therein.

ii. E-Bid will provide access to Technical as well as Financial part of bid. Along with the Technical part, Bidders can attach the required documents listed at **page 31** of this bid document along with scan copy of the proof of submission of tender fee, Bid Security Declaration with the bid in line with the Bid document.

iii. The successful bid submission can be ascertained once acknowledgement is given by the system through bid submission number after completing all the process and steps.

iv. The bids have to be submitted online as well as physical submission. However, documents which necessarily have to be submitted in originals like Technical Proposal, Proof of submission of Tender fee & Bid Security Declaration and any other documents mentioned in the bid documents have to be submitted offline. Financial Bid should not be submitted in a sealed envelope. BMTPC shall not be responsible in any way for failure on the part of the bidder to follow the instructions.

v. Financial Bid shall contain only price as per Schedule of Quantities (in form of an excel sheet) without any condition. The lump sum rate / item rates along with tax and other components shall be filled up in figures and the total amount shall be automatically calculated and rounded off to the nearest rupee. It is to be noted that the Financial Bid shall contain only PRICES and no conditions whatsoever.

vi. The online bid shall be uploaded through digital signatures by someone legally authorized to enter into commitment on behalf of the Bidder. The Bidder shall upload among other documents, Power of Attorney in favour of the person who is authorized to enter into commitments on behalf of the Bidder.

vii. It is advised that the bidder upload small sized documents at a time to facilitate in easy uploading into e-biding site. BMTPC does not take any responsibility in case of failure of the bidder to upload the documents within specified time of bid submission.

viii. The Bidder(s) shall submit the Technical Bids in the format as mentioned in Tender online and also submit its hard copy in sealed envelope and mark the envelope as "**Tender for Construction of Demonstration Housing Project (G+3) for use as accommodation for Contractual Safai Karamchari and Community Centre on Design & Build basis using emerging technologies including onsite infrastructure work at Guwahati, Assam**". The hardcopy shall be submitted to The Executive Director, Building Materials & Technology Promotion Council, Core-5A, 1st Floor, India Habitat Centre, Lodhi Road, New Delhi – 110003 on 22-06-2021 by 1500 hrs and shall clearly mention name of Project, Bid No. and Bidders details.

ix. The bid shall comprise a sealed single packet containing the online submitted technical bid along with all documents and proof of online deposited tender fees & Bid security declaration shall be placed in hard binding and the pages shall be numbered serially. The document shall clearly mention Name of Bidder and Emerging Technology proposed. Each page thereof shall be initiated in blue ink by the authorized signatory. The Bid shall be marked as Original on right hand corner of Cover page of proposal in Tender in Red ink along with required documents.

4. MINIMUM ELIGIBILITY CRITERIA

The bidder should meet the following minimum qualifying criteria:

A) Work Experience:

i. Experience of having successfully completed similar works during the last 7 years ending previous day of last date of submission of bids:

a. Three similar works each costing not less than 40% of the estimated cost put to bid

OR

b. Two similar works each costing not less than 60% of the estimated cost put to bid

OR

c. One similar work costing not less than 80% of the estimated cost put to bid.

ii. The definition of similar work shall mean construction of "Residential/Non-Residential buildings using proposed emerging technology/hybrid proposed technology/any conventional technology.

iii. The past experience in similar nature of work should be supported by certificates issued by the client's organization. In case the work experience is of Private sector the completion certificate shall be supported with copies of Letter of Award and copies of corresponding TDS certificates. In case of foreign firms, necessary evidences with respect to taxes may be attached appropriately.

iv. The value of executed works shall be brought to the current level by enhancing the actual value of work done at a simple rate of 7% per annum, calculated from the date of completion to previous day of last day of submission of bids.

v. If any information furnished by the Bidder is found incorrect at a later stage, the bidder shall be liable to be debarred from further bidding and taking works. The BMTPC reserves the right to verify the contents / particulars furnished by the bidder independently including inspection of work completed by them.

B) In order to promote MAKE IN INDIA Mission of Govt. of India, the Bidder must have manufacturing facilities of the proposed technology in India. Bidder has to provide details such as production capacity of manufacturing unit, complete address of unit with telephone no., email etc.

C) The purpose of the Demonstration Housing Projects (DHP) is to popularise all innovative construction technologies available in the country for speedier, durable and affordable construction. Therefore, each DHP will be executed with different technology.

D) Technology for the project

The DHP will be constructed using 54 technologies recommended by MoHUA under GHTC -I as listed at Annexure –I.

E) The technologies which have been selected in earlier four DHP Projects i.e. Panchkula, Haryana (Light Gauge Steel Framed Structure with fibre cement board on both side and infill of rockwool – M/s Nipani Infra and Industries Pvt. Ltd.); Agartala, Tripura (Stay-in-Place Formwork System- Coffor - M/s Coffor Construction Technology Pvt. Ltd); Ahmedabad, Gujarat (Integrated Hybrid Solution – ONE (IHS – ONE - M/s Adlakha Associates Pvt. Ltd.), Chimbel, Goa (Light Gauge Steel Framed Structure with Infill Concrete Panel Technology – M/s Elemente Designer Home) F), Bhopal, Madhya Pradesh (Insulating Concrete Forms – M/s Reliable Insupack) shall not be considered to have each DHPs with different technologies.

F) Financial Strength:

i) The Average annual financial turnover of last consecutive fiscal years for last immediate 5 years shall be at least 50% of the estimated cost put to bid. The requisite Turnover shall be duly certified by a Chartered Accountant with his Seal/ signatures and registration number.

ii) Net Worth of the participating agency as on 31stMarch of previous Financial Year should be positive

iii) Networth of minimum 15% of the ECPT (Estimated Cost Put to Tender) issued by the certified Chartered Accountant.

iv) The bidder should not have incurred any loss in more than two years during available last five consecutive balance sheets. The bidder/s are required to upload and submit page of summarized Balance Sheet (Audited) and also page of summarized Profit& Loss Account (Audited) for last five years.

G) In case of Joint-venture/consortia of firms/companies:

i) A Consortium of a maximum of 3 (Three) members comprising one Lead Member with two other members shall be allowed and shall hereinafter be referred as "Consortium".

ii) The Bidder should submit a Power of Attorney authorizing the signatory of the application to commit the Bidder.

iii) Bids submitted by a Consortium should comply with the following additional requirements:

a) The number of members in the Consortium would be limited to three (3);
b) The Application should contain the information required from each member;
c) The Application should include a description of the roles and responsibilities of all the members;
d) Members of the Consortium shall nominate one member as the Lead Member and that member must be an entity as defined above;
e) The Bidder who has participated in this bid in its individual capacity or as part of a Consortium cannot participate as a separate agency of any other Consortium participating in this bid;
f) The members of the Consortium shall execute a Power of Attorney for Lead Member of Consortium.
g) The JV will be registered within one month from the date of award of work.
h) The members of the Consortium shall enter into a Memorandum of Understanding (MoU), for the purpose of submission of the bid. The MoU should, inter alia,
   - Clearly outline the proposed roles and responsibilities of each member of the Consortium; and
   - Include a statement to the effect that all members of the Consortium shall be liable jointly and severally for the assignments arising out contract agreement therefore;
   - A copy of the MoU signed by all members should be submitted along with the technical bids. The MoU entered between the members of the Consortium should contain the above requirements, failing which the bid shall be considered non-responsive.

iv) A Bidder which has earlier been barred by BMTPC or blacklisted by any State /UT Government or Central Government / department / agency in India from participating in Bidding Process shall not be eligible to submit bids, either individually or as member of a Consortium, if such bar subsists as on the submission Due Date. The Bidder or consortium shall be required to furnish an affidavit that there is no such bar imposed and existing as on date.

v) A Bidder or member of Consortium should have, during the last three years, neither failed to perform on any agreement, as evidenced by imposition of a penalty or a judicial pronouncement or arbitration award against the Bidder or member of Consortium, nor been expelled from any project or agreement nor have had any agreement terminated for breach by such Bidder or member of Consortium.

vi) The Application and all related correspondence and documents should be furnished by the bidder with the Application may be in any other language provided that these are accompanied by appropriate translations of the pertinent passages in the English language by approved/authorized/ licensed translator. Supporting material, which are not translated into English, may not be considered. For the purpose of interpretation and evaluation of the Application, the English language translation shall prevail.

vii) Bidder /consortium should be profit making organization. The audited balance sheet for the last five years maybe attached with the technical bids, otherwise bids will be rejected.

H) Foreign Work Experience Certificate:

i. In case the work experience is for the work executed outside India, the Bidder have to submit the completion/experience certificate issued by the owner duly signed &stamped and affidavit to the correctness of the completion/experience certificates. The Participating Agency shall also get the completion/experience certificates attested by the Indian Embassy/ Consulate/ High Commission in the respective country.

ii. In the event of submission of completion /experience certificate by the Bidder in a language other than English, the English translation of the same shall be duly authenticated by Chamber of Commerce of the respective country and attested by the Indian Embassy/Consulate / High Commission in the respective country.

iii. For the purpose of evaluation of Bidder, the conversion rate of such a currency into INR shall be the daily representative exchange rate published by the IMF as on 7 (Seven) days prior to the Last Date of Submission of bid including extension(s) given if any.

ANNEXURE – I

LIST OF TECHNOLOGIES RECOMMENDED UNDER GHTC -INDIA BY MINISTRY OF HOUSING AND URBAN AFFAIRS, GOVT. OF INDIA

Sl No	Technology Broad Specification	Applicants	Recommendations
A. Precast Concrete Construction System - 3D Precast volumetric (4)			
01	Pre-cast concrete system with columns, beams, walls, slabs, hollow core slabs 86 also 3D Volumetric components	Katerra	Suitable up to seismic zone IV.
02	Vertical structural modules cast in Plant/Casting yard are assembled together through casting of floor panel. The unit is transported & installed at site.	Moducast Pvt. Ltd	Suitable up to seismic zone IV. Requires proper access to site & special transport logistic. Suitable up to G+3 due to limited hoisting capacity
03	3D Modular casting using steel mould and high performance concrete of building modules in factory. These pods are transported to the construction site & assembled	Magicrete Building Solutions	Suitable up to seismic zone IV. Site must have accessibility & technology needs special transport logistics.
04	Modules with 3D Volumetric Precast concrete unit, various units make on house	Ultra-tech Cement Ltd	Suitable up to seismic zone IV Site must have accessibility & technology needs special transport logistics.
B. Precast Concrete Construction System - Precast components assembled at site (8)			
05	Precast Large Concrete Panel (PLCP) System with structural members (wall, slab etc.) cast in a factory/ casting yard and brought to the building site for erection & assembling	Larsen & Toubro	Suitable up to seismic zone IV.
06	Pre-cast Concrete Structural system comprising of pre-cast column, beam, precast concrete / light weight slab, AAC blocks/ infill concrete walls.	B.G. Shirke Construction Technology Pvt. Ltd	Suitable up to seismic zone IV.
07	Optimal Pre-cast concrete System through structural Analysis, design & equipment support	Elematic India	Suitable up to seismic zone IV. The firm needs to tie up with a construction Agency.
08	Precast concrete construction system using precast walls with precast plank floor	PG Setty Construction Technology Pvt Ltd.	Suitable up to seismic zone IV
09	Pre cast components comprising of beams, columns, staircase, slab, hollow core slab etc. manufactured in plant & erected on sit	Teemage	

10	Pre-cast sandwich panel system & Light weight Pre cast Light Weight concrete slab	Nordicflex	
11	Prefabricated Interlocking Technology (without mortar) with Roofing as Mechanized Precast R.C. Plank & Joist system **(not to be considered)**	Adalakha Associates Pvt. Ltd	Suitable up to G+3 storeys & Seismic Zone — IV
12	Large Hollow wall prefab concrete Panel (lightweight, interlocking, concrete panel) using factory produced large standard hollow interlocking concrete block	William Ling,	Suitable up to seismic zone IV
C. Light Gauge Steel Structural System & Pre-engineered Steel Structural System -(16)			
13	LGS Framing with various walling & roofing options	Mitsumi Housing Pvt. Ltd,	Suitable for G+ 3 storeys. Hybrid with steel frame for high rise Paneling materials to be used should meet the site specific quality and durability requirements .
14	LGS Framing with various walling & roofing options	Everest Industries Ltd,	
15	LGS Framing with various walling & roofing options	JSW Steel Ltd.,	
16	LGS Framing with various walling & roofing options	Society for Development of Composites	
17	LGS Framing with various walling & roofing options (not to be considered)	Elemente Designer Homes	
18	LGS Framing with various walling & roofing options	MGI Infra Pvt. Ltd.,	
19	LGS Framing with various walling & roofing options	RCM Prefab Pvt. Ltd,	
20	LGS Framing with various walling & roofing options (not to be considered)	Nipani Infra and Industries Pvt. Ltd.,	
21	LGS Framing with various walling & roofing options	Strawcture Eco	
22	LGS Framing with various walling & roofing options	Visakha Industries Ltd.	
23	Prefabricated steel structural system with Dry wall system as AAC panels, PUF panels etc.	RCC Infra Ventures Ltd.	Suitable technology
24	Hot rolled steel frame with speed floor	Jindal Steel &Power Ltd.	Suitable technology with accepted walling components
25	Hot rolled steel section with AAC Panels as floor & slab	HIL Ltd.	
26	AAC wall and roof panel system to provide integrated solution. AAC products are reinforced and used in both load and non-loadbearing applications.	Biltech Building Elements Ltd.	Suitable up to G+3 (Load bearing) Suitable with steel frame for high rise

27	AAC Panels are Wire mesh/ steel reinforced for use as wall & slab. Appears to be non-load bearing panels to be used with structural framing	SCG International India Pvt. Ltd	
28	Precast Light Weight Hollow-core wall Panel is a non-structural construction material with framed structures	Pioneer Precast Solutions Pvt Ltd.	Suitable with steel frame
D. Prefabricated Sandwich Panel System- (9)			
29	Reinforced Expanded Polystyrene sheet core Panel with sprayed concrete as wall & slab	Worldhaus	Suitable for G+ 3 storeys.
30	EPS Cement sandwich Panel wall & slab with EPS Cement sandwich Panel to be used with RCC or Steel structural frame. Load bearing upto G+3 storey	Bhargav Infrastructure Pvt. Ltd.	Suitable up to G+3 (Load bearing) Hybrid with Steel/RCC frame for multi storey
31	EPS Cement sandwich Panel): wall & slab with EPS Cement sandwich Panel to be used with RCC or Steel structural frame. Load bearing upto G+3 storey	Rising Japan Infra Private Limited	
32	Reinforced Expanded Polystyrene sheet core Panel with sprayed concrete as wall & slab	Bau Panel Systems India Pvt Ltd.	Suitable for G+ 3 storeys.
33	Reinforced Expanded Polystyrene sheet core Panel with sprayed concrete as wall & slab	BK Chemtech Engineering	
34	Reinforced Expanded Polystyrene sheet core Panel with sprayed concrete as wall & slab	MSN Construction	
35	Reinforced Expanded Polystyrene sheet core Panel with sprayed concrete as wall & slab	Beardshell Ltd.	
36	Pre-fab PIR (Poly-isocyanurate) based Dry Wall Panel System" as non-load bearing wall	Covestro India Pvt. Ltd.,	Suitable with steel frame
37	Sandwich panels as wall & slab	Project Etopia Group	Suitable for G+ 3 storeys.
E. Monolithic concrete Construction (9)			
38	Aluminium form work for Monolithic System Concrete construction	Maini Scaffold systems	Suitable Technology
39	Aluminium form work for Monolithic System Concrete construction	Kumkangkind India Pvt. Ltd.	
40	Aluminium form work for Monolithic System Concrete construction	S-Form India Pvt. Ltd.	
41	Aluminium form work for Monolithic System Concrete construction	ATS Infrastructure Ltd.	
42	Aluminium form work for Monolithic System Concrete construction	Innovative housing & Infrastructure Pvt.	

		Ltd.	
43	Aluminium form work for Monolithic System Concrete construction	MFS formwork Systems Pvt. Ltd.	
44	Aluminium form work for Monolithic System Concrete construction	Knest Manufacturers LLP	
45	'Tunnel form' construction technology, an cast in situ RCC system, based on the use of high-precision, reusable room-sized, steel forms or moulds for monolithic concrete construction	Outinord Formworks Pvt. Ltd.	Suitable Technology
46	Aluminium form work for Monolithic System Concrete construction	Brilliant Etoile	Suitable Technology
F. Stay In Place Formwork System (8)			
47	Expanded-Steel Panel reinforced with all-galvanised Steel Wire-Sturts serving both as the load- bearing steel structure and asthe stay-in-place steel formwork filled with EPS-alleviated concrete	JK Structure	Suitable for G+3 storeys
48	Factory made prefab Glass fiber reinforced Gypsum cage panels suitable for wall & slab with reinforcement & concrete as infill as per the requirement	FACT RCF Building Products Limited,	Suitable up to 10 storeys in seismic zone—III, & up to 6 storeys in seismic zone-V if conforming to design requirements
49	Structural Stay In Place Galvanized Steel formwork system for walling with the same bottom single layer Formwork for slabs/ in-situ slab **(not to be considered)**	Coffor construction Technology Pvt. Ltd.	Suitable for G+3 storeys
50	Factory produced PVC Stay in place formwork with concrete & reinforcement in walling units with cast in-situ RCC Slab	Joseph Jebastin (Novel Assembler Private Limited),	Suitable Technology
51	Fully load bearing walls with 150 mm monolithic concrete core sandwiched inside two layers of EPS as walling The forms are open ended hollow polystyrene interlocking blocks which fits together to form shuttering system **(not to be considered)**	Reliable Insupack	Suitable up to G+3 in Seismic Zone V and higher storeys in Seismic Zone IV as per design
52	Ready to use Stay in place polymer formwork, light weight, with flooring slab(combination of ferro -cement and natural stone) placed on RCC precast joists)	Kalzen Realty Pvt. Ltd.	Not suitable as the system presented by the applicant does not qualify as a proven technology. However, it is suitable technology as Stay in place pre -assembled PVC wall forms along with cast in-situ RCC slab.

53	Fast Bloc, Insulated Concrete Form (ICF), acts as formwork for concrete and rebar, Column/post and beam construction, creating an strong skeleton in the walls.	Fast block Building Systems	Suitable up to G+3 in Seismic Zone V and higher storeys in Seismic Zone IV as per design
54	Formwork system "Plaswall" with Two fibre cement boards (FCB) & HIMI (High Impact Molded Inserts) bonded between two sheets of FCB in situ and erected to produce a straight-to-finish wall with in-situ concrete	FTS Buildtech Pvt. Ltd	Suitable up to G+3 in Seismic Zone V and higher storeys in Seismic Zone IV as per design

ANNEXURE-II

BANK DETAILS OF BUILDING MATERIALS & TECHNOLOGY PROMOTION COUNCIL, NEW DELHI FOR NEFT/RTGS

Name of the Account Holder	**Building Materials & Technology Promotion Council, New Delhi**
Account No.	62054931366
Bank Name	State Bank of India
Bank Address	Pragati Vihar, Delhi Branch, Ground Floor, Core 6, SCOPE Complex, Lodi Road, New Delhi – 110 003
IFSC Code	SBIN0020511
Type of Account	Savings
Branch Code	20511
GST No.	07AAATB0304Q1ZW

ANNEXURE III

(On non judicial stamp paper of minimum of Rs. 100)

Form of Performance Security (Guarantee)
Bank Guarantee Bond

BG No. _____
Dated _____
Due on_____
For Rs. _____

In consideration of the Building Materials & Technology Promotion Council (hereinafter called "BMTPC") having offered to accept the terms and conditions of the proposed agreement between **Building Materials & Technology Promotion Council** and ..... (hereinafter called "the said Agency") for the **work .....** (hereinafter called "the said agreement") having agreed to production of an irrevocable Bank Guarantee for Rs. ..... (Rupees: .....only) as a security/guarantee from the Agency for compliance of his obligations in accordance with the terms and conditions in the said agreement.

1. We, **.....** (hereinafter referred to as "the Bank") hereby undertake to (indicate the name of the bank) pay to the BMTPC an amount not exceeding Rs. ..... (Rupees: .....only) on demand by the BMTPC.

2. We, **.....** (indicate the name of the Bank) do hereby undertake to pay the amounts due and payable (indicate the name of the bank) under this guarantee without any demure, merely on a demand from BMTPC stating that the amount claimed as required to meet the recoveries due or likely to be due from the said agency. Any such demand made on the bank shall be conclusive as regards the amount due and payable by the bank under this Guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. Rs. ..... (Rupees: .....only)

3. We, the said bank further undertake to pay the BMTPC any money so demanded notwithstanding any dispute or disputes raised by the agency in any suit or proceeding pending before any court or Tribunal relating thereto, our liability under this present being absolute and unequivocal. The payment so made by us under this bond shall be a valid discharge of our liability for payment thereunder and the agency shall have no claim against us for making such payment.

4. We, ... (indicate the name of the Bank) further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said agreement and that it shall continue to be enforceable till all the dues of the BMTPC under or by virtue of the said agreement have been fully paid and its claims satisfied or discharged or till Competent Authority on behalf of BMTPC certified that the terms and conditions of the said agreement have been fully and properly carried out by the said Agency and accordingly discharges this guarantee.

5. We, ... (indicate the name of the Bank) further agree with BMTPC that BMTPC shall have the fullest liberty without our consent and without affecting in any manner our obligation hereunder to vary any of the terms and conditions of the said agreement or to extend time of performance by the said Agency from time to time or to postpone for any time or from time to time any of the powers exercisable by BMTPC against the said Agency and to forbear or enforce any of the terms and conditions relating to the said agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Agency or for any forbearance, act of omission on the part of BMTPC or any indulgence by BMTPC to the said Agency or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision, have effect of so relieving us.

6. This guarantee will not be discharged due to the change in the constitution of the Bank or the Agency.

7. We, ...(indicate the name of the Bank) lastly undertake not to revoke this guarantee except with the previous consent of the BMTPC in writing.

8. This guarantee shall be valid up to ……unless extended on demand by the BMTPC. Notwithstanding anything contained herein above:

   i. Our liability under this guarantee shall not exceed to Rs. ..... (Rupees: .....only)
   ii. This bank guarantee shall be valid upto ……..
   iii. We are liable to pay the guaranteed amount or any part thereof under this bank guarantee only and only if you serve upon us a written claim or demand on or before ……. (mention period of the Guarantee as found under clause(ii) above plus claim period.

For .....

DATE ..... SIGNATURE

WITNESS ..... SEAL OF THE BANK

(SIGNATURE, NAME AND ADDRESS)

5. GENERAL INFORMATION AND INSTRUCTIONS TO BIDDERS

1. The tender document shall be accepted only by E- Tendering on CPP Portal (https://eprocure.gov.in/eprocure/app).

2. The tender document consisting of general specifications to be executed and the set of terms and conditions of the contract to be complied with and other necessary documents can be seen and downloaded from CPP Portal (https://eprocure.gov.in/eprocure/app) and BMTPC website www.bmtpc.org. Those bidders not registered on CPP Portal (https://eprocure.gov.in/eprocure/app) are required to get registered before submitting the tender online.

3. The cost of tender fee will not be refunded under any circumstances.

4. Bid Security Declaration in the form specified in Bid document only shall be accepted.

5. The tender offer shall be valid for 120 days from the last date of submission of Bid.

6. Tender offer without Tender fees, Bid security declaration and other required documents or any of the condition or submitted incomplete documents in any respect liable to be rejected.

7. The bidder/s are required to quote strictly as per terms and conditions, specifications, standards of emerging technologies provided in the bid documents and not to stipulate any deviations.

8. The bidder/s are advised to submit complete details with their bids as Technical Bid Evaluation will be done on the basis of documents uploaded on website by the bidder with the bids. The information should be submitted in the prescribed proforma. Bids with Incomplete /Ambiguous information will be rejected.

9. The bidder/s are advised in their own interest to submit their bid documents well in advance from last date/time of submission of bids so as to avoid problems which the bidder may face in submission at last moment /during rush hours.

10. When it is desired by BMTPC to submit revised financial bid within the validity period then it shall be mandatory to submit revised financial bid. If not submitted then the bid submitted earlier shall become invalid and action will be taken as per bid security declaration.

11. If the bidder/s is found ineligible after opening of bids, his bid shall become invalid and cost of tender fee shall not be refunded.

12. Notwithstanding anything stated above, BMTPC reserves the right to assess the capabilities and capacity of the bidder to perform the contract, in the overall interest of BMTPC. In case, bidder capabilities and capacities are not found satisfactory, BMTPC reserves the right to reject the bid.

13. Certificate of Financial Turnover: At the time of submission of bid, the bidder shall upload Affidavit/Certificate from Chartered Accountant mentioning Financial Turnover of last 5 years or for the period as specified in the bid document. There is no need to upload entire voluminous balance sheet. However, one page of summarised balance sheet (Audited) and one page of summarized Profit &Loss Account (Audited) for last 05 years shall be uploaded and submitted in hard copy also.

14. The bidder/s if required, may submit queries, if any, through E-mail and in writing to the bid inviting authority to seek clarifications upto date of pre-bid meeting from the date of uploading of bid document on website. BMTPC will reply to only those queries which are essentially required for submission of bids. BMTPC will not reply to the queries which are not considered fit like replies of which can be implied/found in the NIT/ Bid Documents or which are not relevant or in contravention to NIT/Bid Documents, queries received after 7days from the date of uploading of Bid on website. Technical Bids are to be opened on the scheduled dates. Requests for Extension of opening of Technical Bids will not be entertained.

15. Pre-bid meeting shall be held with the eligible and intending bidder at stated time and venue as mentioned earlier in NIT. As a result of pre-bid meeting, certain modifications may be issued to all eligible bidder/s by BMTPC corrigendum, if felt necessary. All modifications /addendums/ corrigendum issued regarding the bidding process, shall be uploaded on CPP Portal (https://eprocure.gov.in/eprocure/app) and website of BMTPC www.bmtpc.org only and shall not be published in any Newspaper.

16. Attending the pre-bid meeting is optional. The Pre-Bid meeting shall be attended by the intending bidder/s only. Further, the intending bidder/s should depute their authorized representative with authorization letter in original to attend the pre-bid meeting.

17. All the uploaded documents should be in readable, printable and legible form, failing which the Bids shall not be considered for evaluation. The relevant Annexure may be tabled with proper indexing.

18. No Clarification will be sought in case of non-submission of tender fee & Bid security declaration or Unconditional letter of acceptance or Affidavit for correctness of document/information. In such cases the bid shall be rejected out rightly without seeking any further clarification/document.

19. All the uploaded and submitted documents shall be considered as duly signed by authorized representative of Bidder.

20. The bid submitted shall become invalid if:
    i. The bidder/s is found ineligible.
    ii. The bidder/s does not deposit tender fee and Bid security declaration with BMTPC
    iii. The bidder/s does not upload all the documents as stipulated in the bid document.
    iv. If any discrepancy is noticed between the documents as uploaded at the time of submission of bid.
    v. Bidder/s bid with deviation or conditional bid.

21. UNFAIR ADVANTAGE- Penalty for use of Undue influence: -The bidder/s undertakes that it has not given, offered or promised to give, directly or indirectly, any gift, consideration, reward, commission, fees, brokerage or inducement to any person in service of the BMTPC or otherwise in procuring the Contracts or forbearing to do or for having done or forborne to do any act in relation to the obtaining or execution of the present Contract or any other Contract with the BMTPC for showing or forbearing to show favour or disfavour to any person in relation to the present Contract or any other Contract with BMTPC. Any breach of the aforesaid undertaking by the bidder/s or any one employed by him or acting on his behalf (whether with or without the knowledge of the bidder/s) or the commission of any offers by the bidder/s or anyone employed by him or acting on his behalf, as defined in Chapter IX of the Indian Penal Code, 1860 or the Prevention of Corruption Act,1986 or any other Act enacted for the prevention of corruption shall entitle the BMTPC to cancel the contract and all or any other contracts with the bidder/s and recover from the bidder/s the amount of any loss arising from such cancellation. A decision of the BMTPC to the effect that a breach of the undertaking had been committed shall be final and binding on the bidder/s. Giving or offering of any gift, bribe or inducement or any attempt at any such act on behalf of the bidder/s towards any officer/employee of the BMTPC or to any other person in a position to influence any officer/employee of the BMTPC for showing any favour in relation to this or any other contract, shall render the bidder/s to such liability/ penalty as the BMTPC may deem proper, including but not limited to termination of the contract, imposition of penal damages, forfeiture of the all type of deposits by the bidder/s and refund of the amounts paid by the BMTPC.

22. Canvassing in connection with the bid are strictly prohibited, and such canvassed bids submitted by the bidder/s will be liable to be rejected and his earnest money shall be absolutely forfeited.

23. The Executive Director BMTPC reserves the right to reject any or all bids or cancel/withdraw the invitation for bid without assigning any reasons whatsoever thereof. No claim of the bidder/s whatsoever shall be entertained on this account.

24. All tendered rates shall be inclusive of all taxes and levies payable under respective

statues.

25. The purpose of the Demonstration Housing Projects (DHP) is to popularise all innovative construction technologies available in the country for speedier, durable and affordable construction. Therefore, each DHP will be executed with different technology.

26. The technologies which have been selected in earlier four DHP Projects i.e. Panchkula, Haryana (Light Gauge Steel Framed Structure with fibre cement board on both side and infill of rockwool – M/s Nipani Infra and Industries Pvt. Ltd.); Agartala, Tripura (Stay-in-Place Formwork System- Coffor - M/s Coffor Construction Technology Pvt. Ltd); Ahmedabad, Gujarat (Integrated Hybrid Solution – ONE (IHS – ONE - M/s Adlakha Associates Pvt. Ltd.) and Chimbel, Goa (Light Gauge Steel Framed Structure with Infill Concrete Panel Technology – M/s Elemente Designer Home) and Bhopal, Madhya Pradesh (Insulating Concrete Forms – M/s Reliable Insupack) shall not be considered to have each DHPs with different technologies.

27. **Labour laws to be complied by the selected agency:**
    i. The selected agency shall obtain a valid license under the Contract Labour (R&A) Act 1970, and the Contract Labour (Regulation and Abolition) Central Rules 1971, before the commencement of the work, and continue to have a valid license until the completion of the work. The selected agency shall also abide by the provisions of the Child Labour (Prohibition and Regulation) Act 1986. Bidder should submit duly signed the undertaking for the same, if not available readily.

    ii. The selected agency shall also comply with the provisions of the building and other construction workers (Regulation of Employment & Conditions of Service) Act, 1996 and the building and other construction workers Welfare Cess Act 1996.

28. The amount tendered for the work should be written in English only.

29. Payment to the contractor will be made stage wise as mentioned in part 4 attached with the bid document.

30. On acceptance of the tender, the name of the accredited representative of the selected agency who will be responsible for taking instructions from the BMTPC's authorized official shall be communicated to BMTPC in writing.

31. GST, Labour Cess and any other tax in respect of the contract shall be payable by the contractor and BMTPC will not entertain any claim whatsoever in this respect.

32. The contractor shall keep necessary books of accounts and other documents for the purpose of the condition as may be necessary and shall allow inspection of the same by a duly authorized representative of BMTPC and further shall furnish such other information/document as the authorized representative of BMTPC require.

33. The bidder shall enter in to an Agreement with the BMTPC on Rs. 500 Stamp Paper as per **ANNEXURE- IV**.

34. The Bidder shall submit only one bid in his name. Submission of any additional bids, for the same work in the name of their partner/associates/group company etc. shall disqualify them.

35. Bidders shall submit PF registration certificate along with tender document.

36. BMTPC reserves the right to engage suitable Project Management Consultant &/or third Party Inspection agency to Engineering Review, monitor & supervise the said work. PMC/TPI will perform its duties as per scope of works /TOR proposed by BMTPC. The selected bidder has to submit all details to PMC.

37. Executive Director, BMTPC reserves the rights to increase /decrease the scope of work and contract without assigning any reason thereof, No claim to that effect shall be entertained.

38. The Bidder shall get the electrical works executed through the authorized Government approved / licensed electrical person or firm in appropriate category in accordance to contractual provisions.

39. The Civil & Electrical works shall be carried out strictly in accordance to the directives issued by the BMTPC.

40. The bidder shall not without the consent in writing of the Executive Director, BMTPC assign or sublet the contract nor make any sub-contract with any person or persons for the execution of the any portion of the work other than for raw materials/ Labour or for any part of the work of which the manufacturers are named on his contract.

41. In case of any dispute or clarification in specification of any tender items the decision of Executive Director, BMTPC shall be final.

42. All the bidders are requested to visit the site. The Cost/rates should be quoted such that expenditure to be done for levelling, removing debris if any, site clearance, retaining wall filling etc. should include in the quoted rate. No extra payment shall be given in any cases.

43. The site of work may be inspected by the bidder or his representative at his own cost. Technical persons of BMTPC may accompany the bidder, if convenient on prior intimation. The certificate regarding site visit shall be given by the bidder in the Form – 'I'.

44. Bidder shall have to make his own arrangements for water and electricity for the purpose of construction work at site at his own expenses.

45. The Bidder, whose tender is accepted, shall be required to furnish by way of Performance Guarantee/Security Deposit for due fulfilment of this contract at the

following rate:-

i. Performance Guarantee of 3% (Three percent) of the tendered amount to be deposited in BMTPC account or in the form of Bank Guarantee from any Indian Scheduled/Commercial Bank in prescribed format given at Annexure III for the proper performance of the Contract Agreement within 15 (Fifteen) days of issue of letter of intent. Maximum allowable 30 days. After 15 days a late fee @0.1% per day of PG amount shall be payable which shall be non-refundable. This amount shall be deposited in the BMTPC Account as per details at **ANNEXURE–II** through NEFT/RTGS; Performance guarantee will be released as below:

   After 2 years of issue of completion certificate -1.0%
   After 4 years of issue of completion certificate -1.0%
   After 5 years of issue of completion certificate -1.0 %
   Provided that there is no defect detected within the said periods.

ii. Security Deposit (SD) @ 2.5% of the tendered value, this shall be recovered from the running bills of the contractor at the rate of 2.5% till total SD reach 2.5%. Bank Guarantee from any Indian Scheduled/Commercial Bank in prescribed format given at Annexure III can also be submitted. 50% of the security deposit shall become refundable after successful completion of Maintenance period of 2 years. The remaining 50% of the security deposit shall be released after the completion of defects liability period.

46. The layout plan & architectural drawings of the proposed building (G+3) is attached at Part 8. The same may slightly deviate as per technology requirement (due to change in thickness of external and internal walls) with the approval of BMTPC. However, the minimum carpet area of various rooms and other provisions including kitchen/pantry, toilet, balcony/ verandah and circulation areas such as steps, entrance plateform, ramp, staircase, lobby and corridor/passage need to be maintained as per enclosed drawings in the tender. The Built Up area may vary accordingly.

47. All Bidders are required to quote the rates in financial bid for both the works i.e. building& other provisions and on site Infrastructure works respectively. L1 will be decided on the basis of lowest total quoted amount of work, otherwise, bids will be considered as no-responsive and will be rejected without assigning any reason/s.

48. All the taxes such as TDS etc. as applicable under Govt. of India Rules shall be deducted from the running / final bills of the selected agency.

49. Integrity Pact duly signed by the bidder/s shall be submitted as per **ANNEXURE-V**. Any bid without signed integrity Pact shall be liable for rejection.

50. The Bid Security Declaration shall cease to be valid in case of non successful Bidders or 120 days after the expiration of the validity of Bid.

51. The successful bidder shall deposit the Performance Guarantee within prescribed period as per tender document.

52. In case of any query, please contact on Ph. No. 011-24652416, 24636705 and E- mail: info@bmtpc.org .

Executive Director
BMTPC

6. LIST OF DOCUMENTS TO BE UPLOADED WITH TECHNICAL BID

1) Letter of Transmittal
2) Integrity pact duly signed by the bidder (**ANNEXURE-V**). The Bidder /s are required to download the Integrity Pact as uploaded in the bid documents, and sign on the same, put rubber stamp/seal and upload the signed copy on e-biding websites.
3) Unconditional Letter of Acceptance of Bid Conditions (in original) mentioned in **ANNEXURE-VI** (On Letter Head of the bidder)
4) Memorandum as **ANNEXURE-VIII**.
5) Financial information of Bidder - FORM-A.
6) Networth Certificate duly certified by authorised Chartered Accountant in form B.
7) Details of Similar Works and work Experience Certificates from certified Chartered Accountant FORM-C and FORM -D
8) Structure and Organization Details of Firm – FORM E
9) Proof of deposited of Tender Fee and Bid security declaration (Appendix-II) – FORM F
10) Balance sheet (Audited) and Profit &Loss Account (Audited) for last 05 years of bidder/s duly certifies by Chartered Accountant.
11) Income tax return of last 5 financial years of bidder (For all parties in case of JV).
12) Form-G of Contract Conditions –Affidavit duly notarized by Notary Public on Non Judicial Stamp Paper of Rs. 100 for correctness of Documents /Information.
13) Power of Attorney of the person authorized for signing/submitting the bid.
14) Copy of MOU signed by the all members of JV along with Power of Attorney authorising the signatory of the bid to commit the bidder.
15) Certificate of registration of bidder.
16) Valid GST registration/EPF registration/PAN NO. (For all parties in case of JV).
17) All pages of the entire Corrigendum (if any) duly signed by the authorized person.
18) Pre-bid clarifications, if any.
19) Registration Details of the participating agency as per GST Act in the State at the location of the Project– Form-H or duly signed undertaking for obtaining the same, if not readily available.
20) Certificate regarding site visit by the contractor in the FORM – 'I'
21) Details of Administrative and Technical staff to be associated in the project
22) Geographical presence of the Bidder
23) Valid License under Contract Labour (R & A) Act 1970 or duly signed undertaking for obtaining the same, if not readily available.
24) Complete details of proposed technology including specifications.
25) Details of manufacturing facilities of the proposed technology in India.
26) Complete detailed of technology of proposed
27) Project brief on approach to design and construction work for this project.
28) Any other documents as deemed fit by bidder.

NOTE: i) All the uploaded documents should be in readable, printable, legible and in the order mentioned above, failing which the Bids shall not be considered for evaluation.

ii) All the above documents duly paginated, signed, indexed and bound in one volume are also required to be submitted in physical form to BMTPC before last date of submission of bid.

ANNEXURE- IV

PROFORMA FOR AGREEMENT

(On Non-Judicial Stamp Paper of Rs. 500/-)

THIS AGREEMENT made this ……day of ……. between the BMTPC, established under the MoHUA, having its Office at Core 5A, 1st Floor, India Habitat Centre, Lodhi Road, New Delhi – 110003 (which expression shall mean and include its successor or successors in office and assignee) acting through the Executive Director, BMTPC, New Delhi hereinafter called, 'The Council' on the one part and M/s/Sri ……..... …….. hereinafter called the "Agency" which expression shall mean and include their heirs, executors, administrators and assignee) on the other part.

WHEREAS, BMTPC, is desirous of construction of **(NAME OF WORK)** (hereinafter referred to as the "PROJECT") on behalf of the **(NAME OF OWNER/MINISTRY)** (hereinafter referred to as "OWNER"), had invited tenders as per Tender documents vide NIT No. _____.

AND WHEREAS **(NAME OF CONTRACTOR)** had participated in the above referred tender vide their tender dated _____ and BMTPC has accepted their aforesaid tender and award the contract for (NAME OF PROJECT) on the terms and conditions contained in its Letter of Intent No. _____ and the documents referred to therein, which have been unequivocally accepted by **(NAME OF CONTRACTOR)** vide their acceptance letter dated _____ resulting into a contract.

NOW THEREFORE THIS DEED WITNESSETH AS UNDER:

ARTICLE 1.0 – AWARD OF CONTRACT

a. SCOPE OF WORK

BMTPC has awarded the contract to **(NAME OF CONTRACTOR)** for the work of **(NAME OF WORK)** on the terms and conditions in its letter of intent No. _____ dated _____ and the documents referred to therein. The award has taken effect from **(DATE)** i.e. the date of issue of aforesaid letter of intent. The terms and expressions used in this agreement shall have the same meanings as are assigned to them in the "Contract Documents" referred to in the succeeding Article.

ARTICLE 2.0 – CONTRACT DOCUMENTS

2.1 The contract shall be performed strictly as per the terms and conditions stipulated herein and in the following documents attached herewith (hereinafter referred to as "Contract Documents").

a) BMTPC Notice Inviting Tender No. _____ date _____and BMTPC's tender document consisting of:

i) _____

ii) _____

iii) _____

b) **(NAME OF CONTRACTOR)** letter proposal dated _____ and their subsequent communication:

i. Letter of Acceptance of Tender Conditions dated _____
ii. _____
iii. _____

2.2 BMTPC's detailed Letter of Intent No. _____ dated ____.

2.3 All the aforesaid contract documents referred to in Para 2.1 and 2.2 above shall form an integral part of this Agreement, in so far as the same or any part thereof column, to the tender documents and what has been specifically agreed to by BMTPC in its Letter of Intent. Any matter inconsistent therewith, contrary or repugnant thereto or deviations taken by the Contractor in its "TENDER" but not agreed to specifically by BMTPC in its Letter of Intent, shall be deemed to have been withdrawn by the Contractor without any cost implication to BMTPC. For the sake of brevity, this Agreement along with its aforesaid contract documents and Letter of Intent shall be referred to as the "Contract".

ARTICLE 3.0 – CONDITIONS & CONVENANTS

3.1 The scope of Contract, Consideration, terms of payments, advance, security deposits, taxes wherever applicable, insurance, a greed time schedule, compensation for delay and all other terms and condition contained in BMTPC's Letter of Intent No. _____ dated _____ are to be read in conjunction with other aforesaid contract documents. The contract shall be duly performed by the contractor strictly and faithfully in accordance with the terms of this contract.

3.2 The scope of work shall also include all such items which are not specifically mentioned in the Contract Documents but which are reasonably implied for the satisfactory completion.

3.3 Contractor shall adhere to all requirements stipulated in the Contract documents.

3.4 Time is the essence of the Contract and it shall be strictly adhered to. The progress of work shall conform to agreed works schedule /contract documents and Letter of Intent.

3.5 This agreement constitutes full and complete understanding between the parties and terms of the presents. It shall supersede all prior correspondence to the extent of inconsistency or repugnancy to the terms and conditions contained in Agreement. Any modification of the Agreement shall be effected only by a written instrument signed by the authorized representative of both the parties.

3.6 The total contract price for the entire scope of this contract as detailed in Letter of Intent is Rs._____ (Rupees _____ only), which shall be governed by the stipulations of the contract documents

ARTICLE 4.0 – NO WAIVER OF RIGHTS

4.1 Neither the inspection by BMTPC or the authorized representative of BMTPC or Owner or any of their officials, employees or agents nor order by BMTPC or the authorized representative of BMTPC for payment of money or any payment for or acceptance of, the whole or any part of the work by BMTPC or the authorized representative of BMTPC or any extension of time nor any possession taken by the authorized representative of BMTPC shall operate as waiver of any provisions of the contract, or of any power herein reserved to BMTPC, or any right to damage herein provided, nor shall any waiver of any breach in the contract be held to be a waiver or any other or subsequent breach.

ARTICLE 5.0 – GOVERNING LAW AND JURISDICTION

5.1 The Laws applicable to this contract shall be the laws in force in India and jurisdiction of Delhi Court (s) only.

5.2 Notice of Default

Notice of default given by either party to the other party under the Agreement shall be in writing and shall be deemed to have been duly and properly served upon the parties hereto, if delivered against acknowledgment due or by FAX or by registered mail duly addressed to the signatories at the address mentioned herein above.

IN WITNESS WHEREOF, the parties through their duly authorized representatives have executed these presents (execution whereof has been approved by the Competent Authorities of both the parties) on the day, month and year first above mentioned at New Delhi.

For and on behalf of: For and on behalf of:

SIGNED AND DELIVERED FOR AND ON BEHALF OF M/s /Shri
……

IN THE PRESENCE OF

WITNESS 1. 2.

SIGNED AND DELIVERED FOR AND ON BEHALF OF
BUILDING MATERIALS & TECHNOLOGY PROMOTION
COUNCIL (BMTPC)
IN THE PRESENCE OF

WITNESS 1. 2.

PART-2

Technical Bid

1. BRIEF PARTICULARS OF WORK

1. Salient details of the work for which bids are invited are as under:

Name of work	Estimated Project Cost put to bid (Rs. in Lakhs)	Stipulated period of completion of work
Construction of Demonstration Housing Project (G+3) for use as accommodation for Contractual Safai Karamchari and Community Centre on Design & Build basis using emerging technology listed at **Annexure–I** including onsite infrastructure work Guwahati, Assam	929.18	10.5 Months

2. The site for work has been allotted by Guwahati Municipal Corporation, Guwahati at Fatashil Ambari, Guwahati – 25 through Mission Director, PMAY-HFA (U), Assam.

3. The salient features of the project are as under:

i.	DHP consist of	DUs (a Living Room, a Bed Room, a Kitchen, a Bath Room, a WC, a lobby and & a Balcony) – 40 nos. **Other Provisions** A Community Centre consist of a Hall, a kitchen, 2 toilets, green room, 2 shops & a office
ii.	Plot area for DHP	1800 Sqmt.
iii.	No. of Floors	G+3 (Houses), G Community Centre
iv.	Carpet area of each Unit	31.03 Sqmt
v.	Total built up area of Building (houses)	1875 Sqmt.
vi.	Total built up area of community centre	341 Sqmt
vii.	Total built up area of Building and Community Centre (Based on external wall thickness of 200 mm and internal wall thickness of 100 mm) including passage/corridors / lobby and staircase	2216 Sqmt.
viii.	Infrastructure components	Roads & pavements, Boundary wall & Gate, Sewerage, Septic tank, External water supply, Drainage, Bore well, Underground water tank, Rain water Harvesting, External Electrification, Solar street lights, Fire-fighting works, Landscaping, etc.

4. The soil Investigation report received from Mission Director, PMAY-HFA (U), Assam is placed at Part-6. However, soil investigation report may be further verified by the bidder at site.

5. The work for building including other provisions will be on lump sum basis and onsite infrastructure works will be on Item Rate basis.

6. Major components of scope of work are as under:
   i) Architectural design and obtaining all statutory/local body approvals required to start and execute the construction work.The layout plan & architectural drawings of the proposed building (G+3) and Community Centre is attached at Part-8. The same may slightly deviate as per technology requirement (due to change in thickness of external and internal walls) with the approval of BMTPC. However, the minimum carpet area of different rooms and other provisions including, toilet, balcony/verandah and circulation areas such as staircase, corridor/passage need to be maintained as per enclosed drawings in the tender. The Built Up area may vary accordingly.

   ii) Structural design of the DHP as per proposed technology from a competent structural Engineer/firms.

   iii) Vetting of structural design by Technical / Research institutions of repute such as IITs, NITs, Govt. Engineering Colleges, CSIR Labs, Govt. Research Institutions.

   iv) Construction of building and other provisions including all associate facilities and services complete in all respect as per approved drawings and specification on Lump-Sum basis.

   v) Construction of onsite infrastructure works such as Roads & pavements, Boundary wall & Gate, Sewerage, Septic tank, External water supply, Drainage, Bore well, Underground water tank, Rain water Harvesting, External Electrification, Solar street lights, Fire-fighting works, Landscaping, etc. as per approved drawings and specifications on item rate basis.

   vi) Arranging required material, machinery and manpower so as to complete the work in stipulated time.

   vii) Maintenance of structure and onsite infrastructure works during defect liability period of Five Years.

7. Work shall be executed according to Clauses of Contract of General Condition of Contract (GCC) (EPC) of CPWD 2019 with upto date amendments mentioned at Part – 3 and schedule of finishes & specifications given in Part -3 of this bid document and latest CPWD Specification with upto date amendments issued by CPWD till the last of submission of bid.

2. INFORMATION AND GUIDELINES FOR BIDDERS

1.0 General:

1.1 Letter of transmittal and forms for deciding eligibility are given at Section 3 (Page No. 44).

1.2 All information called for in the enclosed forms should be furnished against the relevant columns in the forms. If for any reason, information is furnished on a separate sheet, this fact should be mentioned against the relevant column. Even, if no information is to be provided in a column, a 'nil' or 'no such case' entry should be made in that column. If any particulars/query is not applicable in case of the bidder, it should be stated as 'Not applicable'. The bidder are cautioned that not giving complete information called for in the application forms or not giving it in clear terms or making any change in the prescribed forms (or) deliberately suppressing the information may result in the bid being summarily disqualified. Bid made by telegram or telex and those received late will not be entertained.

1.3 The bid should be in English. The bidder should sign on each page of application, forms and documents before scanning& uploading and to ensure proper numbering and indexing.

1.4 Corrections if any should be made by neatly crossing out, initialing, dating and rewriting. Pages of the eligibility criteria document are numbered. Additional Sheets if any added by the bidder should also be numbered by him. They should be submitted as a package with signed letter of transmittal. Over writing should be avoided.

1.5 References, information and certificate from the respective clients certifying suitability, technical knowledge or capability of the bidder should be signed by an authorized officer.

1.6 The bidder may furnish any additional information, which he thinks is necessary to establish his capabilities to successfully complete envisaged work. He is however advised not to furnish superfluous information. No information shall be entertained after submission of eligibility criteria document unless it is called for by BMTPC.

1.7 If private works are shown in support of eligibility, certified copy of the TDS shall be submitted along with the experience certificate and the TDS amount shall tally with the actual amount of work done.

1.8 All bidder as a single entity or in JV/ Consortium have to meet all eligibility conditions mentioned in bid document comprehensively otherwise bid submitted will be rejected.

2.0 Definitions:

2.1 In this document the following words and expressions have the meaning hereby assigned to them.

2.2 Employer: Means the BMTPC acting through the Executive Director

2.3 Bidder: Means the Technology/system providers (single business entity) and Joint Venture/ consortia of firms / companies (hereafter called Agency)

2.4 "Year" means "Financial Year" unless stated otherwise

3.0 Final Decision Making Authority:

The BMTPC reserves the right to accept or reject any bid and to annul the process and reject all bids at any time without assigning any reason or incurring any liability to the bidder/s.

4.0 Addendum/ Corrigendum

Addendum/Corrigendum to the bid documents may be issued prior to the date of submission of the bid to clarify or effect modification in specification and/or contract terms included in various bid documents. The bidder/s shall suitably take into consideration such Addendum/Corrigendum while submitting his bid. The bidder shall upload / return such Addendum/Corrigendum duly signed and stamped as confirmation of its receipt & acceptance and submit along with the bid document. All Addendum/Corrigendum shall be signed and stamped on each page by the bidder and shall become part of the bid and contract documents.

5.0 Site Visit:

It is incumbent upon the bidder to visit the site at his own cost, and examine it and its surroundings by himself collect all information that is considered necessary for proper assessment, planning, design and construction of the project. It is expected that while bidding, the bidder will take utmost care and diligence by visiting the sites and collecting the required parameters necessary. In case of any discrepancies later, BMTPC will not be held responsible.

6.0 Evaluation Criteria:

6.1 The details submitted by the bidder will be evaluated in the following manner:-

6.1.1 The initial criteria prescribed in the bid document in respect of experience of similar work experience, eligibility, net worth and financial strength etc., will first be scrutinized and the bidder/s eligibility for the project will be determined.

6.1.2 The bidder/s qualifying the initial criteria as mentioned above will be evaluated as per the criteria mentioned below by scoring method on the basis of details furnished by the bidder/s-

a. Financial strength (Form 'A'& 'B')- **Max.25 marks**
b. Experience in similar nature of work during last 7 years(Form 'C')- **Max.25 marks**
c. Performance on works (Time over Run) (Form 'D') –**Max.10 marks**
d. Performance on works (Quality) (Form 'D')- **Max.20 marks**
b. Assessment in terms of Technical Competency, plant and machinery, consulting capabilities, approach to design and construction and work plan– **Max 20 marks**

Total – 100marks

The Detailed criteria for evaluation of performance of Bidder for Pre-Eligibility is given at **Appendix – I**

6.1.3 To become eligible for short listing and for opening the Financial Bid, the bidder must secure at least 50% (Fifty percent)marks in each category and 60% (Sixty percent) marks in aggregate.

6.1.4 BMTPC, however reserves the right to restrict the list of such qualified Bidder to any number deemed suitable by it.

6.1.5 After evaluation of Technical Bids, Financial Bids will be opened only of technically qualified bidders as per the criteria defined above and the work will be awarded to the lowest quoted (L1)bidder.

Note: The average value of performance of works for time over run and quality shall be taken on the basis of performance report of the eligible similar works.

7.0 Financial Information:

Bidder should furnish the following financial information:

i. Annual financial statement for the last Five years in Form 'A' and
ii. Net worth Certificate in form B.

8.0 Experiences in Works Highlighting Experience in Similar Works:

8.1 Bidder should furnish the following:

i. List of all works of similar nature successfully completed during last

Seven years in Form 'C'

ii. Performance reports (corresponding to work mentioned in (Form-C) in Form-D. If needed, the bidder may attach a separate certificate in this regard from performance report issuing authority.

9.0 Organization Information:

9.1 Bidder is required to submit the information in respect of his/her/their organization in Form- 'E'.

9.1.1 The bidder should have sufficient number of Technical and Administrative employees for proper execution of the contract. The Bidder should have to submit a list of these employees stating clearly how these would be involved in this work within 15 days of award of work.

10.0 Construction Plant and Equipment:

The Bidder should furnish the list of construction plant and equipment required to be used in carrying out the work.

11.0 Letter of Transmittal:

The Bidder should submit the letter of transmittal attached with the document.

12.0 Opening of Financial Bid:

After evaluation of pre-qualification documents, a list of short listed agencies who qualifies in technical bids will be prepared. There after the financial bids of only the qualified and technically acceptable bidder shall be opened at the notified time, date and place in the presence of the qualified bidders or their representatives if they desire to be present. The bid shall remain valid for 120 days from the date of opening of Technical bid (eligibility bid).

13.0 Award criteria:

13.1 The BMTPC reserves the right, without being liable for any damages or obligation to inform the bidder to:

13.1.1 Amend the scope and value of contract.

13.1.2 Reject any or all the applications without assigning any reason.

13.1.3 Any effort on the part of the bidder or his agent to exercise influence or to pressurize the BMTPC would result in rejection of his bid. Canvassing of any kind is prohibited.

Appendix - I

Detailed Criteria for Evaluation of the performance of bidders for Pre-Eligibility

S. No	Attributes	Max. Marks	Evaluation
1	**Financial Strength (Maximum 25 Marks)**	20 Marks	1. a). 60% marks for minimum eligibility criteria b) 100% marks for twice the minimum eligibility criteria or more In between (a) & (b) - on pro-rata basis
		05 Marks	2. Minimum 15% of the ECPT issued by the certified Chartered Accountant
2.	**Past Experience in similar work (Maximum 25 Marks)**	25 marks	a). 60% marks for minimum eligibility criteria b) 100% marks for twice the minimum eligibility criteria or more In between (a) & (b) - on pro-rata basis
3.	**Performance on works [Time Over Run (TOR)]: Maximum 10 marks**		

	Parameter	Calculation for points	Score				Maximum Marks
	If TOR =		1.00	2.00	3.00	>3.50	10
	(i) Without levy of compensation		10	7.5	5	5	
	(ii) With levy of compensation		10	2.5	0	0	
	(iii) Levy of compensation not decided		10	5	0	0	
	TOR = AT/ST, where AT =Actual Time; ST= Stipulated Time. Note: Marks for value in between the stages indicated above is to be determined by straight line variation basis.						

4	**Performance of works (Quality): Maximum 20 Marks**	
	(i) Outstanding	20 Marks
	(ii) Very Good	15 Marks
	(iii) Good	10 Marks
	(iv) Poor	0 Marks
5	**Assessment in terms of Technical Competency, plant and machinery, consulting capabilities, approach to design and construction with work plan: Max 20 Marks** (Attach the list of technical staffs, existing consultation partners, plant and machinery details, geographical presence and other moveable and immovable assets)	
	i. Technical staffs, existing consultation partners	05 Marks
	ii. Plant and machinery details	05 Marks
	iii. Geographical presence and other moveable and immovable assets	05 Marks
	iv. Approach to design and construction, work plan based on design philosophy mentioned in scope of work	05 Marks
	Grand Total	**100 Marks**

3. TEMPLATE OF FORMS

LETTER OF TRANSMITTAL

From:

_____

_____

To,

Executive Director,
Building Materials & Technology Promotion Council (BMTPC)
Core 5A, 1st Floor, India Habitat Centre,
Lodhi Road, New Delhi – 110 003

Name of Work: Construction of Demonstration Housing Project (G+3) for use as accommodation for Contractual Safai Karamchari and Community Centre on Design & Build basis using Emerging technology including on site Infrastructure Work at Guwahati, Assam.

Sir,

Having examined details given in the bid document for the above work, I/we hereby submit the relevant information.

1. I/We hereby certify that all the statements made and information supplied in the enclosed Forms A to J and accompanying statement are true and correct.

2. I/we have furnished all information and details necessary for eligibility and have no further pertinent information to supply.

3. I/we submit the requisite net worth certificate by certified chartered accountant and authorize the……to approach the CA issuing the net worth certificate to confirm the correctness thereof. I/We also authorize……to approach individuals, BMTPC, firms and corporation to verify our competence, work experience, and general reputation.

I/we submit the following certificates in support of our suitability, technical knowledge and capability for having successfully completed the following works:

Certificate

It is certified that the information given in the enclosed eligibility bid are correct. It is also certified that I/We shall be liable to be debarred, disqualified/cancellation of enlistment in case any information furnished by me/us found to be incorrect.

Enclosures:

Date of submission

Seal of Bidder& Signature(s) of bidder/s

FORM 'A'

FINANCIAL INFORMATION

Name of the firm/Bidder……..:

I. Financial Analysis-Details to be furnished duly supported by figures in balance sheet/profit & loss account for the last five years duly certified and audited by the Chartered Accountants, as submitted by the bidder to the Income Tax Department (Copies to be attached).

(Rs.in Lakh)

Sl. No.	**Particulars**	**Financial Years**				
i)	Turnover of construction works	2015-16	2016-17	2017-18	2018-19	2019-20
ii)	Profit/ Loss					

II. Financial arrangements for carrying out the proposed work.

III. Net Worth Certificate from authorized CA of participating agency in the prescribed Form "B"

SIGNATURE OF BIDDER/S Signature of Chartered Accountant with Seal

FORM 'B'

FORM FOR CERTIFICATE OF NETWORTH FROM CHARTERED ACCOUNTANT

It is to certify that as per the audited balance sheet and profit & loss account during the financial year ……., Net Worth of M/s…… (Name & Registered Address of individual/firm/company), as on …… (the relevant date) is Rs. …… after considering all liabilities. It is further certified that the Net Worth of the company has not eroded by more than 30% in the last three years on (the relevant date.)"

Signature of Chartered Accountant

……

Name of the Chartered Account

……

Membership No. of ICAI

Date and Seal

FORM 'C'

DETAILS OF ELIGIBLE SIMILAR NATURE OF WORKS COMPLETED IN LAST SEVEN YEARS ENDING PREVIOUS DAY OF LAST DATE OF SUBMISSION OF BID

Name of the firm/Bidder……..

S.No.	Details
1.	Name of work/project and location
2.	Owner or sponsoring organization
3.	Cost of work in Rs. in Crores
4.	Date of commencement as per contract
5.	Stipulated date of completion
6.	Actual date of completion
7.	*Litigation/arbitration cases pending/in progress with details
8.	Name and Address (Postal & E-mail)/telephone number of officer to whom reference may be made
9.	Whether the work was done on back to back basis

Certified that the above list of works is complete and no work has been left out and that the information given is correct to my/our knowledge and belief.

SIGNATURE OF BIDDER/S WITH STAMP

*indicate gross amount claimed and amount awarded by the Arbitrator.

FORM 'D'

PERFORMANCE REPORT OF WORKS REFERRED IN FORM-C

1.	Name of work/Project & Location		
2.	Agreement No.		
3.	Estimated Cost		
4.	Bided Cost		
5.	Date of Start		
6.	Date of completion		
	i)	Stipulated Date of Completion (as mentioned in work order)	
	ii)	Actual Date of Completion	
7.	i)	Whether case of levy of compensation for delay has been decided or not	Yes/ No.
	ii)	If decided, amount of compensation levied for delayed completion, if any.	
8.	Performance Report		
	1) Quality of Work		Outstanding / Very Good / Good / Poor
	2) Financial Soundness		Outstanding / Very Good / Good / Poor
	3) Technical Proficiency		Outstanding / Very Good / Good / Poor
	4) Resourcefulness		Outstanding / Very Good / Good / Poor
	5) General Behavior		Outstanding / Very Good / Good / Poor

Dated: Competent Authority

Note: This certificate should be issued by the owner of the project. However, the quality and performance shall be established by the BMTPC by conducting site visits to the selected project sites

FORM 'E'

STRUCTURE & ORGANIZATION

1.	Name & Address of the Bidder		
2.	Telephone No. / Email id /Telex No./Fax No.		
3.	Legal status of the bidder (attach copies of original document defining the legal status).		
	a)	A Business Entity	
	b)	A Proprietary Firm	
	c)	A Firm in Partnership	
	d)	A Limited Company or Corporation	
4.	Particulars of registration with various Government bodies (attach attested photo-copy).		
	ORGANIZATION/PLACE OF REGISTRATION		REGISTRATION No.
	1.		
	2.		
	3.		
5.	Names and Titles of Directors& Officers with designation to be concerned with this work.		
6.	Designation of individuals authorized to act for the organization.		
7.	Has the bidder or any constituent partner in case of partnership firm, ever abandoned the awarded work before its completion? If so, give name of the project and reasons for abandonment.		
8.	Has the bidder, or any constituent partner in case of partnership firm/limited company/ joint venture, ever been convicted by the court of law? If so, give details.		
9.	In which field of Civil Engineering Construction, the bidder has specialization and interest?		
10.	Any other information considered necessary but not included above.		

Signature of bidder/s with stamp

FORM 'F'

TENDER FEE AND BID SECURITY DECLARATION FORMAT

1. Name of Work: Construction of Demonstration Housing Project (G+3) for use as accommodation for Contractual Safai Karamchari and Community Centre on Design & Build basis using Emerging technology including on site Infrastructure Work at Guwahati, Assam.

2. BID No: BMT/S/2021/DHP-TN

3. Name of Bidder:

4. Details of Tender Fee Deposit through RTGS/NEFT in BMTPC account:

   Bank UTR No ----------, Date ----------, Name of Bank----------

   ----------, Amount----------

5. Bid Security declaration as per Appendix- II

6. Last date of submission of bid:

.

Signature of bidder/s with stamp

Appendix - II

Proforma for Bid Security Declaration

Whereas, I / we ……. (name of agency) ……. have submitted bids for ……. (name of work) ……..

I/We hereby submit following bid security declaration in lieu of submitting Earnest Money Deposit:

1) If after the opening of tender, I/we withdraw or modify my / our bid during the period of validity of tender (including extended validity of tender) specified in the tender documents.

or

2) If, after the award of work, I/we fail to sign the contract, or to submit performance guarantee before the deadline defined in the tender documents.

I/We shall be suspended for one year and shall not be eligible to bid for BMTPC tenders from date of issue of suspension order.

I/We understand this Bid Security Declaration shall cease to be valid if I am /we are not the successful Bidder, upon the earlier of (i) the receipt of your notification of the name of the successful Bidder; or (i) 120 days after the expiration of the validity of my / our Bid.

Signature of Bidder /
Authorized Signatory with seal of Agency

Date: ……..

Place: ……

(Note: In case of a Joint Venture, the Bid Security Declaration must be in the name of all partners to the Joint Venture that submits the bid)

Form-G

AFFIDAVIT

(To be submitted by bidder on non-judicial stamp paper of Rs.100/- (Rupees Hundred only) duly attested by Notary Public)

Affidavit of Mr. .....S/o ..... R/o .....

I, the deponent above named do hereby solemnly affirm and declare as under:

1. That I am the Proprietor/Authorized signatory of M/s …….Having its Head Office /Regd. Office at……
2. That the information/documents/Experience certificates submitted by M/s…….. along with the tender for …… (Name of work)…… to BMTPC are genuine and true and nothing has been concealed.
3. I shall have no objection in case BMTPC verifies them from issuing authority(ies). I shall also have no objection in providing the original copy of the document(s), in case BMTPC demands so for verification.
4. I hereby confirm that in case, any document, information & / or certificate submitted by me found to be incorrect / false / fabricated BMTPC at its discretion may disqualify / reject / terminate the bid/contract and also forfeit the Tender fee and Bid Security Declaration / All dues.
5. I hereby confirm that our firm /company is not blacklisted/ barred /banned from tendering by BMTPC. If this information is found incorrect, BMTPC at its discretion may disqualify / reject / terminate the bid/contract.
6. The person who has signed the tender documents is our authorized representative. The Company is responsible for all of his acts and omissions in the tender.

I, ..., the Proprietor / Authorised signatory of M/s..... do hereby confirm that the contents of the above Affidavit are true to my knowledge and nothing has been concealed there from..... and that no part of it is false.

DEPONENT

Verified at .....this.....day of ..... DEPONENT

ATTESTED BY (NOTARY PUBLIC)

FORM-H

GST Registration Details of Bidder	
Name	
Address (As per registration with GST)	
City	
Postal Code	
Region/State (Complete State Name)	
Permanent Account Number	
GSTIN ID/Provisional ID No.: (copy of Acknowledgement required)	
Type of Business (As per registration with GST)	
Service Accounting Code/HSN Code:	
Contact Person	
Phone Number and Mobile Number	
Email ID	
Compliance Rating (if updated by GSTN)	

FORM- 'I'

SITE VISIT CERTIFICATE

(To be submitted on the letter head of Bidder)

I ---------- authorised representative of M/s ---------- ---------- has /have visited the site of the project Construction of Demonstration Housing Project (G+3) for use as accommodation for Contractual Safai Karamchari and Community Centre on Design & Build basis using Emerging technology including on site Infrastructure Work at Guwahati, Assam.

We have inspected and evaluated the existing site with reference to its location, soil conditions, sub soil water table, etc. We have submitted this offer after satisfying ourselves about the local conditions, local costs, etc.

Signature of the Tenderer

FORM 'J'

FORMAT OF BANK GUARANTEE FOR MOBILISATION ADVANCE
(Clause 10 B(ii) of Contract Condition)

Bank guarantee made on this ……. Between …… (hereinafter called "the Bank") of the One Part and Building Materials & Technology Promotion Council (hereinafter called "the Implementing Agency ") of the other Part.

WHEREAS Building Materials & Technology Promotion Council has awarded the Bid No. BMT/S/2021/DHP-ASSAM for "Construction of Demonstration Housing Project (G+3) for use as accommodation for Contractual Safai Karamchari and Community Centre on Design & Build basis using Emerging technology including on site Infrastructure Work at Guwahati, Assam" to M/s …… (hereinafter called "the Contractor"), having its registered office at ……..

AND WHEREAS vide Clause 10 B (ii) of contract condition, General Conditions of Contract, Mobilization Advance up to ---% (--- percent) of the original contract value of Rs…….. is payable to the contractor against Bank Guarantees, the contractor hereby applies for Mobilization Advance of --% (--- percent) amounting to Rs……../- (Rupees……..) of the Contract Price,

Now, we the undersigned, Bank of ……., being fully authorized to sign and to incur obligations for and on behalf of and in the name of Bank of ……..hereby declare that the said Bank will guarantee the Implementing agency the amount of Rs. ……../- (Rupees……..) as stated above.

We, Bank of ……., do hereby unconditionally, irrevocably and without demur guarantee and undertake to pay the Implementing agency immediately on demand any or all money payable by the contractor to the extent of Rs. ……./- (Rupees……..) without any demur, reservation, context, recourse or protest and/or without any reference to the contractor. Any such demand made by the Implementing agency on the Bank shall be conclusive and binding notwithstanding any difference between the Implementing agency and the contractor on any dispute pending before any court, Tribunal, Arbitrator or any other authority. We agree that the guarantee herein contained shall be irrevocable and shall continue to be enforceable till the Implementing agency discharges this guarantee.

This guarantee is valid till ……..

At any time during the period in which this guarantee still valid of the consultant fails to fulfill its obligation under the Contract, it is understood that the Bank will extend this guarantee under the same condition for the required time on demand by the Implementing agency at the cost of the contractor.

The Guarantee hereinbefore contained shall not be affected by any change in the constitution of the Bank or of the contractor.

The neglect or forbearance of the Implementing agency in enforcement of payment of any money, the payment whereof is intended to be hereby secured or the giving of time by the Implementing agency for the payment hereof shall in no way relieve the Bank of their liability under this Deed.

The expressions "the Implementing agency", "the Bank" and "the contractor" hereinbefore used shall include their respective successors and assigns.

Notwithstanding anything contained herein:

Our liability under this Bank Guarantee shall not exceed Rs……./- (Rupees…….)

this bank Guarantee shall be valid up to…….

We are liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only and only if you serve upon us a written claim or demand on or before ……(date of expiry of Guarantee).

In witness whereof we of the Bank have signed and sealed this Guarantee on the ……day of …….. being herewith duly authorized.

For and on behalf of the Bank of…….

Signature of Authorized Bank Official

Name: _____

Designation _____

Stamp/Seal of the bank _____

Signed, sealed and delivered for and on behalf of the bank by the above named…….. in the presence of

Witness 1	Witness 2
Signature	Signature
Name	Name
Address	Address

Note:

1. The Bank guarantee should be furnished on stamp paper of value not less than Rs. 100/-.
2. The Stamp paper should have been purchased in the name of the Bank executing the Guarantee.

ANNEXURE-V

INTEGRITY PACT

To,

Executive Director,
Building Materials & Technology Promotion Council (BMTPC)
Core 5A, 1st Floor, India Habitat Centre,
Lodhi Road, New Delhi – 110 003

Sub.: Submission of Bid for the work of Construction of Demonstration Housing Project (G+3) for use as accommodation for Contractual Safai Karamchari and Community Centre on Design & Build basis using Emerging technology including on site Infrastructure Work at Guwahati, Assam.

Dear Sir,

I/We acknowledge that BMTPC is committed to follow the principles thereof as enumerated in the Integrity Agreement enclosed with the bid/bid document.

I/We agree that the Bid document is an invitation to offer made on the condition that I/We will sign the enclosed integrity Agreement, which is an integral part of bid documents, failing which I/We will stand disqualified from the biding process. I/We acknowledge that THE MAKING OF THE BID SHALL BE REGARDED AS AN UNCONDITIONAL AND ABSOLUTE ACCEPTANCE of this condition of the bid.

I/We confirm acceptance and compliance with the Integrity Agreement in letter and spirit and further agree that execution of the said Integrity Agreement shall be separate and distinct from the main contract, which will come into existence when bid/bid is finally accepted by BMTPC. I/We acknowledge and accept the duration of the Integrity Agreement, which shall be in the line with Article 1 of the enclosed Integrity Agreement.

I/We acknowledge that in the event of my/our failure to sign and accept the Integrity Agreement, while submitting the bid/bid, BMTPC shall have unqualified, absolute and unfettered right to disqualify the Bidder/bidder and reject the bid/bid is accordance with terms and conditions of the bid/ bid.

Yours faithfully

(Duly authorized signatory of the Bidder)

INTEGRITY AGREEMENT

(To be signed by the bidder and same signatory competent /authorized to sign the relevant contract on behalf of BMTPC)

This Integrity Agreement is made at ..... on this..... day of .....20.....

BETWEEN

……..……,
……....., (Name of Office) BMTPC,
.....,
(Hereinafter referred as the 'Principal/Owner', which expression shall unless repugnant to the meaning or context hereof include its successors and permitted assigns)

AND

.....
..... (Name and Address of the Individual/firm/Company)
through .....
(Hereinafter referred to as the (Details of duly authorized signatory)
"Bidder/Bidder" and which expression shall unless repugnant to the meaning or context hereof include its success or sand permitted assigns)

Preamble

WHEREAS the Principal / Owner has floated the Bid No…….. (hereinafter referred to as "Bid/Bid") and intends toward, under laid down organizational procedure, contract for ……..
..... (Name of work)
hereinafter referred to as the "Contract".

AND WHEREAS the Principal/Owner values full compliance with all relevant laws of the land, rules, regulations, economic use of resources and of fairness/transparency in its relation with its bidder/s.

AND WHEREAS to meet the purpose aforesaid both the parties have agreed to enter into this Integrity Agreement (hereinafter referred to as "Integrity Pact" or "Pact"), the terms and conditions of which shall also be read as integral part and parcel of the Bid/Bid documents and Contract between the parties.

NOW, THEREFORE, in consideration of mutual covenants contained in this Pact, the parties hereby agree as follows and this Pact witnesses as under:

Article 1: Commitment of the Principal/Owner

1. BMTPC commits itself to take all measures necessary to prevent corruption and to observe the following principles:

a) No employee of the Principal/Owner, personally or through any of his/her family members, will in connection with the Bid, or the execution of the Contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

b) BMTPC will, during the Bid process, treat all bidder/s with equity and reason. BMTPC will, in particular, before and during the Bid process, provide to all bidder/s the same information and will not provide to any bidder/s)confidential / additional information through which the Bidder/s could obtain an advantage in relation to the Bid process or the Contract execution.

The Principal/Owner shall endeavor to exclude from the Bid process any person, whose conduct in the past has been of biased nature.

2. If BMTPC obtains information on the conduct of any of its employees which is a criminal offence under the Indian Penal code (IPC)/Prevention of Corruption Act, 1988 (PC Act) or is in violation of the principles herein mentioned or if there be a substantive suspicion in this regard, the Principal/Owner will inform the Chief Vigilance Officer/Competent Authority and in addition can also initiate disciplinary actions as per its internal laid down policies and procedures.

Article 2: Commitment of the Bidder/Bidder(s)

1. It is required that each bidder/s(including their respective officers, employees and agents) adhere to the highest ethical standards, and report to the Government / Department all suspected acts of fraud or corruption or Coercion or Collusion of which it has knowledge or becomes aware, during the biding process and throughout the negotiation or award of a contract.

2. The Bidder(s)/Bidder(s) commits himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the Bid process and during the Contract execution:

a) The bidder/s) will not, directly or through any other person or firm, offer, promise or give to any of the Principal/Owner's employees involved in the Bid process or execution of the Contract or to any third person any material or other benefit which he/she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the Bid process or during the execution of the Contract.

b) The Bidder(s) will not enter with other bidder/s into any undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitive enessor to cartelize in the bidding process.

c) The Bidder(s) will not commit any offence under the relevant IPC/PC Act. Further the bidders/ Contract(s) will not use improperly, (for the purpose of competition or personal gain), or pass on to others, any information or documents provided by the Principal/Owner as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

d) The Bidder(s)/Bidder(s) of foreign origin shall disclose the names and addresses of agents/ representatives in India, if any. Similarly Bidder(s) of Indian Nationality shall disclose names and addresses of foreign agents/representatives, if any. Either the agent on behalf of the foreign principal or the foreign principal directly could bid in a bid but not both. Further, in cases where an agent participate in a bid on behalf of one manufacturer, he shall not be allowed to quote on behalf of an other manufacturer along with the first manufacturer in a subsequent/parallel bid for the same item.

e) The Bidder(s) will, when presenting is bid, disclose any and all payments he has made, is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the Contract.

3. The Bidder(s)/Bidder(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

4. The bidder/s will not, directly or through any other person or firm indulge in fraudulent practice means a will ful misrepresentation or omission of facts or submission of fake/forged documents in order to induce public official to act in reliance thereof, with the purpose of obtaining unjust advantage by or causing damage to justified interest of others and/or to influence the procurement process to the detriment of the Government interests.

5. The bidder/s will not, directly or through any other person or firm use Coercive Practices (means the act of obtaining something, compelling an action or influencing a decision through intimidation, threat or the use of force directly or indirectly, where potential or actual injury may befall upon a person, his/ her reputation or property to influence their participation in the biding process).

Article 3: Consequences of Breach

Without prejudice to any rights that may be available to the Principal/Owner under law or the Contract or its established policies and laid down procedures, the Principal/Owner shall have the following rights in case of breach of this Integrity Pact by the Bidder(s) and the Bidder/ Bidder accepts and undertakes to respect and uphold the Principal/Owner's absolute right:

1. If the Bidder(s), either before award or during execution of Contract has committed a transgression through a violation of Article 2 above or in any other form, such as to put his reliability or credibility in question, the Principal/Owner after giving 14 days notice to the bidder shall have powers to disqualify the Bidder(s)/Bidder(s) from the Bid process or terminate/determine the Contract, if already executed or exclude the Bidder/Bidder from future contract award processes. The imposition and duration of the exclusion will be determined by the severity of transgression and determined by the Principal/Owner. Such exclusion may be forever or for a limited period as decided by the Principal/Owner.

2. Forfeiture of Performance Guarantee/Security Deposit: If the Principal/Owner has disqualified the Bidder(s) from the Bid process prior to the award of the Contract or terminated/determined the Contract or has accrued the right to terminate/determine the

Contract according to Article 3(1), the Principal/Owner apart from exercising any legal rights that may have accrued to the Principal/Owner, may in its considered opinion forfeit the entire amount of Performance Guarantee and Security Deposit of the Bidder/Bidder and liable to face action as per bid security declaration.

3. Criminal Liability: If the Principal/Owner obtains knowledge of conduct of a Bidder or Bidder, or of an employee or a representative or an associate of a Participating agency or Bidder which constitutes corruption within the meaning of IPC Act, or if the Principal/Owner has substantive suspicion in this regard, the Principal/Owner will inform the same to law enforcing agencies for further investigation.

Article 4: Previous Transgression

1. The bidder/s declares that no previous transgressions occurred in the last 5 years with any other Company in any country confirming to the anticorruption approach or with Central Government or State Government or any other Central/State Public Sector Enterprises in India that could justify his exclusion from the Bid process.

2. If the Bidder makes incorrect statement on this subject, he can be disqualified from the Bid process or action can be taken for banning of business dealings/ holiday listing of the Bidder/Bidder as deemed fit by the Principal/ Owner.

3. If the Bidder/Bidder can prove that he has resorted/recouped the damage caused by him and has installed a suitable corruption prevention system, the Principal/Owner may, at its own discretion, revoke the exclusion prematurely.

Article 5: Equal Treatment of all Participating Agency/Participating agencies/Sub-bidder(s)

1. The Bidder(s)/Bidder(s) undertake(s) to demand from all sub bidder a commitment in conformity with this Integrity Pact. The Bidder/Bidder shall be responsible for any violation(s) of the principles laid down in this agreement/Pact by any of its sub bidder/sub-vendors.

2. The Principal/Owner will enter into Pacts on identical terms as this one with all Bidder and Bidder.

3. The Principal/Owner will disqualify Participating Agency, who do not submit, the duly signed Pact between the Principal/ Owner and the bidder, along with the Bid or violate its provisions at any stage of the Bid process, from the Bid process.

Article 6- Duration of the Pact

This Pact begins when both the parties have legally signed it. It expires for the Bidder/Vendor five years after the completion of work under the contract or till the continuation of defect liability period, whichever is more and for all other Participating Agency, till the Contract has been awarded. If any claim is made/lodged during the time, the same shall be binding and continue to be valid despite the lapse of this Pacts as specified above, unless it is discharged/determined by the Competent Authority, BMTPC.

Article 7- Other Provisions

1. This Pact is subject to Indian Law, place of performance and jurisdiction is the Headquarters of the Division of the Principal/Owner, who has floated the Bid.

2. Changes and supplements need to be made in writing. Side agreements have not been made.

3. If the Bidder is a partnership or a consortium, this Pact must be signed by all the partners or by one or more partner holding power of attorney signed by all partners and consortium members. In case of a Company, the Pact must be signed by a representative duly authorized by board resolution.

4. Should one or several provisions of this Pact turn out to be invalid; the remainder of this Pact remains valid. In this case, the parties will strive to come to an agreement to their original intensions.

5. It is agreed term and condition that any dispute or difference arising between the parties with regard to the terms of this Integrity Agreement/ Pact, any action taken by the Owner/Principal in accordance with this Integrity Agreement/Pact or interpretation thereof shall not be subject to arbitration.

Article 8- LEGAL AND PRIOR RIGHTS

All rights and remedies of the parties hereto shall be in addition to all the other legal rights and remedies belonging to such parties under the Contract and/or law and the same shall be deemed to be cumulative and not alternative to such legal rights and remedies aforesaid. For the sake of brevity, both the Parties agree that this Integrity Pact will have precedence over the Bid/Contact documents with regard any of the provisions covered under this Integrity Pact.

IN WITNESS WHEREOF the parties have signed and executed this Integrity Pact at the place and date first above mentioned in the presence of following witnesses:

..... (For and on behalf of Principal/Owner)

.....(For and on behalf of Bidder/Bidder)

WITNESSES:

1. ..... (signature, name and address)

2. ..... (signature, name and address)

Place:
Dated:

ANNEXURE-VI

UNCONDITIONAL LETTER OF ACCEPTANCE OF BID CONDITIONS (ON THE LETTERHEAD OF THE BIDDER)

Name of Work: **Construction of Demonstration Housing Project (G+3) for use as accommodation for Contractual Safai Karamchari and Community Centre on Design & Build basis using Emerging technology including on site Infrastructure Work at Guwahati, Assam**

i) To be uploaded on website: https://eprocure.gov.in/eprocure/app
ii) To be opened in the presence of bidders who may be present in the office of BMTPC.

I/We have read and examined the notice inviting bid, including all documents and amendments up to the last date of submission of bids, clauses of contract, special conditions, bill of quantities & other documents and rules referred to in the contract conditions and all other contents in the bid document for the work.

I/We hereby bid for the execution of the work specified for BMTPC within the time specified in …….. viz., schedule of quantities and in accordance in all respect with the specifications, designs, drawing and instructions and contract conditions given in this document.

We agree to keep the bid open for one hundred twenty **(120) days** from the date of opening of technical bid and not to make any modification in its terms and conditions.

A copy of receipt of deposit of tender fee of Rs 5000/- in BMTPC account through NEFT/RTGS and Bid Security declaration are scanned and uploaded. If I/We, fail furnish to the prescribed performance guarantee within prescribed period, I/We agree that the said BMTPC or his successors, in office shall without prejudice to any other right or remedy, be at liberty to forfeit the said tender fee and take action according to Bid Security declaration. Further, if I/We fail to commence work as specified, I/We agree that BMTPC or the successors in office shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the said performance guarantee absolutely, the said performance guarantee shall be a guarantee to execute all the works referred to in the bid documents upon the terms and conditions contained or referred to those in excess of that limit at the rates to be determined in accordance with the provision contained in clause 12.2and 12.3 (as modified) of the bid form.

Further, I/We agree that in case of forfeiture of Performance Guarantee as aforesaid, I/We shall be abide by the action as per Bid Security declaration.

I/we undertake and confirm that eligible similar work(s) has/have not been got executed through another agency on back to back basis. Further that, if such a violation comes to the notice of Department, then I/we shall be debarred for bidding in BMTPC in future forever. Also, if such a violation comes to the notice of Department before date of start of work, the Competent Authority shall be free to forfeit the entire amount of Performance Guarantee.

I/We hereby declare that I/We shall treat the bid documents drawings and other records connected with the work as secret/confidential documents and shall not communicate information/derived there from to any person other than a person to whom I/We am/are authorized to communicate the same or use the information in any manner prejudicial to the safety of the State.

Dated: ……

Signature of Bidder…….

Address:

Witness:

Postal Address

Occupation:

[to be filled by Bidder]

ANNEXURE-VII

ACCEPTANCE OF BID BY BMTPC

The above bid (as modified by you as provided in the letters mentioned hereunder) is accepted by me for and on behalf of BMTPC for a sum of Rs.…….…….. (Rupee…….……
……...……...).

The letters referred to below shall form part of this contract agreement: -

(a)

(b)

(c)

For & on behalf of BMTPC

Signature ……

Dated: …….. Designation ……

ANNEXURE – VIII

MEMORANDUM

Sl. No.	Description	Values/Description to be Applicable for Relevant Clause(s) of contract as per Site
1)	Name of Work	**Construction of Demonstration Housing Project (G+3) for use as accommodation for Contractual Safai Karamchari and Community Centre on Design & Build basis using emerging technology listed at Annexure–I including onsite infrastructure work Guwahati, Assam.**
2)	Client/Owner	Building Materials and Technology Promotion Council, New Delhi
3)	Type of Bid	Design and Build basis (Dwelling units and community centre on lump sum cost basis and on site infrastructure works on Item Rate basis)
4)	Earnest Money Deposit	Bid Security declaration
5)	Estimated Cost	Rs 929.18 lakhs (Rupees Nine hundred twenty nine lakhs and eighteen thousand Only)
6)	Time allowed for actual Construction of Work at site	9 Months (Nine Months) from the date of handing over the site and approvals.
7)	Mobilization Advance	Admissible Not exceeding10% of the project cost against Bank Guarantee of 110% with simple interest of 10% per Annum
8)	Secured Advance	Not exceeding 75% of the assessed value of Non Perishable materials brought on site
9)	Performance Guarantee	3% (Three Percent Only) of contract value within 15 days from the issue of Letter of Award maximum allowable 30 days. After 15 days, late fee @0.1% per day of PG amount shall be payable which shall be non-refundable.
10)	Security Deposit / Retention Money	2.50% (Five Percent Only) of the gross value of each running/final bill.
11)	Time allowed for starting the work	The date of start of contract shall be reckoned from the date of handing over the site and approvals.
12)	Escalation	No extra Item will be entertained for the building work and community centre. However, for onsite infrastructure work extra items/substituted items may be permitted as per the utmost requirement of site condition and with the approval of BMTPC. Escalation cost towards any change in statutory taxes will be accepted.
13)	Defect Liability Period	Five Years after issuance of date of Completion Certificate by BMTPC.

14)	Standard Schedule of rates	The latest Schedule of Rates issued by CPWD till the last date of submission of bid shall be followed wherever applicable	
15)	Specifications	As per Schedule of finishes and specifications mentioned at Part-3 of this bid document and specifications issued by CPWD till the last date of submission of bid shall be followed wherever applicable	
16)	Authority for fixing compensation under Clause-2, Extension of time, Rescheduling of Milestones and Shifting of date of start in case of delay in handing over of site and deciding reduced rates	Executive Director, BMTPC	
17)	Description of Milestone		
S. No.	Description of Milestones D = Date of Award of work D1 = Date of commencement of work on ground (D + 1.5 months)	Time Allowed in Months	Amount to be withheld in case of non achievement of Milestone
1	Submission of complete Architectural /Structural drawings as per proposed technology and on site infrastructure works for approval of local body and approval of Vetted structural design by BMTPC	D + 1.5 months	0.75%
2	Completion of excavation work, laying of foundation and reaching plinth level of building	D1 + 2 months	1.0 %
3	Completion of Civil works of super-structure of building	D1 + 7 months	2.0 %
4	Completion of building fit with all services, fixtures and fittings.	D1 + 8 months	0.75 %
5	Completion of all onsite infrastructure works and handing over the project to BMTPC	D1 + 9 months	0.5 %
	Note: In the event of non-achieving the necessary progress as assessed from the running payment, above amount will be withheld for failure of each milestone subject to Maximum 5% of contract value.		
18)	Technical Manpower required to be engaged at project site	As per **ANNEXURE - XI**	

ANNEXURE-IX

PROFORMA FOR JVA

JOINT VENTURE AGREEMENT (ON NON-JUDICIAL STAMP PAPER OF APPROPRIATE VALUE)

JOINT VENTURE AGREEMENT BETWEEN M/S …… AND M/S …….. FOR SUCCESSFUL PERFORMANCE OF THE CONTRACT FOR ……(INSERT NAME OF CONTRACT, BRIEF DESCRIPTION OF WORKS AND NAME OF CLIENT)

This Joint Venture Agreement executed on this …….. day of …… two thousand and …… between M/s…….. …… a Company incorporated under the law of ……. And having its Registered Office at ……. (Member-1,Herein after called the "Lead member" Which expression shall include its successors, administrators, executors and permitted assigns) and M/s……. a Company incorporated under the law of …… and having its Registered Office at…….. (hereinafter called the"Members" which expression shall include its successor, administrators Executors and permitted assigns) for the purpose of submitting a bid and entering into a Contract (in case of award) against Bid document No…… invited by BMTPC.……
……..... AND

WHEREAS the Bidding Documents stipulates that the selected agency for participation in the Selection Process may be a single entity or a Joint Venture (JV) of not more than three entities. AND WHERAS the bid is being submitted to the BMTPC on behalf of the JV in accordance with the requirements of the Joint Venture criteria as stipulated in the Bid documents.

Role and Responsibilities of Member 1

Role and responsibilities of other Member/s

NOW THEREFORE, THIS DEEDWITNESSETH AS UNDER:

1. That All the responsibilities and obligations of each of the Members delineated in this agreement are expressly understood and agreed between the Members. The share of Lead Member shall be ……% and share of other Member shall be ……% in the Joint Venture.

2. That in consideration of the Award of Contract by BMTPC to the Member-1 on behalf of JV, we the members to the Joint Venture Agreement do hereby agree thatMember-1 shall act as lead member of the JV. The lead member is authorized to deal with the bid, make all correspondence with BMTPC and further to sign the agreement, enter into contract and similar such actions in respect of the bided work.

3. The lead member which shall represent the JV in all the dealings with BMTPC shall be solely and severally responsible for performance of the entire contract for and on behalf of any or both the members of the Joint Venture.

4. JVA shall be valid during the entire currency of the contract including the period of extension, if any. Both the members of the JV shall remain associated with the project till completion of the project. There shall be significant technical contribution of both the members for the project. However, after completion of the project, lead member shall be solely responsible for all responsibilities and liabilities of JV.

5. Once the bid is submitted, the JVA shall not be modified/altered/terminated during the validity of the bid. In case any member of the JV fails to observe /comply with this stipulation, the action shall be liable to be taken as per bid security declaration. Similarly, after the contract is awarded, the constitution of JV shall not be allowed to be altered during the currency of contract. Failure to observe this stipulation shall be deemed to be the breach of contract with all contractual consequences.

6. No member of the JV shall have the right to assign or transfer the interest right or liability in respect of contract without the written consent of the other member and that of BMTPC.

7. In case of any breach of this Contract committed by any of the Members of the Joint Venture Agreement, both the Members do hereby undertake, declare and Confirm that both the members shall be solely and severally responsible for Performance of the works in accordance with the terms and conditions of the NIT, for the work of Bid Document and/or Contract and undertake to carry out all the obligations and responsibilities under this Joint Venture Agreement.

8. If the owner sustains any loss or damage on account of any breach of the contract, the lead member of Joint Venture undertake to pay such loss/damages, caused to the BMTPC on its written demand without any demur, reservation, contest or protest in any manner whatsoever. This is without prejudice to any rights of the BMTPC against the Joint Venture/lead member under the contract and/or guarantees.

9. We agree that this Agreement shall be without any prejudice to the various liabilities of the Joint Venture Members including the performance security as well as other obligations of Joint Venture members in terms of the contract.

10. The Joint Venture members will be fully governed by the terms and conditions of the contract and shall be responsible for the quality of all the works and timely execution thereof to meet the completion schedule under the contract.

11. This Agreement shall be construed and interpreted in accordance with the Laws of India and the respective courts of India shall have exclusive jurisdiction to adjudicate upon the disputes between the parties.

12. We, the Joint Venture members agree that this Agreement shall be irrevocable and shall form an integral part of the Contract. We further agree that this agreement

shall continue to be enforceable till the successful completion of contract and till the BMTPC discharges it.

13. On award of contract, a single Performance Bank Guarantee shall be submitted by the lead member on behalf of JV as per bid conditions.

14. This Agreement shall not be construed as establishing or giving effect to any legal entity such as, a company, a partnership, etc. It shall relate solely towards BMTPC/the BMTPC for submission of Bid/Bid and related execution of works to be performed pursuant to the contract and shall not extend to any other activities.

15. That this Agreement shall be operative from the effective date of the contract.

IN WITNESS WHEREOF, the Joint Venture members through their authorized Representatives have executed these presents and affixed common seal of their respective companies, on the day, month and year first mentioned above.

For M/s ……(Joint Venture- Lead Member)

Witness: 1. …… …….

For M/s ……(Joint Venture Member/s)

Witness: 1. ……

ANNEXURE-X

ESTABLISHING SITE LABORATORY AND TESTING OF MATERIALS
(As per Proposed Technology)

Equipment for conducting necessary tests shall be provided and installed at site in the well-furnished site laboratory by the agency at its own cost to establish that the work is being done as per contract specifications and standards. It is also suggested that site laboratory need to be kept at Standard Atmospheric Temperature and humidity.

List of Laboratory & Testing Equipment

1.

2.

3.

4.

5.

Note: Tests can also be carried out by the agency at NABL accredited Laboratory with the prior approval of Competent Authority in BMTPC.

ANNEXURE-XI

A SUGGESTIVE LIST OF PLANT AND EQUIPMENT AT SITE (As per Proposed Technology)- to be provided by the Selected agency

The plant and equipment as required for the technology are to be provided by selected agency here.

List of Plant & Equipment at site

1.

2.

3.

4.

5.

ANNEXURE-XII

Minimum Requirement of Technical Representative at Site

Requirement of Technical Representative(s) and Recovery Rates

S. No	Requirement of Technical Staff		Minimum Experience (Years)	Designation of Technical Staff	Rate at which recovery shall be made from the contractor in the event of not fulfilling the condition
	Qualification	Strength			
1.	Graduate Engineer	1 No	5 (and having experience of one similar nature of work)	Project Manager	Rs.60,000/- per Month
2.	Graduate Engineer Or Diploma Engineer	1+1 No	2 or 5 respectively	Project planning / quality/billing Engineer	Rs. 40,000/- per Month per person
	Note: 1. The above given strength shall be required to be deployed as and when necessity arises at site or so directed by Competent Authority. 2. The Selected agency shall submit a certificate of employment of the technical representative(s) along with every account bill/final bill and shall produce evidence of regular physical availability of such engineers on the above project if at any times so required by the Competent Authority.				

Part-3

Contract & Other Conditions and Specifications

1. CONTRACT CONDITIONS

(As per General Condition of Contract (GCC) (EPC) 2019 of CPWD with up to date Amendments)

A. DEFINITIONS

The Contract means the documents forming the bid and acceptance thereof and the formal agreement executed between the competent authority on behalf of Building Materials and Technology Promotion Council (BMTPC), and the selected agency, together with the documents referred to therein including these conditions, the specifications, designs, drawings and instructions issued from time to time by BMTPC and all these documents taken together, shall be deemed to form one contract and shall be complementary to one another.

1.1 Building Materials and Technology Promotion Council, hereinafter called 'BMTPC' propose to get the works executed as mentioned in the Contract as Implementing /Executing Authority.

1.2 In the contract, the following expressions shall, unless the context otherwise requires, have the meanings, hereby respectively assigned to them: -

a. BMTPC shall means Building Materials and Technology Promotion Council with its office at Core 5A, 1st Floor, India Habitat Centre, Lodhi Road, New Delhi - 110003 or its Administrative officers or other employees authorized to deal with any matter with which these persons are concerned and authorized on its behalf.

b. COMPETENT AUTHORITY means the Executive Director, BMTPC.

c. APPROVAL means approved in writing including subsequent written confirmation of previous verbal approval.

d. SCHEDULE OF QUANTITIES means the complete quantity statement forming or Schedule of Quantities forming part of the bid.

e. SELECTED AGENCY shall mean the individual, firm, LLP or company, whether incorporated or not, undertaking the works and shall include the legal personal representative of such individual or the persons composing such firm or LLP or company, or the successors of such firm or company and the permitted assignees of such individual, firm or company.

f. CONTRACT VALUE means the sum for which the bid is accepted as per the letter of Award.

g. DRAWINGS mean the drawings referred to in the contract document including modifications if any and such other drawings as may from time to time be furnished and/ or approved by BMTPC.

h. DATE OF COMMENCEMENT OF WORK: The date of start of contract shall be reckoned from the date of handing over of site and approvals.

i. LANGUAGE: All documents and correspondence in respect of this contract shall be in English Language.

j. "LETTER OF AWARD" shall mean BMTPC's letter or notification conveying its acceptance of the bid subject to such conditions as may have been stated therein.

k. MONTH means English Calendar month 'Day' means a Calendar day of 24 Hrs each.

l. OWNER/CLIENT means the BMTPC, who will be entering into the contract and getting the work executed.

m. SITE means the lands and other places on, under, in or through which the works are to be executed or carried out and any other lands or places provided by BMTPC or used for the purpose of the contract.

n. BID means the Selected agency's priced offer to BMTPC for the execution and completion of the work and the remedying of any defects therein in accordance with the provisions of the Contract, as accepted by the Letter of Award or Award letter. The word BID is synonymous with Bid and the word BID DOCUMENTS with "Biding Documents" or "offer documents".

o. WRITING means any manuscript typed, written or printed statement under or over signature and/or seal as the case may be.

p. Works or Work shall unless there be something either in the subject or context repugnant to such construction, be construed and taken to mean the works by or by virtue of the contract contracted to be executed whether temporary or permanent, and whether original, altered, substituted or additional.

q. Headings in the clauses/conditions of bid documents is for convenience only and shall not be used for interpretation of the clause/condition.

r. Words imparting the singular meaning only also include the plurals and vice versa where the context requires. Words importing persons or parties shall include firms and corporations and organizations having legal capacities.

s. Excepted Risk are risks due to riots (other than those on account of selected agency's employees), war (whether declared or not) invasion, act of foreign enemies, hostilities, civil war, rebellion revolution, insurrection, military or usurped power, any acts of Government, damages from aircraft, acts of God, such as earthquake, lightening and unprecedented floods, and other causes over which the selected agency has no control and accepted as such by the BMTPC.

t. Market Rate shall be the rate as decided by the Competent

Authority on the basis of the prevailing cost of materials and labour at the site where the work is to be executed plus the percentage mentioned elsewhere in the bid document to cover, all overheads and profits.

B. CLAUSES OF CONTRACT

Clause 1.0 Performance Guarantee

Applicable with following modifications:

The selected agency shall deposit an Performance Guarantee of 3% (Three percent) of the contract amount in addition to other deposits mentioned elsewhere in the contract for his proper performance of the contract agreement, (not withstanding and/or without prejudice to any other provisions in the contract) within 15 (fifteen) days from the date of issue of letter of acceptance. Maximum allowable 30 days. After 15 days a late fee @0.1% per day of PG amount shall be payable which shall be non-refundable. This Performance guarantee shall be deposited in BMTPC account through NEFT/ RTGS or in the form of Bank Guarantee from any Indian Scheduled/Commercial Bank in prescribed format. After record in of the completion certificate for the work by the competent authority, the Performance Guarantee shall be returned to the selected agency, without any interest in following manner.

After 2 years of issue of completion certificate -1.0%
After 4 years of issue of completion certificate -1.0%
After 5 years of issue of completion certificate -1.0 %
Provided that there is no defect detected within the said periods.

Clause 1A Recovery of Security Deposit

Applicable with following modifications

50% of the security deposit shall become refundable after successful completion of Maintenance period of 2 years without any interest. The remaining 50% of the security deposit shall be released after the completion of defects liability period without any interest.

Clause 2.0 Compensation for Delay

Applicable

Clause 2A. Incentive for early completion

Applicable

Clause 3.0 When Contract can be Determined

Applicable

Clause 3A Applicable

Clause 4.0 Selected agency liable to pay Compensation even if action not taken under Clause 3 In any case in which any of the powers conferred upon the Competent

Applicable

Clause 5.0 Time and Extension for Delay
Applicable

Clause 6.0 Measurements of Work Done
Applicable

Clause 6A Computerized Measurement Book
Applicable

Clause 7.0 & 7A Payment on Intermediate Certificate to be regarded as advances
Applicable

Clause 8.0 & 8B Completion Certificate and Completion Plans
Applicable

Clause 9.0 Payment of Final Bill
Applicable

Clause 9A Payment of Selected agency's Bills to Banks
Payments payable to selected agency may, if so desired by him, be made to agency's bank account.

Clause 10 Materials supplied by Government
Not-Applicable

Clause 10A Materials to be provided by the selected agency
Applicable

Clause 10B (i) Secured Advance on Non-perishable Materials
Applicable

Clause 10 B (ii) Mobilization Advance
Applicable

Clause 10 B (iii) Plant Machinery & Shuttering Materials Advance
Not-Applicable

Clause 10 B (iv) Interest and recovery
Applicable

Clause 10C, 10CA & 10CC
Not applicable

Clause 10D
Applicable

Clause 11.0 Work to be executed in Accordance with Specifications, Drawings and

Orders etc.
Applicable

Clause 12.0 Deviations/ Variations Extent and Pricing
No extra Item/s will be entertained for the building and other provisions, work. However, for onsite infrastructure work extra items/substituted items may be permitted as per the utmost requirement of site condition and with the approval of BMTPC. The clause 12 will be applicable for only on site infrastructure works.

Clause 13.0 Foreclosure of contract due to Abandonment or Reduction in Scope of Work
Applicable

Clause 14.0 Carrying out part work at risk & cost of selected agency
Applicable

Clause 15.0 Suspension of Work
Applicable

Clause 16.0 Action in case Work not done as per Specifications
Applicable

Clause 17.0 Selected agency Liable for Damages, defects during defect liability period
Applicable

Clause 18.0 Selected agency to Supply Tools & Plants etc.
Applicable

Clause 18A Recovery of Compensation paid to Workmen
Applicable

Clause 18B Ensuring Payment and Amenities to Workers
Applicable

Clause 19.0 Labour Laws to be complied by the selected agency
Applicable

Clause 20.0 Minimum Wages Act to be complied with
Applicable

Clause 21.0 Work not to be sublet. Action in case of insolvency
Applicable

Clause 22.0 Compensation
Applicable

Clause 23.0 Changes in firm's Constitution to be intimated

Applicable

Clause 24.0 Applicable

Clause 25.0 Settlement of Disputes & Arbitration
Applicable

Clause 26.0 Bidder to indemnify Govt. Against Patent Rights
Applicable

Clause 27.0 Withholding and lien in respect of sum due from selected agency
Applicable

Clause 28 Lien in respect of claims in other Contracts
Applicable

Clause 29.0 Not-Applicable

Clause 30.0 Arrangement of water for construction
Applicable

Clause 32.0 Employment of Technical Staff and employees as per Annexure-XI
Applicable

Clause 33.0 Levy/Taxes payable by selected agency
Applicable

Clause 34.0 Conditions for reimbursement of levy/taxes if levied after receipt of bids
Applicable

Clause 35.0 Termination of Contract on death of selected agency
Applicable

Clause 36.0 If relative working in BMTPC then the selected agency not allowed to bid
Applicable

Clause 37.0 No Engineer to work as Contractor with one of retirement
Applicable

Clause 39.0 Compensation during war like situations
Applicable

Clause 40.0 Apprentices Act provisions to be complied with
Applicable

Clause 41.0 Release of Security deposit after labour clearance
Applicable

Note:

i. In General Condition of Contract (GCC) (EPC)-2019 with amendments, wherever, President of India / Director General / Chief Engineer/ Superintending Engineer appears it will be meant as Executive Director, BMTPC.

ii. In place of Government / Technical examiner it will be BMTPC in this case.

iii. "Applicable" or "Not Applicable" mentioned means that relevant clause/s will be followed or will not be followed respectively as per clauses of General Condition of Contract (GCC) (EPC)-2019 of CPWD with up to date amendments.

2. SPECIAL CONDITIONS FOR USE OF EMERGING TECHNOLOGIES AND WORKS

1. The bidder shall use one of the Emerging technology out of 54 technologies recommended by MoHUA under GHTC -I as listed at Annexure –I of this bid document.

2. In case, one proposed unique technology is not suitable for the site as per structural and local geo-climatic requirement, the bidder/s may use hybrid construction system other than conventional system (In situ RCC framed structure) subject to proof of its structural integrity, fire safety, thermal performance and fulfillment of other functional requirements of the buildings. The bidder/s required to submit a detailed note on specifications and code of practice and how the particular technology can be effectively used in proposed DHP.

3. It will be the responsibility of the bidder to establish that the proposed technology is worth adopting for this work and shall provide value addition in respect of quality and time.

4. The bidder shall provide detailed specifications and execution methodology to be adopted for the execution of the work. The bidder shall support the proposal along with the details where this technology has been successfully used in the prescribed proforma given in this bid. The bidder shall make their own sufficient arrangements for visit to the site at own expense.

5. The bidder shall be responsible for the performance of the technology used and buildings constructed by using this. If bidder fails to complete the work with the proposed technology then bidder shall be liable to complete the work by using other technology/s as suggested by Competent Authority. The cost incurred in doing so shall be borne by the bidder completely.

6. The bidder shall engage professionals with experience of proposed technology as per list mentioned in ANNEXURE-XII.

7. All necessary measures like thermal comfort, fire-fighting provisions, natural light and ventilation, etc. shall be taken by the bidder to provide as per NBC 2016 and as defined in Scope of work earlier in the bid document.

8. The necessary suggestions if any, given by the Competent Authority for carrying out the construction work with emerging technology shall be incorporated by the bidder for which nothing extra shall be payable.

9. The bidder shall submit the list of laboratories equipment for test and locations of the same along with the proposal of technology. The decision of Competent Authority shall be final in this matter.

10. The bidder shall provide the list and numbers of T&P/ equipment etc. likely to

be used for completing the work. The bidder shall engage the same during the execution.

11.0 Project Management

11.1 The Selected Agency shall prepare the phase wise (monthly) resource chart (materials, manpower and machinery) based on the project execution schedule as mentioned in contract conditions.

11.2 The Selected Agency shall submit the photographs & videos of progress of work on fortnightly basis to make it possible to create a short film of the entire execution of the work to be kept in archive.

11.3 Selected Agency shall submit a detailed monthly progress & program report to the Competent Authority.

11.4 The Selected agency shall stick to the construction schedule, if there is any hindrance or delay due to any reason the same shall be mitigated through engaging extra manpower, material and machinery.

12.0 Contract Coordination Procedures, Coordination Meetings and Progress Reporting

The selected agency shall prepare and finalize in consultation with BMTPC, a detailed contract coordination procedure within 15 days from the date of issue of Letter of Award for the purpose of execution of the contract. The selected agency shall have to attend all the meetings at his own cost with BMTPC or consultants of BMTPC during the period of the contract, as and when required and fully cooperate with such personal and agencies involved during these discussions.

a) The project would be evaluated and documented by reputed technical Institution such as IIT/NIT/ Government engineering college. The cost of such evaluation will be borne by BMTPC.

b) The selected agency will facilitate any visits by such Technical Institutes and provide necessary data

13.0 Organization of Sensitization / Capacity Building Programme/s

BMTPC will organize need based sensitization / capacity building programme/s at project site/ other place on new / alternate technologies for the benefit of working professionals and local construction workforce in the region. The cost of such programme/s will be borne by BMTPC. The selected agency will fully cooperate in successful organization of such programme/s.

14.0 Defect liability:

The contractor's liability during the defect liability period of five years from the final date of completion shall be limited to rectification of defects including replacement

as follows

Sr. No.	Description	Defect Liability
i.	Proposed structural system alongwith Walls and roof of building using proposed technology	Rectification of all structural/non-structural defects to ensure structural integrity of the building.
ii.	Concrete	a) Rectification of structural / superficial / non-structural cracks. b) Rectification of dampness / seepage in roof slab / junctions & sunken portion. c) Rectification of cracks in beam, shade, column.
iii.	Walls as per proposed technology / Brick work	a) Rectification of cracks in panel wall / portion. b) Cracks / settlement of dwarf walls. c) Rectification of efflorescence.
iv.	Joinery	a) Replacement of warped joinery. b) Cracks in panels, rails / styles etc.
v.	Building Hardware	a) Repairs / Replacement of loosened / pre-mature failure of fittings. b) Tightening / Replacement of sag in mosquito proof net.
vi.	Steel & Iron work	a) Rectification / Replacement of defective part of pressed steel door frames, rolling shutter. b) Redoing of defective portion in fabrication / welding including painting. c) Grills, gates etc. – defects to be rectified.
vii.	UPVC windows	Rectification / Replacement of defective parts
viii.	Roof treatment	Rectification of leakage / seepage of roof slab including covering at junction till guarantee period.
ix.	Plastering	a) Rectification of structural / superficial cracks if any. b) Rectification of protruding / peeling off plaster if any. c) c) Rectification of efflorescence
x.	Flooring	a) Rectification of sinking portion of plinth protection including saucer drain. b) Settlement of foundation & floors.
xi.	Plumbing / Sanitary fittings	a) Making good of leakage through soil / waste pipe joints. b) Replacement of looking mirror if found wavy. c) Rectification of leakage of over head tanks. d) Leakage / seepage of sunken floor,

		blockage of taps / pipes, non-functioning of cistern.
xii.	Finishing	Making good of defective / dissimilar patches of painting to match with remaining surfaces.
xiii.	Internal Supply	a) Repairs / Replacement of defective taps / fittings. b) Repair to leakage of CPVC water pipe lines including joints. c) Removal of blockage of PVC pipe lines.
xiv.	Roads	Repair of sinking portion of road & potholes, if any
xv.	Sewage	a) Rectification of slope / system if found defective during use. b) Rectification of major blockage in Sewer lines. c) Cracks & settlement of sewage lines.
xvi.	Drains	a) Repair to Drains. b) Settlement of Drains
xvii.	External Supply	Repairs to installations & fittings.
xviii.	Horticulture works	To maintain the plants and grass in good condition
xix.	General	All manufacturing defects of structures / fixtures / fittings / equipment other than listed above.
xx	Pumps	Maintenance and repair of pumps
xxi	Firefighting equipments and accessories	Maintenance of firefighting and accessories as per the fire safety norms

15.0 Conditions for environment protection

15.1 The selected agency shall not store/dump construction material or debris on the metalled road.

15.2 The selected agency shall get prior approval from Competent Authority for the area where the construction material or debris can be stored beyond the metalled road. This area shall not cause any obstruction to the free flow of traffic /inconvenience to the pedestrians. It should be ensured by the selected agency that no accidents occur because such permissible storage.

15.3 The selected agency shall ensure that all the trucks or vehicles of any kind which are used for construction purposes/or are carrying construction material like material like cement, sand and other allied material are fully covered. The selected agency shall take every necessary precaution that the vehicles are properly cleaned and dust free to ensure that enroute their destination, the dust, sand or any other particles are not released in air/contaminate air.

15.4 The selected agency shall provide mask to every worker working on the construction site and involved in loading, unloading and carriage of construction material and construction debris to prevent inhalation of

dust particles.

15.5 The selected agency shall comply all the preventive and protective environmental steps as stated in the MoEF guidelines 2010 and / or any other guidelines issued later on.

15.6 The selected agency shall carry out on- road-inspection for black smoke generating machinery. The selected agency shall use cleaner fuel.

15.7 The selected agency shall use vehicles having pollution under control certificate. The emissions can be reduced by a large extent by reducing the speed of a vehicle to 20Kmph. Speed bumps shall be used to ensure speed reduction. In case where speed reduction cannot effectively reduce fugitive dust, the selected agency shall divert traffic to nearby paved areas.

15.8 The selected agency shall ensure that the construction material is covered by tarpaulin. The selected agency shall take all other precaution to ensure that no dust particles are permitted to pollute air quality because of such storage.

15.9 The paving of the path for plying of vehicles carrying construction material is more permanent solution to dust control and suitable for longer duration projects.

15.10 It is mandatory to use of wet jet in grinding and stone cutting.

15.11 The selected Agency shall take appropriate protection measures like raising wind breakers of appropriate height on all sides of the plot/area using CGI sheets or plastic and / or other similar material to ensure that no construction material dust fly outside the plot area.

15.12 Any violation of orders of MoEF including guidelines of State Government, SPCB or any officer of any department shall lead to stoppage of work for which selected Agency shall be responsible and no hindrance shall be accounted in this regard.

3. GENERAL CONDITIONS FOR PLANNING & DESIGNING

1.0 Scope of Work

1.1 The layout plan & architectural drawings of the proposed work is attached at Part -8. The same may slightly deviate as per technology requirement (due to change in thickness of external and internal walls) with the approval of BMTPC. However, the minimum carpet area of dwelling units and other provisions including kitchen/pantry, toilet, balcony/ verandah and circulation areas such as steps, entrance plateform, ramp, staircase, lobby and corridor/passage need to be maintained as per enclosed drawings in the tender. The Built Up area may vary. The work is on design and build basis from design to completion and handing over in fit conditions

1.2 The site for work has been allotted by Guwahati Municipal Corporation, Guwahati at Fatashil Ambari, Guwahati – 25 through Mission Director, PMAY-HFA (U), Assam. The land is free from encroachment and all encumbrances and there is no hindrance to execute the work. The agency shall fix a permanent bench mark at the site of work. All necessary approvals will be provided by local Administration on request of selected agency.

1.3 Scope of the work shall include but not limited to the following:

1.3.1 To carry out survey of the site handed over for execution of the project and shall verify the site dimensions as per the layout plan provided with bid document

1.3.2 The selected agency shall have to prepare the architectural drawings as per the proposed technology for building and related infrastructure facilities as per prevailing local building bye-laws and development control norms in the area of the State. The selected agency shall prepare all drawings and get all statutory approvals from concerned authorities.

1.4 The soil Investigation report received from Mission Director, PMAY-HFA (U), Assam is placed at Part - 6. However, soil investigation report may be further verified by the bidder at site.

1.5 To prepare complete structural design drawings for foundations, superstructure, services, taking into consideration the protection against seismic/ wind forces required for disaster resistant structures. The structural design shall be vetted by Technical / Research Institutions of repute such as IITs, NITs, Govt. Engineering Colleges, CSIR Labs, Govt. Research Institutions and submitted to the Competent Authority. The structural drawings shall got approved from Competent Authority After approval of the structural drawings by Competent Authority, if any modification in design/drawing is needed, as per site conditions, the agency shall do/re-do without any extra cost. The decision of the Competent Authority shall be final and binding. No claim whatsoever shall be entertained on this account.

1.6 Planning, designing and execution of all internal services like internal sanitary, water supply, drainage system, Electrical work, firefighting works etc. complete

for the buildings planned including all its fittings, fixtures, testing etc.

1.7 Planning and Designing of onsite infrastructure works such as Roads & pavements, Boundary wall & Gate, Sewerage, Septic tank, External water supply, Drainage, Bore well, Underground water tank, Rain water Harvesting, External Electrification, Solar street lights, Fire-fighting works, Landscaping, etc. as per attached drawings including making connections with the peripheral services after getting the services design approved from the local bodies.

1.8 The structural design shall be carried out in terms of latest editions and up-to-date correction/amendment/errata of BIS Codes (Bureau of Indian Standards), other relevant seismic/other codes for making building hazard resistant for hazard such as earthquake, cyclone, flood, landslide or any other natural calamity, sound engineering practices. The selected agency will get proof checking of structural drawings with IITs or NITs or reputed govt. Engineering Colleges for proof checking of structural drawings/proposals prepared by the structural Engineer/firms. The consultant will liaison and co-ordinate with such Institute as and when required and as per the direction of Competent Authority.

1.9 Complete leveling/dressing including filling of earth, its supply, disposal of surplus earth is to be completed as directed by the Competent Authority.

1.10 Planning, designing and construction of boundary walls, MS gates, sign boards, Numbering of rooms etc. all complete as per the drawing approved and direction of Competent Authority.

1.11 Setting up a testing laboratory at site equipped with the apparatus needed for day to day testing of construction materials during construction period as directed by the Competent Authority.

1.12 Taking all precautionary measures to safeguard safety measures against any accidents for the agency's employees, labour, public and staff by providing all necessary safety equipment, helmets etc. at work site.

1.13 The scope as described above is only indicative and not exhaustive. In additions to the above, the agency shall be responsible for executing all the items required for completing the project in all respect to make the dwelling units habitable and ready for occupation with electrical, horticultural works complete as per direction of Competent Authority.

1.14 The design and construction shall consider the requirements of Rating 3 of GRIHA Affordable Housing Standards.

2.0 Planning and Designing in purview of Vulnerability Atlas of India

Vulnerability Atlas of India (VAI) is a comprehensive document which provides existing hazard scenario for the entire country and presents the digitized State/UT –wise hazard, maps with respect to earthquakes, winds and floods for district-wise identification of vulnerable areas. It also includes additional digitized maps for thunderstorms, cyclones and landslides. The main purpose of this Atlas is its use for disaster preparedness and

mitigation at policy planning and project formulation stage.

This Atlas is one of its kind single point source for the various stakeholders including policy makers, administrators, municipal commissioners, urban managers, engineers, architects, planners, public etc. to ascertain proneness of any city/location/site to multi-hazard which includes earthquakes, winds, floods thunderstorms, cyclones and landslides. While project formulation, approvals and implementation of various urban housing, buildings and infrastructures schemes, this Atlas provides necessary information for risk analysis and hazard assessment.

The Vulnerability Atlas of India has been prepared by Building Materials and Technology Promotion Council under Ministry of Housing and Urban Affairs, Government of India and available at their website www.bmtpc.org.

It is mandatory for the bidders to refer Vulnerability Atlas of India for multi-hazard risk assessment and include the relevant hazard proneness specific to project location while planning and designing the project in terms of:

i) Seismic zone (II to V) for earthquakes,
ii) Wind velocity (Basic Wind Velocity: 55, 50, 47, 44, 39 & 33 m/s)
iii) Area liable to floods and Probable max. surge height
iv) Thunderstorms history
v) Number of cyclonic storms/ severe cyclonic storms and max sustained wind specific to coastal region
vi) Landslides incidences with Annual rainfall normal
vii) District wise Probable Max. Precipitation

4. GENERAL & SPECIAL CONDITIONS AND SPECIFICATIONS OF CIVIL, ELECTRICAL AND INFRASTRUCTURE WORKS

1.0 General Conditions for Civil Works

1.1 The work in general shall be carried out in accordance with the schedule of finishes and specifications attached at Part-3 with document and CPWD Specifications (corrected up to the last date of submission/uploading of bid) hereinafter referred as CPWD Specifications.

1.2 Selected Agency(s) shall provide permanent bench marks, flag tops and other reference points for the proper execution of work and these shall be preserved till the end of the work. All such reference points shall be in relation to the levels and locations, given in the Architectural and plumbing drawings. On completion of work, the Selected Agency(s) shall submit two prints of "as built" drawings to the Competent Authority.

1.3 The selected agency (s) should engage approved, licensed Electrician/plumbers for the work and get the materials (fixtures/fittings) tested, by the local electricity deptt./municipal Body/Corporation authorities wherever required at his own cost. The selected agency(s) shall submit for the approval of the Competent Authority, the name of the electric/ plumbing agency proposed to be engaged by him.

1.4 The selected agency shall give performance test of the entire installation(s) as per the specifications in the presence of the Competent Authority or his authorized representative before the work is finally accepted and nothing extra what-so-ever shall be payable to the selected agency for the test.

1.5 The work shall be carried out in accordance with the Architectural drawings and structural drawings as approved by the Competent Authority.

1.6 Before commencement of any item of work the selected agency shall correlate all the relevant architectural and structural drawings, and specifications etc. and satisfy himself that the information available is complete and unambiguous. The selected agency alone shall be responsible for any loss or damage occurring by the commencement of work based on any erroneous and or incomplete information and no claim whatsoever shall be entertained on this account.

1.7 The work of dwelling units with other provisions including its services and on site infrastructure works may be executed simultaneously.

1.8 If the work is carried out in more than one shift or during night, no claim on this account shall be entertained. The selected agency must take permission from the police authorities etc. if required for work during night hours, no claim/hindrance on this account shall be considered if work is not allowed during night time.

1.9 The selected agency shall be responsible for the watch and ward/guard of the buildings safety, fittings and fixtures provided by him against pilferage and breakage during the period of installations and thereafter till the

building is physically handed over to the department. No extra payment shall be made on this account.

1.10 Sample of building materials, fittings and other articles required for execution of work shall be got approved from the Competent Authority before use in the work. The quality of samples brought by the selected agency shall be judged by standards laid down in the relevant CPWD/BIS specifications. All materials and articles brought by the selected agency to the site for use shall conform to the samples approved by the Competent Authority which shall be preserved till the completion of the work.

1.11 ISI marked materials except otherwise specified shall be subjected to quality test at the discretion of the Competent Authority besides testing of other materials as per the specifications described for the item/material. Wherever ISI marked materials are brought to the site of work, the selected agency shall, if required, by the Competent Authority, furnish manufacturer's test certificate or test certificate from approved testing laboratory to establish that the material/procured by the selected agency for incorporation in the work satisfies the provisions of specifications/BIS codes relevant to the material and/or the work done.

1.12 The selected agency shall procure the required materials in advance so that there is sufficient time to testing of the materials and clearance of the same before use in the work. The selected agency shall provide at his own cost suitable weighing and measuring arrangements at site for checking the weight/dimensions as may be necessary for execution of work.

1.13 Regarding testing of civil & electrical materials, the testing of materials shall be conducted in Govt. Laboratory/Govt. colleges/IITs/NITs or from the laboratory approved by Competent Authority. The charges of testing of materials in approved laboratory shall be borne by the selected agency.

1.14 Selected Agency shall submit minimum Quality Control/ Quality Assurance plan within 45 days after award of work which shall be consisting of:

1.14.1 Required tests and frequency of components/ products of proposed technology shall be as per national/ international standards as applicable for proposed technology.

1.14.2 Lot-size, number of required tests and frequency of testing. While deciding these criteria CPWD specifications & provisions of BIS Code and standard practices may be referred. Volume of work, practical difficulties and site conditions etc. may also be kept in view. The lot size, number of tests and frequencies of testing can be altered or modified by the Competent Authority from the prescribed limits.

1.14.3 It should clearly indicate the machinery and other Tool & plants required to be deployed at site by the selected agency. Entire machinery and T&P may not be required at the start of work, therefore, a proper time schedule by which each machinery and T&P is to be brought at site should also be indicated.

1.14.4 Receipt of Material, testing of the same &maintenance of Register of Tests.

1.14.5 All the registers of tests carried out at construction site or in outside laboratories shall be maintained by the selected agency, which may be inspected by Competent Authority or his/her designee at any point of time.

1.14.6 The selected agency shall allow access to Third Party Quality Assurance Agency (TPQAA) engaged by Competent Authority to have a control on quality and methodology of execution. In case of sample collection for testing, all arrangements for transporting and getting them tested shall be made by the selected agency.

1.14.7 All the test in field lab setup at construction site shall be carried out by the Quality control team to be engaged by the selected agency which can be witnessed by Competent Authority or his/her designee. A daily report of Tests to be conducted on a day shall be submitted to Competent Authority or his/her designee.

1.14.8 All the entries in the registers will be made by the designated Engineering Staff of the selected agency.

1.14.9 Selected Agency shall be responsible for safe custody of all the test registers.

1.14.10 Submission of copy of all test registers, material at site register and hindrance register along with each alternate running account bill and final bill shall be mandatory.

1.14.11 Selected agency will submit manufacturer test certificate for each and every lot materials brought to the site including walling and roofing system of the proposed technology.

1.15 Method Statement

1.15.1 The selected agency shall submit a 'Methods statement' for each important activity for the approval of the Competent Authority soon after the award of work to him. The 'Methods statement' is a statement by which the construction procedures for any activity of construction are formulated and stated in chronological order. The 'Methods statement', should have a description of the item with elaborate procedures in steps to implement the same, the specifications of the materials involved, their testing and acceptance criteria, equipment to be used, Precautions to be taken, steps of measurement, etc.

1.16 Check-list for Execution of work

1.16.1 As and when any important item is taken up for execution, the selected agency shall submit the specifications and develop a checklist and other relevant details. This sample checklist should be

got approved from the Competent Authority and should be used at site. This check list should be shown to the Competent Authority or his/her designee during inspection. This procedure is not restricted to the proposed technology and its components but also to be followed for all hidden items, CC/RCC work, Steel-reinforcement, shuttering, cast-in-situ mosaic flooring, doors & windows, plumbing, including water supply pipe lines, roof treatment, earth filling etc.

1.16.2 The selected agency shall be responsible for all documenting the total sequence of this project by way of photography, slides, audio-video recording etc. nothing extra shall be payable to the selected agency on this account.

1.16.3 General

The selected agency shall acquaint himself with the proposed site of work, its approach roads, working space available before quoting his rates.

i. No Entry/exit/roads other than specified by the Competent Authority for purpose of construction activities will be allowed to be used for construction activity purposes or movement of trucks/lorries/load-carriers and nothing extra/delay whatsoever will be accounted for on this part.

ii. No payment shall be made for any damage caused by rain, snowfall, flood or any other natural calamity, whatsoever during the execution of the work. The selected agency shall be fully responsible for any damage to the govt. property and work for which the payment has been advanced to him under the contract and he shall make good the same at his risk and cost. The selected agency shall be fully responsible for safety and security of his material, T&P, machinery brought to the site by him.

iii. The selected agency shall ensure that no construction leach ate (e.g. cement slurry etc.), is allowed to percolate into the ground. Adequate precautions are to be taken to safeguard against this including, reduction of wasteful curing processes, collection, basic filtering and reuse. The selected agency shall follow requisite measures for collecting drainage water run-off from construction areas and material storage sites and diverting water flow away from such polluted areas. Temporary drainage channels, perimeter dike/swale, etc. shall be constructed to carry the pollutant-laden water directly to the treatment device or facility (municipal sewer line).

iv. The selected agency shall comply with the safety procedures, norms and guidelines (as applicable) as outlined in the document Part 7 Constructional Practices and Safety- 2016, National Building code of India and Bureau of Indian Standards. A copy of all pertinent regulations and notices concerning accidents, injury and first-aid shall be prominently exhibited at the work site. Depending upon the scope & nature of work, a person qualified in first-aid shall be available at work site

to render and direct first-aid to causalities. A telephone may be provided to first-aid assistant with telephone numbers of the hospitals displayed. Complete reports of all accidents and action taken thereon shall be forwarded to the competent authorities

1.16.4 The selected agency shall ensure the following activities for construction workers safety, among other measures:

i. Guarding all parts of dangerous machinery.
ii. Precautionary signs for working on machinery.
iii. Maintaining hoists and lifts, lifting machines, chains, ropes, and other lifting tackles in good condition during the defect liability period.
iv. Ensuring that walking surfaces or boards at height are of sound construction and are provided with safety rails or belts.
v. Provide protective equipment; helmets etc.
vi. Provide measures to prevent fires. Fire extinguishers and buckets of sand to be provided in the fire-prone area and elsewhere.
vii. Provide sufficient and suitable light for working during night time.

1.16.5 The selected agency shall provide for adequate number of garbage bins around the construction site and the workers facilities and will be responsible for the proper utilization of these bins for any solid waste generated during the construction. The selected agency shall ensure that the site and the workers facilities are kept litter free. Separate bins should be provided for plastic, glass, metal, biological and paper waste and labeled in both Hindi and English with suitable symbols.

1.17 Miscellaneous

1.17.1 A sample unit with proposed technology shall be made ready in the proposed building. The sample unit should be finished in all respect with doors and windows including fittings, painting of hardware, flooring, painting, electrical services, etc. Nothing extra shall be payable for the sample unit.

1.17.2 Selected Agency shall arrange water for construction from its own sources within the ambit of laws and guidelines issued by the competent authority in this regard. Effort should also be made by selected agency for using recycled water for construction.

2.0 Specifications for Civil Works

2.1 The broad specifications of emerging technologies to be used for construction of project are attached in the bid document at Part-7 and need to be followed. As regards procurement and use of cement, steel reinforcement, design mix concrete from batching plant/RMC Plant, etc. and any other required material shall be as per applicable CPWD specifications, relevant Indian Standards and this Bid.

2.2. Waterproofing

2.2.1 The work shall be got executed through the specialized agency as approved by the Competent Authority.

2.2.2 Selected Agency shall also submit the names of water proofing specialist along with information about their technical capabilities and list of similar works executed by the specialized agency in the past for the approval of Competent Authority within 30 days from the date of award of work who have executed satisfactorily a minimum of three works of value not less than 40% of total work of water proofing to be executed each or two works of value not less than 60% of total work of water proofing to be executed each or one work of value not less than 80% of total work of water proofing to be executed in the last seven years.

2.2.3 Total quantity of the water proofing compound required shall be arranged only after obtaining the prior approval of the make by Competent Authority in writing. Materials shall be kept under double lock and key and proper account of the water proofing compound used in the work shall be maintained. It shall be ensured that the consumption of the compound is as per specified requirements.

2.2.4 The finished surface after water proofing treatment shall have adequate smooth slope as per the direction of the Competent Authority.

2.2.5 Before commencement of treatment on any surface, it shall be ensured that the outlet drain pipes / spouts have been fixed and the spout openings have been eased and rounded off properly for easy flow of water.

2.2.6 The approved specialized agency for the work of water proofing will have to execute a guarantee bond in prescribed Proforma enclosed at Appendix-III for removing any defects for at least 5years. Guarantee bond shall be signed by both the specialized agencies as approved by the Competent Authority and the agency to meet there liability under the guarantee bond. However, the sole responsibility about the efficiency of water proofing treatment shall rest with the agency.

2.2.7 If the performance of the work done is found unsatisfactory and any defects noticed during the guarantee period, they shall be rectified by the agency within seven days of receipt of intimation of defects in the work. If the defects pointed out are not attended to within the specified period, the same will be got done from another agency at the risk and cost of the agency.

3.0 General Scope &Specifications of E &M works

3.1 Scope of work

3.1.1 Scope of work covers planning, designing, supply, installation, testing and commissioning of all E&M services such as IEI, Firefighting systems pumps etc. required to be provided in the said

project as per norms of various IS codes/NBC 2016/CPWD specifications/ECBC/CEA, various byelaws and norms of local bodies. The work shall be carried out as per scope & specifications of E& M works given hereafter and given in respective head/part of the scheme sub-head. If any services required to make the building /scheme habitable is not covered in the scope of services same shall either be pointed out in pre- bid meeting else, it shall be presumed that the same shall be provided within the quoted cost and nothing extra shall be paid on this account.

3.1.2 The scope of works also covers the preparation of layout plans, drawings for E&M schemes and approval of the same from the respective local bodies/CFO etc. before the commencement of work. During execution, if the local bodies etc. require a modification, the same shall be executed without any extra cost. Finally, after execution, approvals/NOCs/clearances from local bodies etc. shall be the responsibility of successful agency for which nothing extra is payable in case any modification/ extra work is required. All statutory fees/charges required for obtaining clearances from /Local Bodies shall be paid by the agency.

4.0 General

4.1 These additional terms & conditions are applicable to all the Electrical works.

4.1.1 The agency must study specifications and conditions carefully. The work shall be executed in close coordination with the progress of building work.

4.1.2 The work shall be carried out as per CPWD specifications, if specifications are not available, IS codes shall be followed.

4.1.3 All equipment shall be delivered with (i) manufacturer's test certificate, (ii) manufacturer's technical catalogues, and installation / instruction (O&M) manuals.

4.1.4 Scaffolding & any other T&P required for execution of work shall be arranged by the agencies and nothing extra shall be payable on that account.

4.1.5 The layout plans/drawings/other documents pertaining to Electrical services shall have to be submitted for evaluation & approval, within 45days of award of work.

5.0 Inspection before Dispatch

All routine tests shall be conducted before dispatch of equipment. No equipment shall be dispatched from the manufacture's premises without such tests being conducted and test result recorded. These test certificates shall be given along with the supply of equipment. The authorized representative of BMTPC shall, if he so desires inspect and witness the pre-delivery tests. For this purpose, the agency shall give 15 days' notice. Agency shall arrange for inspection by the department. Department shall bear expenses of its officials for inspection as far as traveling, boarding and / lodging is concerned. However, waiver if any, for inspection

shall be at the discretion of the department without any cost implication but ROUTINE TEST & TYPE TEST certificates shall have to be submitted for equipment.

Prior to dispatch, all equipment shall be adequately protected & insured for the whole period of transit, storage and erection against corrosion and incidental damages etc. from the effect of vermin, sunlight, rain, heat and humid climate.

6.0 Insurance

The agency shall include storage cum erection insurance including third party insurance right from the storage to commissioning of various equipment. All insurance which the agency is required to enter under the contract shall be affected with any authorized general insurance company and the agency shall produce the policies of insurance.

7.0 Remedy of failure to insure

If the agency fails to effect and keep in force the insurance referred to in the preceding sub-clause the department may affect and keep in force any such insurance and pay such premium as may be necessary for that purpose and from time to time deduct the amount, so paid by the department, from any money due or which may become due to bids or recover the same as debit from the agency's bill.

8.0 Quality of material and workmanship

All parts of the equipment shall be of such design, size and material to function satisfactorily under all rated conditions of operation. All components of the equipments shall have adequate factor of safety. The work of fabrication and assembly shall conform to sound engineering practice and based on "Fail Safe Design". The mechanical parts subject to wear and tear shall be easily replaceable type. The construction of the equipments shall be such as to facilitate effortless operation, inspection, maintenance and repairs. All connections and contacts shall be designed to minimize risk of accidental short circuits caused by animals, birds and vermin etc. All identical items and their component parts should be completely, interchangeable including spare parts.

9.0 Inspection and testing at site

9.1 The installation shall be subject to necessary inspection during every stage of erection, by the Competent Authority. The successful agency shall provide all facilities and assistance for the purpose.

9.2 The completed installation shall be inspected and tested by the Competent Authority in the manner as will be laid down by him, in consultation with the agency.

9.3 All instruments and facilities necessary for the tests shall be provided by the agency.

10.0 Completeness of work

10.1 The installations shall be completed in all respects and put in to operation even where certain details have not been mentioned/left out in these specifications. Any discrepancy may be brought out in pre-bid meeting.

10.2 All E&M services such as Internal Electrical installations, Firefighting System, pumps shall be declared as completed after completion of trial run of 1 month.

11.0 Internal electric installation (IEI)

11.1 The work will be carried out as per proposed technology specifications for the internal electric installation. Where such specifications are not available, CPWD specifications shall be adopted.

11.2 FRLS PVC insulated Copper conductor wires will be used for points, circuit & sub-main wiring.

11.3 Agency shall execute the work as per scale of amenities given elsewhere in document after obtaining necessary approval of the layout for internal electrification of all houses, common areas and staircases from Competent Authority. The staircase lighting shall be in group control system.

11.4 Modular type switches, sockets and stepped type electronic fan regulators, bell push along with matching mounting boxes of same make shall be used.

11.5 TV outlet point wiring of each house shall be terminated in suitable size of G.I. box along with splitter at every floor. The interconnections of all splitter boxes fixed at all floors shall be done properly with conduits to form proper distribution system with the prior approval of competent authority.

11.6 Suitable rain protection covers made of 16 SWG galvanized MS sheet wherever required shall be provided.

11.7 Meter Boards & Main Distribution Boards as per local body specification/requirement shall also be provided by the agency. Dwelling units shall be provided with single phase 230 V supply.

11.8 A separate Meter Rooms is to be provided at suitable location in the building block with the prior approval of layout by Competent Authority.

11.9 Laying of HDPE / DWC /Hume pipes for road crossing or in pucca portion & CC path etc. for electric/street lighting cables complete with adequate number of cable chambers shall be provided by the agency.

11.10 After completing the work, necessary test results as envisaged in CPWD General Specifications Part-I (Internal)-2005&Indian Electricity Rules 2005, shall be recorded and submitted to BMTPC. The results shall be within the permissible limits. Test report forms duly signed by authorized person for obtaining electric connections (energy meters) from Power Distribution Company by the agency shall be given to the authority.

12. Firefighting System

12.1 Fire protection systems shall be designed and provided as per NBC-2016 with amendments, updated BIS code and fire bylaws. NOC for the project from local fire service department shall be obtained by the selected agency.

5. LIST OF APPROVED MAKES

Apart from the proposed technology the following specification/brands names of materials to be used as listed wherever required. The efforts should be made by the agency to use indigenous products. The agency should also consider the availability of spares parts/components for maintenance purposes while proposing any brand/manufacturer. The materials of any other brand/manufacturer may be proposed for use by the agency in case the brands specified below are not available in the market and/or agency intends to use some other brand better than the brands mentioned in this list. The alternate brand can be used only after the approval of Competent Authority. The list of approved make for Civil Works is given below:

Sr. No.	**Materials**	**Brands**
1)	PPC / OPC Cement	Ambuja/ Ultratech /ACC/Birla Cement/ Binani/ JK Laxmi/ JK / Dalmia Cement/ Star Cement
2)	White Cement	J.K.White/ BirlaWhite/ Travan core/ Dalmia / Star
3)	White Cement Putty	Birla/JK/Asian/Berger/ Nerolac /ICI
4)	Reinforcement Bar	Confirming to IS: 1786-2008 with upto date amendments (Test report of each lot of steel to be submitted as per CPWD testing frequency along with MTC)
5)	Structural Steel Sections	Confirming to relevant IS code of practice (Test report of each lot of steel to be submitted as per CPWD testing frequency along with MTC)
6)	Kota Stone/Marble/Granite/ Jaisalmer Stone	As per approved sample
7)	Ceramic Tiles(Coloured)	Orient Bell/ Kajaria/ Nitco /Johnson/Asian/Euro/ Varmora/ Somany/ Cengres
8)	Vitrified Tiles	Orient Bell/ Somany/ Kajaria/ Johnson/Asian/Euro/ Varmora/ Granito / RK/ Naveen/ Cengres/ Nitco
9)	Interlocking paver blocks / Grass Pavers / Kerb Stone	Unistone / Ultra / Hindustan/ KK/ Nitco/ Dalal/ Bharat Regency / Duracrete
10)	Commercial Block Board / Commercial Ply /Teak Ply	Greenply/ Novopan/ Kitply/ Century/Anchor/Duro/ Bhutan / Archid / Durian
11)	Laminates/Decorative laminates/Sun–Mica	Decolam/ Greenlam / Merinolam/ Formica/ National laminate/ Neoluxe/ Decolite/ Signature/ Skylam/ EURO /Royal Touch
12)	Pre laminated board	Bhutan/ Novapan/ Eco board/ Bakelite/ Hylem Nepal board/ Green board/ Centuary / Kit Lam
13)	Impregnated Fibre Board	Shalitex by Shalimar Tar Product or equivalent
14)	Teak Veneer	Anchor/ Kitply/ Greenply or equivalent
15)	Flush Doors	Century/ Green/ Kitply/ Duro / Merino / Mayur / Archid / Kutty
16)	Aluminium Section	Indal/ Hindal/ Jindal/ Hindalco/ Nalco

17)	All Aluminium Hardware, Fittings	Everite/Garnish/Arches/Kausal/Nu-lite/Alif/Shalimar(Bombay)Singla/ Opel/Bolt/ Arhish
18)	Stainless Steel Hardware's Fittings	Kitch/ Dorma/ Hafele/ Geze/ Godrej/ Ipsa/ Assa-abloy
19)	Glass/Float/Sheet	Saint Gobain/ Modi/ Hindustan Pilkington/ AIS/ Triveni/ Glaverbel
20)	Door Closer/Floor Spring	Godrej/ Everite, Opel, Doorking/ Hardwin/ Nulite/ Hyper/ Ezec/ Navkar.
21)	Locks	Euro/ Godrej/ Harrison/ Plaza/ Golden/ Doorset/ Yale
22)	Polysulphide Sealant For Expansion Joints All Windows	Chokesy Chemical/ Structure Proofing Co Pidilite/ GESilicon/ Tuff sealor equivalent
23)	Synthetic Enamel Paints/Primer/ Oil bound Distemper	Nerolac/ Berger/ Asian Paint/ ICI Dulux/ Shalimar.
24)	Water Proof Acrylic Paints /Weather proof Acrylic Paints	Nerolac/ Berger/ Asian Paint/ ICIDulux/ Shalimar
25)	Water based Distemper (Washable)	Nerolac/ Berger/ Asian Paint/ ICI Dulux/ Shalimar
26)	Polyurethane Paint	MRF/Alchemica or equivalent
27)	Water Proofing Compound	'CICO'/ Fosroc/ GESillicon/ Pidilite/ MC-Bauchmie/ Sika/ Farmate/ Tape crete /Accoproof/ Impremo /Reoplast
28)	Weather Sealent /Silicon Sealant / Polyisobutylenesealant	Fosroc/ Pidilite/MC-Bauchmie /Wecker789/ Dow corning789 or equivalent
29)	Hardeners	'Ironite'/' Ferrok'/' Hardonate' or equivalent.
30)	Wire Mesh	Sterling Enterprises/Trimurti/Welded Mesh or equivalent
31)	Anti-Termite Treatment	ThyodinbyHoechest/LyntricbyBayerIndia/Durmetby CynamidIndia/NocilPyramid or equivalent
32)	Pre coated Sheets	TataBluescope/Multicolorsteels/Interarch/Kirby/Tiger steelorequivalent
33)	Polyester Fibre	Recron3S/Formate or equivalent
34)	Welding Rod	Advani/ Philips/Sunarc/Eshabor equivalent
35)	Construction Chemicals	Fosroc/MC-Bauchmie/ Sika/ Pidilite/ Formate / Super plast SNF40/BASF
36)	AAC Block	Builtech / Magicrete Building Solution / Aerocon / Indo Bhutan Construction Solution
37)	Chemical mortar/ AAC block jointer	Ultratech / Ferrouscrete / Bal Endura
38)	Polymer Modified Cementitious Grout	Bal Endura / Webber / MykLaticrete
39)	Epoxy Mortar	Fosroc / Sika / Cico / Laticrete
40)	UPVC Windows/Doors	Encraft / Aluplast / Rehau / Duroplast/Fenesta/

	/Ventilators	Polywood
41)	Wooden /Metal / Glaze-Fire Rated Door Shutters	Navair / Sukri / Promat / Kutty/Bhawani / Pacific
42)	Hinges & Brassware	Shalimar/ Indo-Brass / AmarbhoyDossaji / Earl Bihari / Magnum/Kich
43)	Fire-Rated Glass(Two Hour Fire Rating) Transparent Clear Glass	Glaverbel / Saint Gobbin / Pyroguard / Shott
44)	All Hardware And Fittings For All Types Of Glazing /Doors / Windows Etc.	Dorma / Hafele / Gezei / Kich / Godrej / Assa-Abloy
45)	Adhesives	Anchor / Dunlop / Pidilite- Fevicol
46)	SS wire Mesh	GKD / WMW
47)	Hardware Accessories For Fire Doors /Panic Bar / Panic Trim/ Door Closer /Hinges / Mortise Lock	IndersollRond / Dorma/ Geze / Hafele / Assa-Abloy / Kich
48)	Tile Adhesive /Epoxy Grouts	Ferrous Crete / BalllEndura / Pidilite / Lati Crete
49)	Bitumen	Indian Oil, Hindustan Petroleum
50)	Dash Fastners	Hilti/ Fischer/ Bosch
51)	S.S. Railing	Jindal Stainless Steel Ltd./ ICICH Industries/Essal
52)	Nuts, Bolts And Screws, Steel	Kundan/ Priya/ Atul
53)	EPDM Gasket	Hanu/ Anand/ Lescuyer
54)	Fire Glass For Vision Pannels	Saint Gobain / Ashai India
55)	Fire Door	Godrej/ Shakti/ Navair
56)	Rolling Shutter	Rama Rolling Shutter/Jyoti Rolling Shutter/ Anand Industries
57)	POP (Plaster Of Paris)	J K Laxmi/ Sriram Nirman/ Trimurti/ ISI Mark Only
58)	PVC Doors	Fabricated From Rajshree/ Finolex Plastics / Sintex
59)	Factory Made Section Window	ISI Mark Product Only
60)	Powder Coated Aluminium Door Fittings	ISI Mark Only
61)	Gypsum Board	Gyproc by Saint Gobain / USG Boral / Knoff
62)	Fibre Cement Board	Everest / Visaka/ Swastik
63)	Cement Bonded Particle Board	NCL Industries or equivalent ISI mark product only
64)	Project Management Software	Nadhi Information Technologies Pvt. Ltd/ Coaspect Solutions Pvt. Ltd/ Cognisite/ Quickspec/ Superwise Solutions Pvt. Ltd/ Builsys

LIST OF MATERIALS OF APPROVED BRAND / MANUFACTURER (ONLY FIRST QUALITY TO BE USED (WATER SUPPLY & SANITARY WORKS)

Sr. No.	Materials	Brands
1.	Vitreous China Ware	Hindware / Parryware / Cera / Johnson / Hindustan/ Neycer/ Varmora
2.	RCC Pipes	Pragati / Lakshmi / Sood&Sood / Jain & Co /Diwan
3.	UPVC / CPVC Pipes & Fittings	Supreme / Prince / Astral / Finolex / Surya Roshni / Ashirwad/ Prakash/Kisan
4.	Stainless Steel Sinks	Neelkanth / Nirali / Cera/Jayna/ Diamond / Cobra
5.	Spun Cast Iron Pipes & Fittings (IS:3989)	Jaiswal Neco/ RIF / SKF / BIC
6.	Stoneware Pipes and Gully Traps	Perfect / Burn / Anand / Parry/ Hind
7.	Gunmetal Valves (Full Way Valve) Class-I	Zoloto / Castle/ Kartar/Leader /Sant/ Prima
8.	CI Double Flanged Sluice Valve	Kirloskar / IVC / Sondhi / Kejriwal/Burn
9.	CI Manhole Frame & Covers and CI Grating	Neco / RIF / SKF / BIC
10.	Sanitary CP Fittings & Accessories	Marc / Parryware / Kingston/Gem/Parko/ Hindustan /Cera
11.	Floor Traps (Jali)	Jayna / Chilly / Nirali
12.	PVC Water Tank	Sintex / Polycon / SPL/Reno/ Sheetal/ Kisan
13.	Flushing Cistern	CERA/Hindware/Johnson/Hindustan/Perryware
14.	E.W.C. Seats(Cover)	CERA/Hindware/Johnson/Hindustan/Perryware/EID/Neycer/Varmora.
15.	Mirrors	Modi Float glass/Asahi/SaintGobin/ Atul Glasswork
16.	Fibre reinforced R.C.C. Manhole cover	KK / Nitco/ Dalal
17.	C.I. Manhole cover with frame	ISI approved make or equivalent
18.	P.V.C. Pipes &Fittings	Astral/Supreme/Prince/Finolex /Ashirvad Pipes/Jain /Kisan
19.	Ball Cock	Zoloto/ Prima/ IBT/ RCO/Sant
20.	UPVC Pipes (SolventWeldedJoints)	Astral/ Supreme/Prince/Finolex/ Ashirvad Pipes/ Jain/Kisan/ KSR/ Precision /Ajay Dustron
21.	PTMT	Prayag/ Polytuf or equivalent
22.	Ductile Iron Pipe (Water pipe)	Electro Steel/ Kesso/ Kdupl./ Electron Spun
23.	PVC Flushing Cistern	Hindware/ Steelbird / Jindal/ Seabird ISI mark only

LIST OF MATERIALS OF APPROVED BRAND / MANUFACTURER
(ONLY FIRST QUALITY TO BE USED (ELECTRICAL WORKS)

Sr. No.	Materials	Brands
1.	FRLS PVC Insulated Copper Wire /Power Cable / Xlpe Cable / Telephone Cable	L&T / Havel's / Polycab / Finolex / Sky Tone
2.	Co-Axial TV Cable	L&T / Havel's /Polycab / Finolex / Sky Tone.
3.	Steel Conduit	RM Con / AKG/ BEC ISI Marked.
4.	PVC Conduit	AKG / Polycab / Prince
5.	L. T. Panel / Meter Board	Adlecmundka / Associated Switchgears And Project Ltd. / SudhirGenset Ltd. / Control And Switchgears Pvt. Ltd / Kepl/Tricolite
6.	MCB/MCB DB, Prewired MCB Db And Sheet Steel Metal Enclosed Industrial Socket, Plug Top And Isolators	Legrand / Siemens / L&T / Abb / Schneider
7.	Modular Type Switch/Socket, Telephone Socket, Cable Tv Antenna Socket, Electronic Fan Regulator And Gi Boxes	Anchor / Vinay/Crabtree /Legrand (Mylinc / Havel's (Piccadilly) / Honeywell (Midas) /North West (Nova)
8.	LED Fitting	Philips / Crompton / Wipro / Ge / Zumpobel / Trilux
9.	Ceiling Fan / Exhaust Fan	Crompton Greaves / Almonard / Havells / Usha.
10.	Octagonal Steel Pole	Bajaj/ Twinkle / Valmart
11.	Air Circuit Breaker / MCCB	L&T-U Power / Siemens-3wl / Abb- Emax / Schneider-Masterpact- Nw
12.	Alternator	Stamford / Leroy Somer / Caterpillar / Koel Green
13.	Copper Conductor Control Cable	Bonton / Lapp Cable / Havells / Rr Kabel / L&T / Rajnigandha
14.	Communication Cable / Signal Cable	Lapp Cable / Fusion Polymer / Beldon
15.	Motor/ Pumps	ABB/ Siemens/ Kirloskar Crompton Greaves
16.	Starter	L&T/ Siemens / Crompton/ Ge Abb / Bch
17.	Armoured cables	Tropodure/ Incab/ torrent/ Finolex/ Unistar/ Avocab/ Havells/ Gloster
18.	Motor starter/Panel	L&T/Siemens/ Havells/ Galco/ Ellico/ BCH/C&S
19.	Fire Extinguisher	Safex/ Minimex/ Superex/ Ceasefire
20.	First Aid Hose Real, Nozzles, valves, Hose pipe and other fittings	ISI mark only

Notes:

a) The contractor shall produce samples of the materials for approval of the authorized representative of BMTPC. The materials of the makes out of the above as approved by the authorized representative of BMTPC shall be used on the work.
b) In respect of materials for which approved makes are not specified above, ISI make of materials to be used by taking approval from authorized representative of BMTPC. If ISI make materials are not available, materials to be approved by Competent Authority.
c) For all the material of approved brands necessary testing as per IS standards shall be done by the agency and no extra payment shall be paid for that.

Appendix-III

GUARANTEE TO BE EXECUTED BY AGENCY FOR REMOVAL OF DEFECTS AFTER COMPLETION IN RESPECT OF WATER PROOFING WORKS

The agreement made this……..…….day of year two thousand and …….……between ……..……..……. (Hereinafter called the Guarantor of the one part) and the BMTPC (Hereinafter called the Implementing Agency of the other part).

WHEREAS THIS agreement is supplementary to a contract (Hereinafter called the contract) dated …… and made between the GUARANTOR OF THE ONE PART AND the BMTPC of the other part, whereby the agency inter-alia, undertook to render the building and structures in the said contract recited completely water and leak proof.

AND WHEREAS THE GUARANTOR agreed to give guarantee to the affect that the said work will remain water and leak proof for five years from the date of giving of water proofing treatment.

NOW THE GUARANTOR hereby guarantee that water proofing treatment given by him will render the structures completely leak proof and the minimum life of such water proofing treatment shall be ten years to be reckoned from the date after the maintenance period prescribed in the contract.

Provided that the guarantor will not be responsible for leakage caused by earthquake or structural defects or misuse or alteration and for such purpose.

a) Misuse of roof shall mean any operation which will damage proofing treatment, like chopping of firewood and things of the same nature which might cause damage to the proof.
b) Alteration shall mean construction of an additional storey or a part of the roof or construction adjoining to existing roof whereby proofing treatment is removed in parts.
c) The decision of the Competent Authority with regard to nature and cause of defects shall be final.

During this period of guarantee, the guarantor shall make good all defects and in case of any defect being found render the building water proof to the satisfaction of the Competent Authority at his cost and shall commence the work for such rectification within seven days from the date of issue of the notice from Competent Authority calling upon him to rectify the defects failing which the work shall be got done by the Department by some other agency at the Guarantors risk and cost. The decision of the Competent Authority as to the cost payable by the Guarantor shall be final and binding.

That if guarantor fails to execute the water proofing or commits breach there under; then the guarantor will indemnify the Principal and his successors against all loss, damage, cost any default on the part of the GUARANTOR in performance and observance of this supplementary agreement. As to the amount of loss and/ or damage and/or cost incurred by the BMTPC,

the decision of the Competent Authority will be final and binding on the parties.

IN WITNESS WHEREOF these presents have been executed by the selected agency …….. and ……By…….. For and on behalf of the BMTPC on the day, month and year first above written.

SIGNED, sealed and delivered by selected agency in the presence of :

1. …… 2. ……

SIGNED FOR AND ON BEHALF OF BMTPC

By …… in the presence of :

1. …… 2. ……

6. SCHEDULE OF FINISHES &SPECIFICATIONS

1.0 Specifications for Dwelling Units and Community Centre

The specification for construction of Dwelling Units and community centre shall be as under:

Sl.No	Item of Work	Specification
1.	**FOUNDATION & PLINTH (AS PER DRAWING)**	
1.1	Excavation	All type of excavation will be part of work including site clearance, dewatering from trenches etc. or clearing and cutting of shrubs / small trees etc.
1.2	Foundation & Plinth	Pile foundation, Strip foundation, isolated column footing, spread foundation or raft foundation as per structural design, drawings and soil investigation report.
1.3	Concrete in Foundation for Columns / walls	No concreting less than M20 strength will be used for foundation work either for frame structure or raft foundation as per design. The type of mix, thickness and width shall depend on approved structural design. The base concrete will not be less than M7.5
1.4	Plinth Beam	Plinth beam to be provided, Concrete will not be less than M20 strength
1.5	Anti-termite	Chemical Anti-termite treatment / termite-mat as per CPWD specification
1.6	Damp Proof Course over Plinth Beam	Damp-proof course should be 40mm thick with cement concrete 1:2:4 (1 cement : 2 coarse sand (zone-III): 4 graded stone aggregate 12.5mm nominal size), if required.
1.7(a)	Plinth Filling : a) Sand filling : / Concrete under floor :	Filling with sand in trenches or embankment in layers (each layer should not exceed 15 cm), including watering and ramming and 100mm layer of CC 1:4:8 (1 cement: 4 coarse sand: 8 stone aggregate) 40 mm nominal size under floor.
1.7(b)	Internal Filling	Internal filling will be excavated soil or earth filling with soil brought from outside.
1.8	Brick work in foundation & plinth :	Brick of class designation 100 will be used. Brick Masonry provided with cement mortar shall be with coarse sand minimum 1:6 (1 cement: 6 course sand) or richer mixes.
2	**SUPER STRUCTURE WORK**	
2.1	Walling (As per Drawing)	As per specification of proposed Technology
2.2	Slab and Staircase including projections /lintel/sunshades(As per Drawing)	Reinforced Cement Concrete slab with Reinforcement as per structural design and drawing (As per proposed Technology). Grade of Steel and Concrete Shall be Fe 500 D and Minimum M20 strength respectively.

Sl.No	Item of Work	Specification
2.3	Railing in staircase and Balcony	1.10mts high M.S. railing in all the units & staircase of approved pattern with hand railing 40 mm MS (medium class pipe) Minimum weight of railing shall be 14 kg per meter and vertical bars of 12 mm square bar at 100mm c/c embedded in waist slab with base plate .(as per Drawing) The height of railing shall be 1.10mtr from finished level of Floor/steps. MS railing to be provided as per drawings approved by BMTPC.
3.	**WOOD / STEEL WORK (DOOR, WINDOWS & VENTILATORS)**	
3.1	Door frame	The door frame shall be of pressed steel door frame as per CPWD specification Profile "B". The Door frame shall be of double rebate for external doors and single rebate for internal doors. or Chemically treated second class Hollock wood of required size as per CPWD specifications (Single Rebate and Double Rebate)
3.2	Door shutters	The door shutter will be of ISI marked flush door shutters conforming to IS: 2202 (Part I) Non-decorative type, core of block board construction with frame of 1st class hard wood and well matched commercial 3 ply veneering with vertical grains or cross bands and face veneers on both faces of shutters. 35 mm thick including ISI marked Stainless Steel butt hinges with necessary screws with 25mm lipping.
3.3	Collapsible steel shutters for Community Centre	Providing and fixing in position collapsible steel shutters with vertical channels 20x10x2 mm and braced with flat iron diagonals 20x5 mm size, with top and bottom rail of T-iron 40x40x6 mm, with 40 mm dia steel pulleys, complete with bolts, nuts, locking arrangement, stoppers, handles, including applying a priming coat of approved steel primer.
3.4	Rolling shutter for shops	Supplying and fixing rolling shutters of approved make, made of required size M.S. laths, interlocked together through their entire length and jointed together at the end by end locks, mounted on specially designed pipe shaft with brackets, side guides and arrangements for inside and outside locking with push and pull operation complete, including the cost of providing and fixing necessary 27.5 cm long wire springs manufactured from high tensile steel wire of adequate strength conforming to IS: 4454 - part 1 and M.S. top cover of required thickness for rolling shutters. 80x1.25 mm M.S. laths with 1.25 mm thick top cover
3.5	Toilet/Bath Door Frame:	Providing and fixing factory made uPVC door frame made of uPVC extruded sections having an overall dimension as below (tolerance ±1mm), with wall thickness 2.0 mm (± 0.2 mm), corners of the door frame to be Jointed with galvanized brackets and stainless steel screws, joints mitred and Plastic welded. The hinge side vertical of the frames reinforced by galvanized M.S. tube of size 19 X 19 mm and 1mm (± 0.1 mm) wall

Sl.No	Item of Work	Specification
		thickness and 3 nos. stainless steel hinges fixed to the frame complete as per manufacturer's specification and direction of BMTPC Extruded section profile size 42x50 mm
3.6	Toilet/Bath Door Shutters	30 mm thick factory made Polyvinyl Chloride (PVC) door shutter made of styles and rails of a uPVC hollow section of size 60x30 mm and wall thickness 2 mm (± 0.2 mm), with inbuilt decorative moulding edging on one side. The styles and rails mitred and joint at the corners by means of M.S. galvanised/ plastic brackets of size 75x220 mm having wall thickness 1.0 mm and stainless steel screws. The styles of the shutter reinforced by inserting galvanised M.S. tube of size 25x20 mm and 1 mm (± 0.1 mm) wall thickness. The lock rail made up of 'H' section, a uPVC hollow section of size 100x30 mm and 2 mm (± 0.2 mm) wall thickness fixed to the shutter styles by means of plastic/ galvanised M.S. 'U' cleats. The shutter frame filled with a uPVC multi-chambered single panel of size not less than 620 mm, having over all thickness of 20 mm and 1 mm (± 0.1 mm) wall thickness. The panels filled vertically and tie bar at two places by inserting horizontally 6 mm galvanised M.S. rod and fastened with nuts and washers, complete as per manufacturer's specification and direction of BMTPC (WC & bathroom door shutters).
3.7	Door fittings	ISI marked powdered coated Aluminum fittings e.g. Tower bolts, handles, door stopper etc. (IS:1378) Handles 150 mm -2, Tower bolt 12mm dia 300mm length -2, L drop- 300mm long & 16mm dia-1, Stopper-1, Buffer -1, Peep hole and security chain for external door only - 1.
3.8	Windows and Ventilators (Frames + Shutter)	UPVC profile frame with openable/sliding UPVC double shutters, one with glazed panel & other with wire mesh (of SS grade 304) shutter, as per CPWD specifications.
3.9	Sills and Jhambs lining	18 mm thick projected window sill lining, window jhambs in Granite / marble as approved (if permitted as per technology proposed).
3.10	Glass Door at main entrance of building	Providing and fixing 12 mm thick frameless toughened glass door shutter of approved brand and manufacture, including providing and fixing top & bottom pivot & double action hydraulic floor spring type fixing arrangement and making necessary holes etc. for fixing required door fittings, all complete as per direction of BMTPC.
3.11	Mumty Door Shutter	Providing and fixing 1mm thick M.S. sheet door with frame of 40x40x6 mm angle iron and 3 mm M.S. gusset plates at the junctions and corners, all necessary fittings complete, including applying a priming coat of approved steel primer. Using flats 30x6 mm for diagonal braces and central cross piece as required
3.12	Concrete Jali	Providing precast cement concrete Jali 1:2:4 (1 cement : 2

Sl.No	Item of Work	Specification
		coarse sand (zone-III) : 4 graded stone aggregate 6mm nominal size), reinforced with 1.6 mm dia mild steel wire, including centering and shuttering, roughening cleaning, fixing and finishing in cement mortar 1:3 (1 cement: 3 fine sand) etc. complete, excluding plastering of the jambs, sills and soffits. 40 mm thick
3.13	Cupboard	Providing and fixing built in cupboard with RCC / Kota stone / Precast panel having minimum 2 shelves upto 2100 m and shutter of 18 mm thick pre-laminated decorative particle board as shutter including all fittings, hanging SS rod and locking arrangement as per CPWD specification.
3.14	Kitchen Cabinet	Built in cupboard with shutters of 18mm thick Pre laminated commercial / particle board with one side decorative and other side balancing as per approved architectural design.
	FLOORING	
4.1	Rooms and Kitchen,	Vitrified tile of size not less than 600x600 mm of approved make and colour to be used. (As approved by BMTPC).
4.2	Toilet, Dressing & balcony area	Anti skid ceramic tiles (minimum size 300x300mm) of approved make and colour including grouting (As approved by BMTPC).
4.3	Kitchen Counter Top, washbasin counter, window sill	Providing and fixing 20mm thick mirror polished, machine cut for kitchen platforms, vanity counters facias and similar locations of required size of approved shade, colour and texture laid over 20 mm thick base cement mortar 1:4 (1 cement :4 coarse sand) with joints treated with white cement, mixed with matching pigment-epoxy touch ups. Including rubbing, curing, moulding /noising and polishing etc. complete at all levels. Raj Nagar Plain white marble/ Udaipur green marble/Zebra black marble (Area of slab over 0.50 Sqm)
4.4	Staircase	Pre-polished Kota stone/ granite stone slabs 20 mm thick in single length of tread and risers of steps, skirting, dado and pillars laid on 12 mm (average) thick cement mortar 1:3 (1 cement: 3 coarse sand) and jointed with grey cement slurry mixed with pigment to match the shade of the slabs, including rubbing and polishing complete with nosing.
4.5	Common space	Mirror polished Kota stone slab/ granite stone flooring over 20 mm (average) thick base laid over and jointed with grey cement slurry mixed with pigment to match the shade of the slab, including rubbing and polishing complete with base of cement mortar 1 : 4 (1 cement : 4 coarse sand).
4.6	Skirting :	18mm/21mm thick 100mm high skirting with same finish as flooring.
4.7	Dado in toilets, kitchen & wash area	Ceramic tile of minimum size of 200 x 300 or as approved up to full height with decorative band in Toilets / bath shall be

Sl.No	Item of Work	Specification
		provided. Ceramic tile of size not less than 200 x 300 or as approved from floor to full height in kitchen shall be provided. Ceramic tile of minimum size of 200 x 300 or as approved up to full height with decorative band in Wash area shall be provided.
5	**ROOFING**	
5.1	Waterproofing in Sunken/Depressed Portion of WCs, Bath etc.	Providing and laying water proofing treatment in sunken portion of WCs, bathroom etc., by applying cement slurry mixed with water proofing cement compound consisting of applying : (a) First layer of slurry of cement @ 0.488 kg/sqm mixed with water proofing cement compound @ 0.253 kg/ sqm. This layer will be allowed to air cure for 4 hours. (b) Second layer of slurry of cement @ 0.242 kg/sqm mixed with water proofing cement compound @ 0.126 kg/sqm. This layer will be allowed to air cure for 4 hours followed with water curing for 48 hours. All work shall be as per CPWD specification.
5.2	Terrace Treatment :	Providing and laying water proofing treatment on roofs of slabs by applying cement slurry mixed with water proofing cement compound consisting of applying: (A) After surface preparation, two coats of mixed slurry to be applied to the set concrete @1.5-2 kg/m² by a masonry brush, roller or appropriate power spray equipment. This will be allowed to air cure for 4 hours followed by water curing for 48 hours. The entire treatment will be taken upto 30 cm on parapet wall and tucked into groove in parapet all around. (B) After complete curing, laying protection screed concrete in the ratio 1:2:4 not more the 50 mm in thickness. Flooded the entire slab for minimum curing period of 48 hours with heat resistance tiles or Koba treatment as per CPWD specifications and technology requirement.
5.2	Gola in C.C 1:2:4	Providing gola 75x75 mm in cement concrete 1:2:4 (1 cement: 2 coarse sand:4 stone aggregate 10mm and down gauge) including finishing with cement mortar 1:3(1 cement: 3 coarse sand)as per standard design In 75x75 mm deep chase
5.3	Rain Water Pipes	Providing and fixing on wall face un plasticised Rigid PVC rain water pipes conforming to IS : 13592 Type A, including jointing with seal ring conforming to IS : 5382, leaving 10 mm gap for thermal expansion, including all required accessories and making of khurra 45 x 45cm. as per CPWD norms. It shall be responsibility of contractor to make essential arrangement for disposal of rain water by providing proper sloping of roof slab and by providing appropriate uPVC pipes and fittings all complete. Duct portion (if any) up to plinth level shall be constructed as collecting chamber and uPVC pipe/ uPVC shoe at bottom shall be fixed for disposal of rain water.
5.4	Parapet with coping	Parapet in proposed technology having height of 1.10 mt with

Sl.No	Item of Work	Specification
		25mm thick CC coping in M20 grade concrete including neat cement plaster in cement mortar 1:6. Or any other material with the approval of competent authority.
6	**FINISHING**	
6.1	Finishing Internal/ External walls (Wherever required)	12/15/20 mm cement plaster in 1:6 (1 cement : 6 fine sand) finished or as per technology provider's specification including admixture if required .
6.2	Finishing bottom of RCC slab	6 mm cement plaster1:3(1 cement : 3 fine sand) for Finishing bottom RCC Slab, beams, plaster to ceiling etc.
6.3	Painting :Internal finish on walls/Ceilings	Distempering with Oil Bound distemper along with priming coat over 2 mm thick POP/ acrylic putty on walls
6.4	Painting External finish on walls	Weather Proof Acrylic Emulsion paint on base of 2 mm thick external wall putty.
6.5	Primer :	As per CPWD Specification for walls, wood work and steel work.(Zinc chromate primer)
6.6	Painting on wood work & steel work:	Painting with synthetic enamel paint, of approved brand and manufacture, including applying additional coats wherever required to achieve even shade and colour. Two or more coats.
6.7	False Ceiling (As per proposed Technology requirement)	Providing and fixing false ceiling at all height including providing and fixing of frame work made of special sections, power pressed from M.S. sheets and galvanized with zinc coating of 120 gms/sqm (both side inclusive) as per IS : 277 and consisting of angle cleats of size 25 mm wide x 1.6 mm thick with flanges of 27 mm and 37mm, at 1200 mm centre to centre, one flange fixed to the ceiling with dash fastener 12.5 mm dia x 50mm long with 6mm dia bolts, other flange of cleat fixed to the angle hangers of 25x10x0.50 mm of required length with nuts & bolts of required size and other end of angle hanger fixed with intermediate G.I. channels 45x15x0.9 mm running at the spacing of 1200 mm centre to centre, to which the ceiling section 0.5 mm thick bottom wedge of 80 mm with tapered flanges of 26 mm each having lips of 10.5 mm, at 450 mm centre to centre, shall be fixed in a direction perpendicular to G.I. intermediate channel with connecting clips made out of 2.64 mm dia x 230 mm long G.I. wire at every junction, including fixing perimeter channels 0.5 mm thick 27 mm high having flanges of 20 mm and 30 mm long, the perimeter of ceiling fixed to wall/partition with the help of rawl plugs at 450 mm centre, with 25mm long dry wall screws @ 230 mm interval, including fixing of gypsum board to ceiling section and perimeter channel with the help of dry wall screws of size 3.5 x 25 mm at 230 mm c/c, including jointing and finishing to a flush finish of tapered and square edges of the board with recommended jointing compound , jointing tapes , finishing with jointing compound in 3

Sl.No	Item of Work	Specification
		layers covering upto 150 mm on both sides of joint and two coats of primer suitable for board, all as per manufacturer's specification and also including the cost of making openings for light fittings, grills, diffusers, cutouts made with frame of perimeter channels suitably fixed, all complete as per drawings, specification and direction of the authorized representative of BMTPC with painting with 12.5 mm thick tapered edge gypsum moisture resistant board.
7	**INTERNAL SANITARY / WATER SUPPLY INSTALLATIONS**	
7.1	W.C. Pan	White vitreous china pedestal type water closet (European type W.C. pan) with seat and lid, water jet with 10 litre low level white P.V.C. dual flushing cistern, including flush pipe, with manually controlled device (handle lever), conforming to IS : 7231, with all fittings and fixtures complete, including cutting and making good the walls and floors wherever required.
7.2	Water Supply Pipes Internal /External	CPVC Composite Pressure Pipes conforming to IS-15778 having thermal stability for hot & cold water supply, capable to with stand temperature up to 80^0 C, including all special fittings of composite material as per CPWD Specification. All Pipes sizes shall be as per drawing.
7.3	Fittings	Chromium plated Medium Weight Brass bib cocks/tap (min. wt.0.34kg), Brass stop cocks (min. wt.0.15kg) Brass flush cocks (min. wt.0.64kg), Shower rose (min wt. 0.26kg) with shower arm (min wt. 0.125 kg), Angle valve for geyser/basin/PVC flush tank – 15/20mm as per drawing and approved make.
7.4	Kitchen Sink single tub/twin tub as per requirement	Providing and fixing Stainless Steel A ISI 304 (18/8) kitchen sink with CP brass Sink cock (min wt 0.70kg) as per IS : 13983 with C.I. brackets and stainless steel plug 40 mm, including painting of fittings and brackets, cutting and making good the walls wherever required : 470x420 mm bowl depth 178 mm or twin tub / drain board as approved without drain board
7.5	Wash Basin	White Vitreous China Flat back wash basin size 550x 400 mm with single 15 mm C.P. brass pillar tap(min wt 0.42kg) and PTMT Waste Coupling 31 mm dia of 79 mm length and 62mm breadth weighing not less than 45 gms for wash basin and ,of approved quality and colour. Complete as per specification
7.6	Mirror with PTMT glass shelf	Providing and fixing 600x450 mm levelled edge mirror of superior glass (of approved quality) complete with 6 mm thick hard board ground fixed to wooden cleats with C.P. brass screws and washers complete.
7.7	Towel Rail	Providing and fixing 450 mm long SS towel rail with total length of 495 mm, 78 mm wide and effective height of 88 mm, weighing not less than 170 gms towel rail complete with brackets fixed to wooden cleats with CP brass screws with

Sl.No	Item of Work	Specification
		concealed fittings arrangement as per CPWD specification and direction of BMTPC.
7.8	Soap Rack	Providing and fixing SS soap shelves 100 mm wide of standard shape with bracket of the same materials with snap fittings as per CPWD specification and direction of BMTPC.
7.9	Grab Bars	Grab bars is to be provided in each toilet as per CPWD norms.
7.10	Overhead Tank	HDPE water storage tank for drinking and non-drinking purpose of required capacity for each unit on raised platform of minimum 200 mm height.
7.11	Fire tank at terrace	HDPE water storage tank for firefighting system of required capacity on raised platform of minimum 200mm height as per the NBC-2016 provisions / fire safety norms and connection with the underground tank with all required sizes of pipes and fittings. .
7.12	Plumbing for water purifier and Geyser	Required as per CPWD specifications
8	**INTERNAL SEWERAGE**	
8.1	Pipes	Providing and fixing on wall face unplasticised Rigid PVC soild and waste pipes conforming to IS : 13592 Type B, including jointing with seal ring conforming to IS : 5382, leaving 10 mm gap for thermal expansion, including all required accessories Sizes of all pipes shall be as per drawings.
8.2	Manholes	Manholes. with brick of class designation 75 of required size as per drawing in cement mortar 1:4 (1 cement: 4 coarse sand) with foundation concrete 1:3:6 (1 cement: 3 coarse sand: 6 graded stone aggregate 20 mm nominal size) with stone aggregate inside cement plaster 1:4 (1 cement: 4 coarse sand) with floating coat of neat cement, outside (Refer Drawing) cement plaster 1:4 (1 cement: 4 coarse sand) with precast RCC cover heavy duty cover In sub-soil or adverse soil conditions, manholes & encasing pipes shall be as per approved credible structural design to avoid sinking and settlement of lines/manholes. All the manholes inside the building to be lined with sand stone lining from outside up to bottom level.
8.3	Gully Trap	Providing and fixing square-mouth S.W. gully trap of required size as per drawing having class SP-1 complete with C.I. grating brick masonry chamber with water tight C.I. cover with frame of 300 x300 mm size (inside) the weight of cover to be not less than 4.50 kg and frame to be not less than 2.70 kg as per standard design: 100 x 100 mm size P Type With common burnt clay F.P.S. (non modular) bricks of class designation 7.5.
8.4	Floor Trap	Providing 76.2mm (3") NAHANY TRAP of PVC with SS 304 Jali (wt 50 gram) for Kitchen and Toilets.
9	**NUMBERING OF ROOMS ETC.**	

Sl.No	Item of Work	Specification
9.1	Numbering of Units and Mortise lock (as approved by BMTPC) for each Units	The numbering of size 100mm in height shall be printed on glazed tiles above the entrance door and Pad locked shall be provided on entrance door of each unit, as per instructions of authorized representative of BMTPC.

	INTERNAL ELECTRIC INSTALLATION (IEI)
1.	The work will be carried out in recessed PVC conduit wiring system in accordance of latest CPWD General Specifications for Electrical Works with amendments up to the date of opening of tenders and the governing specifications including makes for some of the important materials to be used in the work. In case of ambiguity between the two, the specifications shall prevail. All Pipes sizes shall be as per drawing.
2.	FRLS PVC insulated Copper conductor wires will be used for points, circuit & sub-main wiring. (Sizes shall be as per drawing/requirement)
3.	Contractor shall execute the work as per attached inventory after obtaining necessary approval of the layout for internal electrification of houses staircase from BMTPC. The staircase lighting shall be in group control system.
4.	All internal electrification work will be carried out as per CPWD Specifications, NBC, IE Rules, IS Codes etc. as amended up to the date of tender. In case for any part of the work specification is not available in the aforesaid mentioned documents then part of the work will be carried out in accordance with sound engineering practice and as per directions of BMTPC.
5.	Cover plates at all junction and Points, Ceiling rose for fan point. Modular type plates, switches, sockets and stepped type fan regulators, bell push along with matching mounting boxes of same make shall be used. Points to be provided in each unit shall not be less than 20 Points.
6.	a) DWELLING UNITS Modular Switches &Fixtures to be provided LED Tubelight fitting excluding tube - 1 in each room & 1 in Kitchen Ceiling fan – 1 in each room Provisions of Exhaust fan – 1in each kitchen & Toilet / bath Bracket light with normal fitting excluding lamp/bulb -1 in each room, kitchen, toilet / bath Call Bell Point - 1 on main door, Cable TV Point - 1 in each room Plug Point(5 amp.) - 1 in each room, 2 in kitchen, 1 in toilet, 1 in balcony Power Point(15 amp.6 pin) - 1 in each room, 1 in kitchen, 1 in toilet/ bath, 1 in balcony AC point with MCB - 1 in each room Geyser point – 1 in Kitchen and 1 in Toilet/ bath EDM/MCB (single phase) -1 for each Unit Bracket light / ceiling light with lighting fixture in common area and stair case. b) COMMUNITY CENTRE & SHOPS LED (twin) Tubelight fittings including tube - 6 in multipurpose hall LED (single) Tubelight fittings including tube - 10 in utility area, rooms & shops Ceiling fan – 13 in multipurpose hall, utility area, rooms & shops Provisions of Exhaust fan – 2 in kitchen & Toilets Bracket light with normal fitting including lamp/bulb -13 in utility area & rooms

	Ceiling light – 10 in multipurpose hall Cable TV Point in multipurpose hall Plug Point (5 amp.) - 13 multipurpose hall, utility area, rooms & shops Power Point (15 amp.6 pin) - 13 multipurpose hall, utility area, rooms & shops AC point with MCB – 6 multipurpose hall and office Geyser point – 1 in Kitchen EDM/MCB (single phase) -2 in shops EDM/MCB (three phase) -1 in multipurpose hall Telephone socket – 3 in multipurpose hall and office Switch board – 15 in multipurpose hall, utility area, rooms & shops Two way switch – 1 in stair case Kitchen & Dinning:- All points, fans, fittings as per approved plan NOTE:- All fitting and fixtures shall be provided as per drawing and requirement at site to made the building functional on approval of BMTPC -For Community centre, the number of electrical points, fixtures and fittings will be as per drawings approved by BMTPC.
7.	Suitable rain protection covers made of 16SWG galvanized MS sheet wherever required shall be provided.
8.	Bus Bar, Meter Boards & Main Distribution Boards with MCBs as per specification of Local Govt. shall also be provided by the contractor.

FIREFIGHTING SYSTEM (Dwelling units and community centre)	
1.	Fire extinguishers of required capacity, type and number on each floor as per the provisions of NBC-2016/ Fire Safety Norms
2.	Swinging type First Aid Hose Real with double door hose cabinet of required size having front glass and lockable facilities, hose pipe/s, fire man axe etc. complete in all respect as per the provisions of NBC-2016/ Fire Safety Norms.
3.	MS pipe of suitable size and grade with all fittings, valves etc. complete in all respect as per the provisions of NBC-2016/ Fire Safety Norms.
4.	Bucket stand with sand / fire bucket in required numbers as per the provisions of NBC-2016/ Fire Safety Norms.
5.	Two way fire brigade connection with gun metal male instantaneous inlet coupling with cap and chain including MS pipe upto fire tank complete in all respect.
6.	Electrical driven terrace pump of 900 LPM at 35 meter head mounted MS fabricated common base plate including electrical control panel complete all respect

Note:

1. Before installation of Panel system, the agency shall have to produce evidence of quality of material at site if asked for. The testing of materials will be carried out at the cost of selected agency of BMTPC.
2. Any Material or Component (it's ratio thereof.) not defined or missing, may be adopted by the Agency in consultation & approval of BMTPC.
3. The items of works / specifications described above are only indicative and not exhaustive. In additions to the above the agency shall be responsible for executing all the items required for completing the houses and other provisions in all respect to

make the dwelling units habitable and ready for occupation as per direction of Competent Authority.

2.0 SPECIFICATIONS FOR ONSITE INFRASTRUCTURE WORKS

ROADS

a) Internal Roads: The internal roads feeding the building will be of 100 mm thick RCC of not less than M25 grade over a base course of PCC not less than M 7.5 grade (100mm thick).

b) Peripheral Roads and pathways (as shown in drawing). "Providing and laying factory made chamfered edge Rubber Molded concrete colored paver blocks of required strength, thickness & size/shape, made by table vibratory method, to attain superior smooth finish using PU or equivalent moulds, laid in required mix of colour& pattern over 50mm thick compacted bed of coarse sand, compacting and proper embedding/ laying of inter locking paver blocks into the sand bedding layer through vibratory compaction by using plate vibrator, filling the joints with fine sand and cutting of paver blocks as per required size and pattern, finishing and sweeping extra sand in footpath, parks, lawns, drive ways or light traffic parking etc. all complete as per manufacturer's specifications & direction of Competent Authority: 60mm thick c.c. paver block of M-30 grade with approved colour design".

The peripheral road, pathways and internal roads should be as per the CPWD specifications.

c) Brick on edge flooring (As shown in drawings): Dry brick on edge flooring in required pattern with bricks of class designation 7.5 on a bed of 12 mm mud mortar, including filling joints with fine sand, with common burnt clay non modular bricks.

WATER SUPPLY

50 mm dia 6 kgf/cm2 CPVC including all required fitting etc. as required including connection with existing line.

SEWERAGE SYSTEM

160 mm dia. uPVC pipe and fittings as per IS:13592:2013 Type B including jointing with seal ring conforming to IS : 5382, leaving 10 mm gap for thermal expansion with required Manholes etc. to be provided.

SEPTIC TANK

Septic Tank with Soak Pit of required size will be constructed as per CPWD Specifications.

RAIN WATER HARVESTING TANK

Modular Rain Water Harvesting tank of required size will be constructed as per the CPWD specifications.

EXTERNAL ELECTRIFICATION WORK

- Electric Panel: As necessary for the layout feeder Pillar Floor mounting totally enclosed compartmentalized cubical, dust vermin proof and outdoor type with required Earthing plate and bus bar complete including connections etc.
- Providing and Laying require Electrical cable for providing electrical supply to units, as approved.
- Providing and fixing street solar Lights as required including fixture and SL, as per CPWD specifications. Making required connections to Building and flats.
- Providing and fixing solar light connection in stair case and common area.
- P/Laying XLPE insulated / P.V.C. sheathed cable of 1.1 KV grade with aluminum conductor Armored of IS:7098-I/1554-1 approved make in ground as per IS:1255 including excavation of30cmx75cm size trench, 25 cm thick under layer of sand, 2nd class bricks covering, refilling earth, compaction of earth, making necessary connection, testing etc. as required of size.

  a. 35.0 Sq.mm 3.5 core
  b. 6.0 Sq.mm 2 core
  c. 4.0 Sq.mm 2 Core

BOUNDARY WALL WITH GATES

The selected agency may like to use his proposed alternate technology for construction of boundary walls. Its height shall be minimum 2.1 mtr. high and 0.6 mtr. fencing with proper water proofing and drainage.

Or

Brick / Block Masonry with R.C.C intermittent columns having grill of approved pattern and coping of CC 1:2:4 (1 cement: 2 Coarse sand: 4 graded stone aggregate) on top of wall with pointing as per approved drawing. Height of boundary wall shall be minimum 2.1 mtr. height solid wall and 0.6 mtr fencing above solid wall to make area secured.

Part-4

Payment Schedule

1. PAYMENT – SCHEDULE

1.0 All running /intermediate & final payments shall be made to the agency in accordance with the following schedule:

2.0 The basis of payment on "Pro rate basis" shall be worked out on the percentage of work done out of total scope of work

S. No	Particular	Stage wise percentage	Cumulative percentage
A.	**For Building Works**		
1.	On completion of preparation of structural design/ architectural design, approval by the local authority and approval of vetted structural design	01	01
	On completion of the following:		
2.	Up to Plinth, complete in all respect with lean concrete of Ground floor including anti termite treatment of dwelling units as well as community centre	10	11
3.	Ground floor wall & slab panel casting including circulation & staircase area of dwelling unit and community centre.	10	21
4.	First Floor wall & roof panel casting (with fitting of Ground floor door & window frames) including circulation & staircase area with finishing of Ground Floor of dwelling unit and community centre.	12	33
5.	Second Floor wall & roof panel casting (with fitting of First floor door & window frames) including circulation & staircase area with finishing of First Floor of dwelling unit	12	45
6.	Third Floor wall & roof panel casting (with fitting of second floor door & window frames) including circulation & staircase area with finishing of Second Floor of dwelling unit.	12	57
7.	Construction of Mumty, parapet wall etc. ,Terrace floor (with fitting of third floor door & window frames) including circulation & staircase area with finishing of	12	69

	Third Floor of Ground Floor of dwelling unit and community centre.		
8.	Internal Electrification & fixtures, Internal water supply & fixtures, sanitary work and drainage from roof.	10	79
9.	Overhead tank, fixing of china ware and sanitary fittings and fire fighting system.	6	85
10.	External painting complete in all respect	5	90
11.	After site clearance, issuing of completion certificate and handing over	10	100
B.	For Onsite infrastructure work	Not exceeding four RA bills for the completed item/s as per actual measurements	

For and On Behalf of BMTPC

Accepted by me

Signature of Agency & Seal

Name:_____

Address:_____

Tel No. _____

Fax No. _____

Email_____

Part-5

Financial Bid

FINANCIAL BID

Name of Work: Construction of Demonstration Housing Project (G+3) for use as accommodation for Contractual Safai Karamchari and Community Centre on Design & Build basis using Emerging technology including on site Infrastructure Work at Guwahati, Assam.

ABSTRACT OF COST

S.No	Sub-Head	Amount (in Rs.)
A	**DWELLING UNITS & COMMUNITY CENTRE**	
1.	Total cost of construction of Building (Houses) including all associate facilities & services, fire-fighting, ramp, staircase and mumty complete in all respect as per scope of work with specifications and drawings mentioned in Bid document & including GST, Labour Cess and other Taxes.	
2.	Total cost of construction of Community Centre including all associate facilities & services, fire-fighting, ramp, staircase and mumty complete in all respect as per scope of work with specifications and drawings mentioned in Bid document & including GST, Labour Cess and other Taxes.	
	TOTAL "A" (1+2)	
B	**ON SITE INFRASTRUCTURE WORKS**	
1.	Earth Filling	
2.	Road and Pavement	
3.	Boundary Wall with Entrance Gate	
4.	External Water Supply and Sewerage	
5.	Drainage & Disposal	
6.	Septic Tank	
7.	Under ground Water Tank	
8.	Rain Water Harvesting	
9.	Plinth Protection	
10.	Horticulture	
11.	External Electrification Work	
12.	Tube well	
	TOTAL "B"	
	GRAND TOTAL("A + B")	
	In Words	

SCHEDULE OF QUANTITIES

A DWELLING UNITS AND COMMUNITY CENTRE

Sl. No.	Description of Work	Quantity	Unit	Rate in Rs.	Amount (in Rs.)
1.	Total cost of construction of Building (Houses) including all associate facilities & services, fire-fighting, ramp, staircase and mumty complete in all respect as per scope of work with specifications and drawings mentioned in Bid document & including GST, Labour Cess and other Taxes	1	L.S.		
2.	Total cost of construction of Community Centre including all associate facilities & services, fire-fighting, ramp, staircase and mumty complete in all respect as per scope of work with specifications and drawings mentioned in Bid document & including GST, Labour Cess and other Taxes	1	LS		
				TOTAL "A" (1+2)	

Note:

Nothing extra shall be paid over and above the quoted rate. The rate is inclusive of all costs for completing the dwelling units & other provisions. The contractor shall be responsible for Executing all items required for completing the dwelling units and other provisions in all respect to make the same habitable & ready for occupation.

B. ON SITE INFRASTRUCTURE WORKS (on Item Rate Basis)

S. No.	Particular of Item	Qty	Unit	Rate (Rs.)	Amount (Rs.)
	SUB-HEAD 1				
	EARTH FILLING				
1	Excavating, supplying and filling of local earth (including royalty) by mechanical transport upto a lead of 5km also including ramming and watering of the earth in layers not exceeding 20 cm in trenches, plinth, sides of foundation etc. complete.	648	Cum		
2	Extra for lead beyond 5 km (Rate Only)	1	Cum per km.		
3	Preparation and consolidation of sub grade with power road roller of 8 to 12 tonne capacity after excavating earth to an average of 22.5 cm depth, dressing to camber and consolidating with road roller including making good the undulations etc. and re-rolling the sub grade and disposal of surplus earth with lead upto 50 metres.	324.00	Sqm		
4	Extra for Dewatering work (Rate only)	1	Per Hour		
	TOTAL SUB-HEAD 1				
	SUB-HEAD 2				
	ROAD AND PAVEMENT				
5	Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth lead upto 50 m and lift upto 1.5 m, as directed by Competent authority				
	All kinds of soil	97.2	Cum		
6	Disposal of surplus excavated earth within a lead of 10 km beyond the initial lead of 50m as directed by Competent authority	97.2	Cum		

7	Providing and laying in position cement concrete of specified grade excluding the cost of centring and shuttering-all work upto plinth level.(100 mm thickness)				
	1:4:8 (1 Cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size).	32.4	Cum		
8	Providing and laying C.C. pavement of mix M-25 with ready mixed concrete from batching plant. The ready mixed concrete shall be laid and finished with screed board vibrator , vacuum dewatering process and finally finished by floating, brooming with wire brush etc. complete as per specifications and directions of Competent authority. (100 mm thickness). (Note:- Cement content considered in this item is @ 330 kg/cum. Excess/less cement used as per design mix is payable/ recoverable separately).	54	Cum		
9	Brick work with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 in foundation and plinth in: Cement mortar 1:6 (1 cement : 6 coarse sand)	13.98	Cum		
10	Brick edging in full brick width and half brick depth including excavation, refilling and disposal of surplus earth lead upto 50 metres.				
	With common burnt clay F.P.S. (non modular) bricks of class designation 7.5 (both sides)	100	mtr		
	Interlocking Paver				
11	Providing and laying 60mm thick factory made cement concrete interlocking paver block of M -30 grade made by block making machine with strong vibratory compaction, of approved size, design & shape, laid in required colour and pattern over and including 50mm thick compacted bed of coarse sand, filling the joints with line sand etc. all complete as per the direction of BMTPC or Site Engineer.	540	Sqm		
	TOTAL SUB-HEAD 2				

	SUB-HEAD 3				
	BOUNDARY WALL WITH ENTRANCE GATE				
12	Earth work in excavation by mechanical means (Hydraulic excavator) / manual means in foundation trenches or drains (not exceeding 1.5 m in width or 10 sqm on plan), including dressing of sides and ramming of bottoms, lift upto 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50 m.				
	All kinds of soil.	99.00	Cum		
13	Providing and laying in position cement concrete of specified grade excluding the cost of centring and shuttering-all work upto plinth level.(100 mm thickness)				
	1:4:8 (1 Cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size).	15.40	Cum		
14	Boring with hydraulic piling rigs with power units, providing and installing cast in situ single under reamed piles of specified diameter and length below pile cap in M-25 cement concrete, to carry a safe working load not less than specified, excluding the cost of steel reinforcement but including the cost of boring with bentonite solution and the length of the pile to be embedded in pile cap etc. all complete. (Length of pile for payment shall be measured upto to the bottom of pile cap)				
	300 mm dia piles	240.00	metre		
15	Providing and laying in position specified grade of reinforced cement concrete, excluding the cost of centering, shuttering, finishing and reinforcement - All work up to plinth level 1:1.5:3 (1 cement : 1.5 coarse sand (zone-III): 3 graded stone aggregate 20 mm nominal size)	19.80	Cum		

16	Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. above plinth level up to floor five level, excluding cost of centering, shuttering, finishing and reinforcement				
	1:1.5:3 (1 cement : 1.5 coarse sand : 3 graded stone aggregate 20 mm nominal size).	4.44	Cum		
17	Centering and shuttering including strutting, propping etc. and removal of form for :				
a	Foundation, base of walls, columns etc	60.00	Sqm		
b	Columns, Pillars, Piers, Abutments, Posts and Struts	96.60	Sqm		
c	Lintels, beams, plinth beams, girders, bressumers and cantilevers	431.20	Sqm		
18	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level & above				
	Thermo-Mechanically Treated bars of grade Fe-500D or more (@125cum)	4723.25	Kg		
19	12 mm cement plaster of mix :				
	1:6 (1 cement: 6 coarse sand)	512.60	Sqm		
20	Finishing walls with water proofing cement paint of required shade :				
	New work (Two or more coats applied @ 3.84 kg/10 sqm)	512.60	Sqm		
21	Structural steel work riveted, bolted or welded in built up sections, trusses and framed work, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete.				
	Entrance Gate	800.00	Kg		

22	Fencing with angle iron post placed at required distance embedded in cement concrete blocks, every 15th post, last but one end post and corner post shall be strutted on both sides and end post on one side only and provided with horizontal lines and two diagonals interwoven with horizontal wires, of barbed wire weighing 9.38 kg per 100 m (minimum), between the two posts fitted and fixed with G.I. staples, turn buckles etc. complete. (Cost of posts, struts, earth work and concrete work to be paid for separately). Payment to be made per metre cost of total length of barbed wire used.				
	With G.I. barbed wire	1200.00	mtr		
23	Supplying at site Angle iron post & strut of required size including bottom to be split and bent at right angle in opposite direction for 10 cm length and drilling holes upto 10 mm dia. etc. complete	250.00	kg		
24	Painting with synthetic enamel paint of approved brand and manufacture of required colour to give an even shade :				
	Two or more coats on new work over an under coat of ordinary paint	220.00	Sqm		
	TOTAL SUB-HEAD 3				
	SUB-HEAD 4				
	EXTERNAL WATER SUPPLY AND SEWERAGE				
25	Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes, having thermal stability for hot & cold water supply including all CPVC plain & brass threaded fittings This includes jointing of pipes & fittings with one step CPVC solvent cement, trenching, refilling & testing of joints complete as per direction of Engineer of BMTPC.				
a	50 mm nominal outer dia pipes	160	Metre		
b	32 mm nominal outer dia pipes	80	Metre		
26	Providing and fixing brass ferrule with C.I. mouth cover including boring and				

	tapping the main :				
	20 mm nominal bore	10	Each		
27	Providing and fixing gun metal gate valve with C.I. wheel of approved quality (screwed end) :				
	50 mm nominal bore.	6	Each		
	SEWERAGE				
28	Earth work in excavation by mechanical means (Hydraulic excavator) / manual means in foundation trenches or drains (not exceeding 1.5 m in width or 10 sqm on plan), including dressing of sides and ramming of bottoms, lift upto 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50 m.				
	Depth upto 1.5 m	40.84	Cum		
29	Providing and fixing square-mouth S.W. gully trap class SP-1 complete with C.I. grating brick masonry chamber with water tight C.I. cover with frame of 300 x300 mm size (inside) the weight of cover to be not less than 4.50 kg and frame to be not less than 2.70 kg as per standard design				
	100x100 mm size P type				
	With common burnt clay F.P.S. (non modular) bricks of class designation 7.5	18	Each		

30	Constructing brick masonry manhole in cement mortar 1:4 (1 cement : 4 coarse sand) with R.C.C. top slab with 1:1.5:3 mix (1 cement : 1.5 coarse sand (zone- III) : 3 graded stone aggregate 20 mm nominal size), foundation concrete 1:4:8 mix (1 cement : 4 coarse sand (zone- III) : 8 graded stone aggregate 40 mm nominal size), inside plastering 12 mm thick with cement mortar 1:3 (1 cement : 3 coarse sand) finished with floating coat of neat cement and making channels in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) finished with a floating coat of neat cement complete as per standard design :				
	Inside size 90x80 cm and 45 cm deep including C.I. cover with frame (light duty) 455x610 mm internal dimensions, total weight of cover and frame to be not less than 38 kg (weight of cover 23 kg and weight of frame 15 kg) :				
	With common burnt clay F.P.S. (non modular) bricks of class designation 7.5	12	Each		
31	Extra for depth for manholes :				
	Size 90x80 cm				
	With common burnt clay F.P.S. (non modular) bricks of class designation 7.5	10	Metre		
32	Providing and Fixing uPVC Soil / vent / waste SWR pipe of required diameter conforming to IS - 13592:2013 Type B including necessary fittings with seal ring confirming to IS 5382, leaving 10mm gape for thermal expansion including necessary excavation, laying, filling, testing etc. complete.				
a	110 mm dia	80	Metre		
b	150 mm dia	190	Metre		

33	Providing and laying cement concrete 1:5:10 (1 cement : 5 coarse sand : 10 graded stone aggregate 40 mm nominal size) all-round S.W. / RCC/ uPVC pipes including bed concrete as per standard design				
a	110 mm diameter	30	Metre		
b	150 mm diameter	190	Metre		
34	Making connection of drain or sewer line with existing manhole including breaking into and making good the walls, floors with cement concrete 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) cement plastered on both sides with cement mortar 1:3 (1 cement : 3 coarse sand), finished with a floating coat of neat cement and making necessary channels for the drain etc. complete :				
	For pipes 100 to 250 mm diameter	2	Each		
	TOTAL SUB-HEAD 4				
	SUB-HEAD 4				
	DRAINAGE AND DISPOSAL				
35	Earth work in excavation by mechanical means (Hydraulic excavator) / manual means in foundation trenches or drains (not exceeding 1.5 m in width or 10 sqm on plan), including dressing of sides and ramming of bottoms, lift upto 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50 m. All kinds of soil.				
	In all kinds of soil.				
	Depth upto 1.5 m	97.2	Cum		
36	12 mm cement plaster finished with a floating coat of neat cement of mix :				
	1:4 (1 cement: 4 fine sand)	352.8	Sqm		
37	Brick work with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 in foundation and plinth in:				
	Cement mortar 1:6 (1 cement : 6	18.63	Cum		

	coarse sand)				
38	Providing and Fixing uPVC Soil / vent / waste SWR pipe of required diameter conforming to IS - 13592:2013 Type B including necessary fittings with seal ring confirming to IS 5382, leaving 10mm gape for thermal expansion including necessary excavation, laying, filling, testing etc. complete.				
a	110 mm dia	110	Metre		
b	150 mm dia	50	Metre		
39	Providing and fixing factory made precast RCC perforated drain covers, having concrete of strength not less than M-25, of size 1000 x 450x50 mm, reinforced with 8 mm dia four nos longitudinal & 9 nos cross sectional T.M.T. hoop bars, including providing 50 mm dia perforations @ 100 to 125 mm c/c, including providing edge binding with M.S. flats of size 50 mm x 1.6 mm complete, all as per direction of Engineer-in-charge.	180	Each		
	TOTAL SUB-HEAD 5				
	SUB-HEAD 6				
	SEPTIC TANK				
40	Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10sqm on plan) including getting out and disposal of excavated earth lead upto 50 m and lift upto 1.5 m, as directed by Engineer-in-charge. All kinds of soil				
	Depth upto 1.5 m	30.19	cum		
41	Extra for additional depth of 1.5 m or part thereof in: All kind of soil	20.13	cum		
42	Providing and laying in position cement concrete of specified grade excluding the cost of centring and shuttering-all work upto plinth level.				
	1:4:8 (1 Cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size).	3.02	cum		

43	Brick work with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 in foundation and plinth in:				
	Cement mortar 1:6 (1 cement : 6 coarse sand)	8.87	cum		
44	Providing and laying in position cement concrete of specified grade excluding the cost of centring and shuttering - All work upto plinth level :				
	1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size21)	1.78	Cum		
45	Providing and laying in position specified grade of reinforced cement concrete, excluding the cost of centering, shuttering, finishing and reinforcement - All work up to plinth level :				
	1:1.5:3 (1 cement : 1.5 coarse sand : 3 graded stone aggregate 20 mm nominal size).	2.27	Cum		
46	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level & above				
	Thermo-Mechanically Treated bars of grade Fe-500D or more	506.26	Kg		
47	Centering and shuttering including strutting, propping etc. and removal of form for :				
	Suspended floors, roofs, landings, balconies and access platform	11.88	Sqm		
48	Half brick masonry with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 in foundations and plinth in :				
	cement mortar 1:4 (1 cement : 4 coarse sand) sqm	2.50	sqm		
49	12 mm cement plaster finished with a floating coat of neat cement of mix :				
	1:4 (1 cement: 4 fine sand)	36.25	sqm		

50	Steel work welded in built up sections/ framed work, including cutting hoisting, fixing in position and applying a priming coat of approved steel primer using structural steel etc. as required.				
	In gratings, frames, guard bar, ladder, railings, brackets, gates and similar works	60.00	Kg		
51	Making soak pit. 2.5 m dia 3 m deep with 45x45 cm dry brick honey comb shaft and S.W. drain pipe 100 mm diameter, 1.8 m long complete filled with laterite stone aggregate125to180 mm surrounded by laterite stone aggregate of 40 mm and down gauge as per standard design.	1.00	no.		
	TOTAL SUB-HEAD 6				
	SUB-HEAD 7				
	UNDER GROUND WATER TANK				
52	Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth lead upto 50 m and lift upto 1.5 m, as directed by Engineer-in-charge. Depth upto 1.5 m				
	All kinds of soil				
	Depth upto 1.5 m	30	Cum		
53	Providing and laying in position cement concrete of specified grade excluding the cost of centring and shuttering - All work upto plinth level :				
a	1:4:8 (1 Cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size).	2.25	Cum		
b	1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size21)	1.8	Cum		
54	Providing and laying in position specified grade of reinforced cement concrete, excluding the cost of centering, shuttering, finishing and reinforcement - All work up to plinth level :				

	1:1.5:3 (1 cement : 1.5 coarse sand : 3 graded stone aggregate 20 mm nominal size).	8.79	Cum		
55	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level.				
	Thermo-Mechanically Treated bars of grade Fe-500D or more(@125/cum	1323.75	Kg		
56	Centering and shuttering including strutting, propping etc. and removal of form for :				
a	Foundation, base of walls, columns etc	3.12	Sqm		
b	Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	19.98	Sqm		
c	Suspended floors, roofs, landings, balconies and access platform	9.36	Sqm		
57	12 mm cement plaster of mix :				
	1:6 (1 cement: 6 fine sand)	19.5	Sqm		
58	12 mm cement plaster finished with a floating coat of neat cement of mix :				
	1:4 (1 cement: 4 fine sand)	21	Sqm		
59	Steel work welded in built up sections/ framed work, including cutting hoisting, fixing in position and applying a priming coat of approved steel primer using structural steel etc. as required.				
	In gratings, frames, guard bar, ladder, railings, brackets, gates and similar works	60	Kg		
60	Supply & Installation of Mono Block Pump with starter of approved brand complete (2HP)	2	nos.		
	TOTAL SUB HEAD-7				
	SUB-HEAD 8				
	RAIN WATER HARVESTING				

61	Boring/drilling bore well of required dia for casing/ strainer pipe, by suitable method prescribed in IS: 2800 (part I), including collecting samples from different strata, preparing and submitting strata chart/ bore log, including hire & running charges of all equipments, tools, plants & machineries required for the job, all complete as per direction of Engineer - in-charge, upto 90 metre depth below ground level.				
	In all type of soil				
	300 mm dia	40	Metre		
62	Supplying, assembling, lowering and fixing in vertical position in bore well unplasticized PVC medium well screen (RMS) pipes with ribs, conforming to IS: 12818, including hire & labour charges, fittings & accessories etc. all complete, for all depths, as per direction of BMTPC or Site Engineer.				
	150 mm nominal size dia	39	Metre		
63	Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth lead upto 50 m and lift upto 1.5 m, as directed by BMTPC or Site Engineer. All kinds of soil				
	Pit size 2.7 x 2.0 x 1.8 m	13.8	cum		
64	Brick masonry in foundation with brick of class des.75 in CM 1:6				
	Size 2.7 x 2.0 x 1.8 m	3.48	cum		
65	20 mm cement plaster of mix :				
	1:6 (1 cement: 6 fine sand)	15.12	Sqm		
66	Gravel packing in tubewell construction in accordance with IS: 4097, including providing gravel fine/ medium/ coarse, in required grading & sizes as per actual requirement, all complete as per direction of BMTPC or Site Engineer.				

	Boring	7.5	Cum		
67	Supplying, filling, spreading & levelling stone boulders of size range 5 cm to 20 cm, in recharge pit, in the required thickness, for all leads & lifts, all complete as per direction of BMTPC or Site Engineer.	4.14	Cum		
68	Providing and laying in position cement concrete of specified grade excluding the cost of centring and shuttering-all work upto plinth level.				
	1:4:8 (1 Cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size).	0.96	Cum		
69	Providing and laying in position specified grade of reinforced cement concrete, excluding the cost of centering, shuttering, finishing and reinforcement - All work up to plinth level :				
	1:1.5:3 (1 cement : 1.5 coarse sand : 3 graded stone aggregate 20 mm nominal size).	0.81	Cum		
70	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level.				
	Thermo-Mechanically Treated bars of grade Fe-500D or more(@120)	150	Kg		
71	Centering and shuttering including strutting, propping etc. and removal of form for :				
	Suspended floors, roofs, landings, balconies and access platform	5.4	Sqm		
72	Providing and fixing factory made precast RCC perforated drain covers, having concrete of strength not less than M-25, of size 1000 x 450x50 mm, reinforced with 8 mm dia four nos longitudinal & 9 nos cross sectional T.M.T. hoop bars, including providing 50 mm dia perforations @ 100 to 125 mm c/c, including providing edge binding with M.S. flats of size 50 mm x 1.6 mm complete, all as per direction of Engineer-in-charge.	2	Each		

	TOTAL SUB-HEAD 8				
	SUB-HEAD 9				
	PLINTH PROTECTION				
73	Making plinth protection 50 mm thick of cement concrete 1:3:6 (1 cement :3 coarse sand : 6 graded stone aggregate 20 mm nominal size) over 75 mm thick bed of dry brick ballast 40 mm nominal size, well rammed and consolidated and grouted with fine sand, including finishing the top smooth.	187.2	Sqm		
74	Brick edging 7cm wide 11.4 cm deep to plinth protection with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 including grouting with cement mortar 1:4 (1 cement : 4 fine sand).	208	Metre		
	TOTAL SUB-HEAD 9				
	SUB-HEAD 10				
	HORTILCULTURE				
75	Supplying and stacking at site dump manure from approved source including all lead and lifts (manure measured in stacks will be reduced by 8% for payment) - screened through sieve of IS designation 20 mm.	30	Cum		
76	Supplying & stacking sludge at site including royalty & carriage will all leads & lifts (sludge manure measured in stacks will be reduced by 8 % for payment)	30	Cum		
77	Spreading of sludge / damp manure of / and good earth in required thickness (cost of sludge/ damp manure or / land good earth to paid separately)	25	Cum		
78	Grassing with selection No. 1 grass including watering and maintenance of the lawn for 60 days or more till the grass forms a thick lawn, free from weeds and fit for mowing including supplying good earth.				
	In rows 5 cm apart in both directions	220	Sqm		

79	Supplying and stacking of good earth at site including royalty and carriage upto 5 km complete (earth measured in stacks will be reduced by 20% for payment).	88	Cum		
80	Supplying & Stacking of Selection No.1 doob grass at site fresh & free from weeds having proper roots in green including loading, unloading, carriage and all taxes paid etc.and as per direction of officer in charge.	220	Sqm		
81	Supply and Planting of Croton Golden plant, having ht. 45 cm to 60 cm with 2 to 3 branches, well developed, fresh and healthy foliage in 25 cm size of Earthen pot / Plastic pot as per direction of the officer-in-charge. (As per local conditions suitability)				
	Plants	60	Each		
	TOTAL SUB-HEAD 10				
	SUB-HEAD 11				
	EXTERNAL ELECTRIFICATION				
82	P/Laying XLPE insulated / P.V.C. sheathed cable of 1.1 KV grade with aluminium conductor Armoured of IS:7098-I/1554-1 approved make in ground as per IS:1255 including excavation of 30cmx75cm size trench, 25 cm thick under layer of sand, 2nd class bricks covering, refilling earth, compaction of earth, making necessary connection, testing etc. as required of size.				
a	35.0 Sq.mm	90	Metre		
	3.5 core				
b	6.0 Sq.mm	300	Metre		
	2 core				
83	Supplying and making one end termination with heavy duty single compression brass gland SIBG type, aluminium lugs duly crimped with crimping tool, PVC tape etc for following size of Armoured PVC insulated & PVC sheathed/ XLPE aluminium conductor cable of 1.1 KV grade as required of size.				

	3.5 x 35.0 sq.mm	6	Set		
	2 x 6.0 sq.mm	30	Set		
	Feeder Pillar				
84	Supply and fixing of floor mounting, totally enclosed, compartmentalized, cubical, dust, vermin proof and outdoor type. Feeder pillar fabricated out of 2 mm thick cold rolled carbon annealed, sheet steel, internally strengthened with angle iron frame work with following incoming and outgoing feeders (fabricated out of 2 mm CRCA Sheet steel) including making connection / inter-connections with lugs / glands crimping tools, testing and commissioning of following items inside the panel:				
	Incommer				
	1 No. 200 Amp. 4 poles MCCB (25 Ka) with ON/OFF indications metre				
	Indication				
	Three (3) Nos. phase indicating (R.Y and B) lamps with protection 2A SP MCB's for protection having lens and lamp.				
	Outgoing				
	One (1) NO. 160 Amp. 4 pole MCCb (16 KA) with ON/OFF indications in the in front 15 nos. 32 A D.P. MCB (10 KA)				
	Control				
	4 Pole Contractor with a thermal rating of 32 - 1 no.				
	Time Switch with Daily dial, suitable for operation on 230 Volt, Single phase, 50 Hz, AC supply - 1 No.				
	Auto - Manual Selector switch - 1 No.				
	On / Off Push Buttons - 4 Nos.	3	Set		

85	Plate Earthing as per IS:3043 with copper Earth plate of size 600mm x 600mm x 3.0mm by embodying 3 to 4 mtr. below the ground level with 20 mm dia. G.I. 'B' class watering Pipe including all accessories like nut, bolts, reducer, nipple ,wire meshed funnel, and C.C. finished chamber covered with hinged type with locking arrangement C.I. Cover, C.I. Frame of size300mm x 300mm complete with alternate layers of salt and coke/charcoal, testing of earth resistance as required.	3	Set		
86	Supply, installation and commissioning of SPV Solar Street Light (white LED Based) System as per specifications including supplying of 75 mm dia (nominal) (Medium class), 5.5 metre length (including accessories) complete with base plate and nipple including two coats of black bituminous paint upto 1 mtr. From bottom and two coats of aluminium paint above ground level etc. complete as required. Detail of pole: Planting depth - 1 Mtr and Height above ground level - 4.5 Mtr. over concrete pedestal, 15 Watt LED light Phillips/ Bajaj/ Crompton or Suitable Equivalent.	25	Nos		
87	Supply, installation and commissioning of Solar Panel with 500 Watt for 48 number lighting points in common areas (corridor & Staircase) at suitable locations including LED bulbs with 10 Watt	3	Job		
88	Earth work in excavation in foundation, trenches etc. including dressing of sides and ramming of bottoms, including getting out the excavated material, refilling after laying pipe/ foundation and disposal of surplus excavated material at a lead upto 50m suitable site as per direction of Engineer for following depths below natural ground / Road top level.				

	In all types soils/ saturated soil such as moorum, sand, sandy silt, clay, black cotton soil, kankar, etc.				
	Depth upto 1.5 m	2.25	Nos		
89	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work upto plinth level :				
	1:2:4 (1 Cement : 2 coarse sand : 4 graded stone aggregate 40 mm nominal size).	0.65	Cum		
90	Centering and shuttering including strutting, propping etc. and removal of form for : Foundation etc.	4.32	Sqm		
91	Supplying, installing on wall, testing and commissioning of following capacity made of 1.6 mm thick sheet steel enclosure duly painted with powder coating, wall straps bus bar 100 amp. of size 400 x 300 mm	6	Nos		
	TOTAL SUB-HEAD 11				
	SUB-HEAD 12				
	TUBE WELL				
92	Boring/drilling bore well of required dia for casing/ strainer pipe, by suitable method prescribed in IS: 2800 (part I), including collecting samples from different strata, preparing and submitting strata chart/ bore log, including hire & running charges of all equipments, tools, plants & machineries required for the job, all complete as per direction of Engineer-in-charge, upto 90 metre depth below ground level				
	All types of soil				
	300 mm dia	350	mtr		

93	Supplying, assembling, lowering and fixing in vertical position in bore well, unplasticized PVC medium well casing (CM) pipe of required dia, conforming to IS: 12818, including required hire and labour charges, fittings & accessories etc. all complete, for all depths, as per direction of Engineer - in-charge.				
	150 mm nominal size dia	355	mtr		
94	Supplying, filling, spreading & leveling coarse sand of size range 1.5 mm to 2 mm in recharge pit, in required thickness over gravel layer, for all leads & lifts, all complete as per direction of Engineer -incharge.	40	cum		
95	Development of tube well in accordance with IS : 2800 (part I) and IS:11189, to establish maximum rate of usable water yield without sand content (beyond permissible limit), with required capacity air compressor, running the compressor for required time till well is fully developed, measuring yield of well by "V" notch method or any other approved method, measuring static level & draw down etc. by step draw down method, collecting water samples & getting tested in approved laboratory, i/c disinfection of tubewell, all complete, including hire & labour charges of air compressor, tools & accessories etc., all as per requirement and direction of Engineer-in-charge.	100	hour		
96	Providing and fixing suitable size threaded mild steel cap or spot welded plate to the top of bore well housing/ casing pipe, removable as per requirement, all complete for borewell of:				
	150 mm dia	1	no.		
97	Providing and fixing M.S. clamp of required dia to the top of casing/housing pipe of tubewell as per IS: 2800 (part I), including necessary bolts & nuts of required size complete.				

	150 mm dia	1	no.		
98	Providing and fixing Bail plug/ Bottom plug of required dia to the bottom of pipe assembly of tubewell as per IS:2800 (part I).				
	150 mm dia	1	no.		
99	Providing and fixing G.I. pipes complete with G.I. fittings including trenching and refilling etc.	260	mtr		
100	Submersible Pump-5HP	2	no.		
101	Starter	2	no.		
102	Electrical Flat Cable	300	mtr		
	TOTAL SUB-HEAD 12				
	TOTAL OF SUB HEAD 1 TO 12 (COST OF ONSITE INFRASTRUCTURE WORK) (B)				
	GRAND TOTAL OF DWELLING UNITS & COMMUNITY CENTRE AND ONSITE INFRASTRUCTURE WORK (A+B)				
	GRAND TOTAL IN WORDS				

Note:
All Bidders are required to quote the rates in financial bid for both the works mentioned at A & B i.e. Dwelling Units & Community Centre and on site Infrastructure works respectively. L1 will be decided after getting the rates for both the works, otherwise, bids will be considered as no-responsive and will be rejected without assigning any reason/s.

Part-6

Soil Investigation Report

REPORT
ON
GEO-TECHNICAL INVESTIGATION
FOR

THE CONSTRUCTION OF PROPOSED JNNURM PROJECT AT FATASHIL AMBARI, GUWAHATI.

NAME OF CLIENT: Chief Engineer, GMC, Guwahati

Tested and Report prepared by

DR (MRS.) Binu Sarma, Prof.

B. Sarma 28/4/2010

MR BHASKARJYOTI DAS, Sr.Lecturer

19.2.21
Executive Engineer
Guwahati Municipal Corporation

CONSULTANCY SERVICES
CENTRE FOR ASSAM ENGINEERING COLLEGE CONSULTANCY
(CAEC-CON)
Jalukbari, Guwahati-781013.

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Government of Assam
Assam Engineering College
CIVIL ENGINEERING DEPARTMENT
Jalukbari, Guwahati-781013, Assam

Ref. No.

Date: 28/ 04/2010

To,

The Chief Engineer, GMC, Guwahati

Sub: Submission of Geo-technical investigation report.

Dated: 28th April, 2010.

Dear Sir,

We are pleased to submit the Report of Geo-technical investigation for the proposed JNNURM Project at Fatashil Ambari, Guwahati.

Thanking You,

With regards,

DR (MRS.) Binu Sarma, Professor

B. Sharma. 28/4/2010

MR BHASKARJYOTI DAS, Sr. Lecturer

Countersigned By,

Prof. N. N. Patwari
H.O.D., Civil Engg. Deptt.
A.E.C., Guwahati-781013.

CERTIFICATE

This is to certify that the Geo-technical investigation for the proposed JNNURM Project at Fatashil Ambari, Guwahati is done on behalf of the CENTRE FOR ASSAM ENGINEERING COLLEGE CONSULTANCY (CIVIL ENGINEERING)[CAEC-CON (CE)], Guwahati-781013.

Date: 28/4/10

Prof. N. N. Patwari
H.O.D., Civil Engg. Deptt.
A.E.C., Guwahati-781013

CONTENTS

1. INTRODUCTION

A carefully planned detailed subsoil investigation was carried out on behalf of Chief Engineer, GMC, Guwahati for the proposed JNNURM Project at Fatashil Ambari, Guwahati. The subsoil investigation consisted of drilling of exploratory borehole at eight locations including conducting Standard penetration test as well as collecting soil samples for various laboratory tests.

2. OBJECTIVE

The prime objective of this geo-technical investigation was to explore the suitability of the subsoil involved for the proposed engineering work and to recommend the most suitable type of foundation for preparing adequate and economical design. Effort was made to obtain necessary information about the subsoil profile such as stratification, hydrological conditions, strength and settlement characteristics of the site and to know the engineering properties of the soil up to a depth that is likely to get affected by the proposed structure load.

A composite program comprising of both field and laboratory test for interpretation of results were done according to the relevant I.S. code of practices.

3. FIELD INVESTIGATION

Field investigation consisting of 150mm diameter wash boring in six locations up to the maximum depth of 15.0m from the existing ground surface level was started on 09.03.2010 and was completed on 27.03.2010.Two additional bore holes were made upto a depth of 23.0 meter. Borehole layout is shown schematically in Appendix - IV. During boring, changes in soil stratification were identified by the feel and color of the wash. Color, odor etc. were visually identified during the process of boring. Soil stratification is represented pictorially in the borehole logs enclosed Appendix-I. Standard penetration tests were conducted at each 1.50m interval or where significant variations in soil strata were observed by using standard split-spoon sampler as per IS: 2131-1981.Whenever significant change in soil stratum were encountered disturbed representative soil samples were collected and were sent to laboratory for determination of physical properties of soil, such as, grain size distribution, specific gravity, etc. Similarly, undisturbed thin walled sampling was also done in all significant soil strata or at an interval of 1.5m, which ever was earlier as per IS: 2132-1972.The undisturbed samples were collected in metallic tubes as per IS:1932-1963 specifications and these samples were

appropriately labeled and preserved by waxing at either end and were transported to the laboratory for determination of shear properties ,moisture content, in-situ density etc. The disturbed samples were collected from auger heads or from returning wash water and split spoon sampler. It is then packed in polythene bags after marking in the packets the depth, borehole no. etc. Ground water table in borehole locations were recorded after 24 hours of boring or when stability in ground water table was achieved, whichever was later.

3.1 LABORATORY INVESTIGATION

Selected soil samples were analyzed in the laboratory. The main objectives of laboratory analyses were to identify the physical properties and shear properties of subsoil involved. Accordingly, for determination of physical properties of soil following tests was carried out-

a) Grain size distribution analysis ,

b) In-situ moisture content determination,(w)

c) In-situ bulk density determination, (γ)

d) Determination of specific gravity of soil solids,(G)

e) Determination of Atterberg's Limits-

(i) Liquid limit, and (ii) Plastic limit.

In order to determine the shear properties of soil depending upon the soil drainage and loading conditions, following tests were performed-

a) Unconfined compression test,(UC)

b) Direct shear test (DS).

4. RESULTS

Results of physical properties, shear properties , grain size distribution analysis, and consolidation properties with curves are shown in TABLE-6, TABLE-7 ,Appendix –II, Appendix –III respectively.

ANALYSIS AND DISCUSSION

B.H.1

Depth Of Exploration:15.0 M

In B.H.1 boring was done from 0.3m below the ground surface. Ground water table was encountered at a depth of 2.20m below the ground surface. Filled up soil existed upto 2.80m. Within this depth construction materials like bricks built in cement mortar were encountered which indicates that previous construction with shallow foundation existed at the site. Moreover loose organic material and plastic packets were also found within this depth implying it to be a dumping ground of solid waste material. Hence at 1.5m depth S.P.T. was not done. From 2.8m to 3.8m grey and brown (mixed) coloured clayey soil was found in a soft state of consistency having a corrected N- value of 5. No organic material was encountered. From 3.8m to 7.3m red coloured clay soil with patches of grey clay in between was obtained. The average corrected N- value is (13+7)/2= 10. Undrained shear strength (C_u) value came out to be $4t/m^2$ at 4.0m and 5.0m depth. From 7.3m to 10.3m a change of strata occurs. Brown coloured clayey sand was encountered at this depth. At 7.5m, N- value came out to be 2 indicating a very loose pocket of soil at this depth. From 10.3m upto the explored depth of 15.0m good dense sand exists of high N- value.

Determination of allowable bearing capacity of shallow foundation at 4.5 depth:
Shallow foundation cannot be considered, at a depth less than 4.5m, due to filled up soil upto 2.8m followed by a soft clay layer of 1.0m thickness of corrected N- value 5. So depth of shallow foundation is considered at 4.5m.

Again width of footing greater than 1.5m cannot be considered at the site. For width greater than 1.5m, the seat of settlement will extend into the loose soil pocket at 7.5m depth. Moreover possibility of punching shear failure into the loose soil pocket is also there.

So, a calculation of allowable bearing capacity at 4.5m depth is shown for 1.5m width footing only:

GOVT. OF ASSAM

OFFICE OF THE MISSION DIRECTOR: PMAY-HFA (U) ASSAM

DISPUR:: GUWAHATI-6

Tell No : 0361- 2235166
Website www.pmayassam.in
E-Mail : pmayhfauassam@gmail.com

No. PMAY-U 51 fuel/2017/348

Dated, Dispur the 14th December, 2020

To,

M S Kiran Service Station
Last Gate, Guwahati-6

Sub: Request for POL supply for vehicle of PMAY-Urban and DAY-NULM, Assam

Dear Sir,

With reference to the subject cited above I would like to inform you that Mission Directorate. Pradhan Mantri Awas Yojana (Urban) Assam and DAY-NULM, Assam would like to empanel your fuel station for supply of POL as per the existing rates for vehicles of Mission Directorate.

The payment of the POL will be made on monthly basis after receiving the invoice and copy of fuel slips. Bills may be submitted on the 2nd working day of the following month and the payment will be made on last working day of the First Week.

You are requested to issue two separate copies of fuel slips. One set for DAY-NULM and another for PMAY-Urban.

Yours faithfully

Mission Director
PMAY-HFA(U), Assam

(Suvasish Das, IFS)
Mission Director,
PMAY-HFA-(Urban), Assam
Dated, Dispur the 14th December 2020

Memo No. PMAY-U 51 fuel 2017 348
Copy To:
Office Copy.

(Suvasish Das, IFS)
Mission Director,
PMAY-HFA-(Urban), Assam

Shear Criteria:-

According to IS 6403- 1981

$$q_{ns} = \frac{1}{F}[C_c N_c S_c d_c i_c]$$

$C_c = 4\ t/m^2$, $\phi_u = 0$

$S_c = 1.3$

$N_c = 5.14$

$$d_c = 1+0.2\frac{D_f}{B}\tan(45^\circ + \frac{\phi}{2})$$

$$= 1+0.2\times\frac{4.5}{1.5} = 1.6$$

$$\therefore q_{ns} = \frac{1}{3}[4\times 5.14\times 1.3\times 1.6] = 14.25 t/m^2$$

∴Net safe bearing capacity is 14.25 t/m^2 from shear criteria.

Settlement Criteria:-

The soil tested has been found to be a normally consolidated soil. So, the following expression is used to calculated settlement.

$$S_c = \frac{C_c}{1+e_0}\times H \times \log\frac{P_0 + \Delta P}{P_0}$$

$C_c = 0.14$

$e_0 = 0.724$

$H = 2.5m$

$P_0 = 2.5\times 1.5+1\times 0.6+1\times 0.86+1.125\times 0.8 = 6.11\ t/m^2$

Assuming net safe bearing capacity to act at the base of the footing.

$$\Delta P = \frac{14.25\times 1.5\times 1.5}{(1.5+1.25)^2} = 4.24\ t/m^2$$

$\therefore S_c = 43$ mm

Corrections for 3 dimensional consolidation settlement = $S_c\times\lambda$

$= S_c\times 0.8$

$= 43\times 0.8$

= 34.4 mm (within safe limit)

Hence Shear Criteria governs the design.

∴ Allowable bearing capacity of 1.5m width footing at 4.5m depth is 14.25 t/m^2

Placing depth of shallow foundation at 4.5m is not recommended at the site since G.W.L. is at a depth of around 2.2m below the ground level. Excavation for the shallow foundation will lead to reveling and sloughing of the sides due to the filled up soil and presence of soft clay soil. Moreover suitable lateral side support would be needed.

It is observed that from 10.0 m, sand exists of medium dense state. Hence bored cast in situ pile at 11.0 m depth is recommended. Calculation of load carrying capacity of single piles at 11.0 m and 13.0 m depth are done.

Calculation of pile load:-

Single pile at 11.0 m depth of 30cm diameter:

At 11.0 m depth corresponding to an average N- value of 18, Φ value is 32^0. Taking account of loosening of soil due to construction of bored cast- in- situ pile, a reduced value of $\Phi=30^0$ is taken.

Skin friction of soil upto 3.5m depth is neglected, it being filled up with solid waste and also due to presence of organic soil.

From 3.5m to 7.0m a cohesive layer exists having undrained shear strength of 4 t/m^2 and its skin friction is calculated.

From 7.0m to 8.5m, a loose soil pocket of N- value 2 exists. Therefore its skin friction is also neglected.

Skin friction is calculated from 8.5m to 11.0m taking an average Φ value of 30^0.

Skin friction from 3.5m to 7.0m:-

$Q_{f1} = \alpha C_u A_s$

α is taken as 0.4 corresponding to an average N- value of $\frac{13+7}{2} = 10$

$\therefore Q_{f1} = 0.4 \times 4 \times \Pi\ (0.3) \times 3.5$

$= 5.3$ t

Skin friction from 8.5m to 11.0 m

$Q_{f2} = KP_D \tan\delta A_s$

K= 1 for bored pile in loose to medium dense soil.

P_{Di} = effective surcharge at that depth.

$= 2.2\times1.5 + (3.5-2.2)\times0.5 - 3.5\times0.7 + 3\times0.7 + 1\times0.9$

$= 9.4\ t/m^2$

$Q_{fi} = 1\times9.4\times\tan(30^0)\times\Pi(0.3)\times2.5$ (Here δ is taken as Φ)

$= 12.78\ t$

Point bearing Q_P at 11.0m:-

$$A_p\left[\frac{1}{2}\gamma B N_\gamma + P_D N_q\right]$$

P_D = effective overburden at 11.0 m = $9.4\ t/m^2$

$$= \frac{\Pi(0.3)^2}{4}\left[\frac{1}{2}\times0.9\times0.3\times17 + 9.4\times28\right]$$

$= 18.76\ t$

For $\Phi = 30^0$, $N_q = 28$ (IS 2911 part-I- 1979)

$N_\gamma = 17$ (IS 6403- 1981)

$\therefore Q_a$ (Allowable load), taking F. O. S. = 2.5

$$= \frac{5.3 + 12.78 + 18.76}{2.5} = 14.73\ t$$

Similar calculations are done for 40 cm and 50 cm pile diameter. Allowable load of a 13.0m length pile is also determined. Results are shown in a tabular form in Table 1.

TABLE 1

Allowable Load On Single Piles (Tones)

Length(m)	Diameter(m)	Allowable load (tones)
11	0.3	14.73
11	0.4	23.05
11	0.5	33
13	0.3	21
13	0.4	32
13	0.5	45

B.H.2

Depth Of Exploration:15.0 M

Bore Hole 2 in Patasil Ambari consists of filled up material consisting of municipal solid waste materials like polythene bags upto 2.0 m followed by organic soil upto 4.3m depth. This is followed by a reddish brown clayey strata upto 7.5m and again a one metre layer of brown coloured silty clay i.e.from 7.5m to 8.5m. The N- values in the clay strata varies from 15 to 20 with undrained shear strength of 4.7 t/m^2 indicating its consistency to be in the medium to stiff state. At the depth of 7.5m, one bone piece was also obtained from the face of the SPT sampler.

From 8.5m upto the explored depth of 15.0 m, a fine sand layer of good N- value was obtained. The sand layer is in a medium to dense state.

Calculation of allowable bearing capacity of an isolated footing is shown at 4.5m depth since above 4.5 m the sub soil contains filled up and organic material.

Shear Criteria:-

Net safe bearing capacity from shear criteria is calculated by the following formulae

$$q_{ns}= \frac{1}{F}\left[C_u N_c S_c d_c i_c\right]$$

Since the soil below 4.5m is a saturated cohesive soil.

S_c= 1.3, N_c= 5.14, F.O.S.= 3

C_u= 4.75 t/m^2

For a 1.5m width footing

$$d_c= 1+0.2\frac{D_f}{B}= 1+0.2\frac{4.5}{1.5}= 1.6$$

$$\therefore q_{ns}= \frac{1}{3}\left[4.75\times 5.14\times 1.3\times 1.6\right]$$

$$= 16.92 \text{ t/m}^2$$

For a 2m width footing

d_c= 1.45

$$\therefore q_{ns}= \frac{1}{3}\left[4.75\times 5.14\times 1.3\times 1.45\right]$$

$$= 15.3 \text{ t/m}^2$$

Similarly, q_{ns}= 14.38 t/m^2 for a 2.5m width footing.

Settlement Criteria:-

As in B.H.1, the soil tested has been found to be normally consolidated. So the following relation has been used to calculate settlement.

$$S_i = \frac{C_c}{1+e_0} \times H \times \log \frac{P_0 + \Delta P}{P_0}$$

P_0 = effective overburden pressure at the centre of the consolidating layer-

$P_0 = 1 \times 1.5 + 0.5 \times 0.5 + (4-1.5) \times 0.6 + (0.5+1.5) \times 0.9$

$= 5.05\ t/m^2$

$$\Delta P = \frac{16.92 \times 1.5 \times 1.5}{(1.5+1.5)^2} = 4.23\ t/m^2$$

Compression index is taken as 0.14.

[B.H.1 –C_c = 0.144 at 5m depth

B.H.3- C_c = 0.153 at 5m depth]

∴ In B.H.2, compression index is taken as 0.14.

$$S_c = \frac{0.14}{1+0.724} \times 3 \times \log \frac{5.05+4.23}{5.05}$$

$= 64.3$ mm < 75 mm

∴ Shear Criteria governs the design.

∴ Allowable bearing capacity= $16.92\ t/m^2$

Similar calculations are done for 2.0m and 2.5m width footing.

For 2m footing:-

$$S_c = \frac{0.14}{1+0.724} \times 4 \times \log \frac{5.5+3.825}{5.5}$$

= 74 mm (Safe)

For 2.5m width footing:-

$$S_c = \frac{0.14}{1+0.724} \times 4 \times \log \frac{5.95+3.595}{5.95}$$

= 66 mm < 75mm (Safe)

The results of allowable bearing capacity at 4.5m are shown in a tabular form below in TABLE 2.

TABLE 2

Allowable Bearing Capacity (t/m^2)

Width of footing (m)	Depth of footing (m)	Allowable bearing capacity (t/m^2)
1.5	4.5	16.92
2	4.5	15.3
2.5	4.5	14.38

As shown in B.H.1 for construction of isolated footing at 4.5m, excavation of trench through filled up and organic soil will be a problem as the water table is at a depth of 1.0m from the ground surface. Necessary side support of the trench together with drainage of water from the trench will be necessary. Therefore placing of shallow foundation at 4.5m is not recommended at the site.

It is observed that from 8.5m, a fine sand layer exists upto 15.0m. Hence similar to B.H.1, bored cast in situ pile at 11.0 m depth is recommended. Calculation of load carrying capacity of single piles at 11.0m and 13.0m are done.

Calculation of allowable load of a single pile of length 11.0m and 30 cm diameter:-

Average N- value from 9.0m to 12.0m in B.H.2 = $\frac{17+25+24}{3} = 22$

Corresponding to N = 22, Φ is 34^0 from 6403- 1981. In case of bored cast in situ pile Φ value is further reduced by 2^0- 3^0.

Therefore, design Φ value is taken as 31^0.

For the upper 4.0m, skin friction is not calculated (filled up and organic soil).

Skin friction from 4.0m to 8.5m:-

$Q_{f1} = \alpha C_u A_s$

$C_u = 4.7\ t/m^2$, $\alpha = 0.4$

$\therefore Q_{f1} = 0.4 \times 4.7 \times \Pi(0.3) \times 4.5$

$= 7.97t$

Skin friction from 8.5m to 11.0m:-

$Q_{f2} = K P_D \tan\delta A_s$

K = 1 (loose to medium sand)

$P_{Di} = 1\times1.5+3\times0.5+4.5\times0.86+2.5\times0.95 = 9.24\ t/m^2$

$\therefore Q_{f2} = 1x\ 9.245\tan(31)\times\Pi(0.3)\times2.5$

$= 13.09t$

Point Bearing Resistance:-

$$Q_P = A_P\left(\frac{1}{2}\gamma B N_\gamma + \gamma D_f N_q\right)$$

For $\Phi = 31^0$, $N_\gamma = 17$ (6403-1981)

$N_q = 30$ (2911- part 1/Sec 2)

$$\therefore Q_P = \frac{\pi(0.3)^2}{4}\left[\frac{1}{2}\times0.96\times0.3\times17+9.245\times30\right]$$

$= 19.78\ t$

$$\therefore Q_a = \frac{1}{F}\left[Q_{f1}+Q_{f2}+\theta_p\right]$$

$= 16.336\ t$

Similar calculations are done for 40 cm and 50 cm diameter pile. Table 3 shows the allowable load of 11.0m and 13.0m length.

TABLE 3

Allowable Load On Single Piles (Tones)

Length (m)	Diameter (m)	Allowable load (tones)
11	0.3	16.3
11	0.4	25.3
11	0.5	36
13	0.3	23
13	0.4	35
13	0.5	49.1

B.H.3

Depth Of Exploration:15.0 M

The soil strata in B.H.3 is exactly similar to B.H.2. and B.H.1. In B.H.3, boring had been done from 0.5m below the existing ground surface. There is filled up material followed by organic material and grey coloured organic soil upto 3.5m. From 3.5m to approximately 9.0m there is reddish brownish clay soil of medium to stiff consistency. This layer is followed by a layer of fine sand from 9.0m upto the explored depth of 15.0 m. Ground water table was encountered at a depth of 1.5m below the ground surface.

Allowable bearing capacity for a shallow foundation at 4.5m depth will be similar to B.H.1.

Similar to B.H.1 and B.H.2, bored cast in situ pile is recommended at 11.0 m depth. The values of allowable load on single piles at 11.0m and 13.0 m depth is shown in TABLE 4.

TABLE 4

Allowable Load On Single Piles (Tones)

Length(m)	Diameter(m)	Allowable load (tones)
11	0.3	14.7
11	0.4	22.75
11	0.5	32.4
13	0.3	20.7
13	0.4	31.4
13	0.5	43.8

B.H.4, B.H.5 AND B.H.6

Depth Of Exploration:15.0 M

The soil strata in B.H.4, 5 and 6 is more or less identical upto the explored depth of 15m. In B.H.4, upto 13.0m, the soil consists of blackish organic clay upto 2.15m, followed by bluish silty clay upto 5.0m. From 5.0m to 9.0m there is black coloured organic material of extremely low N- value. From 9.0 to 13.0m, it is very soft deep grey clay soil. From ground surface upto 12.0m, the N- value is consistently low (<5). From 13.0m upto the explored depth of 15.0m grey coloured sandy clay is encountered of N- value 16. This

indicates that upto 12.0m, the original soil was excavated and the site was used as a filling ground of municipal waste material. **In such type of soil upto 12.0m, no foundation for any type of construction is recommended.** B.H.5 and B.H.6 shows similar type of soil like B.H.4 except that original ground surface was not encountered upto 15.0m depth. From ground surface upto 15.0m in B.H.5 and 6, the soil consists of very soft silty clay or soft clay or black organic clay. Undisturbed sample could not be collected at many depths due to its softness. The N- values recorded were less than 5. *Since original ground in B.H.5 and 6 were not encountered upto 15.0m depth of exploration, two additional bore holes were decided to be explored again till original soil was encountered. The two additional bore holes were B.H.7 and B.H.8.*

B.H.7

Depth Of Exploration:23.0 M

In B.H.7, upto 19.0m depth of exploration, the strata consists of grayish and blackish silty clay soil, black coloured soft organic soil and soft bluish clay with organic material. So at the site of B.H.7, upto 19.0m depth, the original soil was dug out and filled with municipal waste material. The soils were in varying stages of decomposition upto 19.0m. The N- values recorded were extremely low (<5). From 20.0m depth upto the explored depth of 23.0m, medium to dense sand was encountered. The N- values recorded were also high values of around 21 to 29. So, it can be inferred, original ground was encountered at 20.0m depth.

B.H.8

Depth Of Exploration:15.0 M

In B.H.8, original ground consisting of sandy clay followed by sand layer was encountered from around 10.0m below the ground surface. From ground surface upto the depth of 10.0m, the soil is silty clay, bluish clayey soil of very soft consistency of N-value less than 5. Black coloured organic soil was also encountered.

Therefore , ongoing through the soil profile of B.H.4 to B.H.8, it has been found that in areas covering B.H.4 and 8, the original soil was excavated upto 10.0m to 13.0m. In areas

covering B.H.5, 6 and 7, the original soil was excavated upto 19.0m to 20.0m depth. The pond created after excavation was used as a dumping ground for municipal waste material.

Hence from a study of the soil profile of B.H.4 to B.H.8, it has been found that the original soil was excavated to create a pond to dump municipal waste. The depth of excavation of the pond at different site is different. In B.H.4 and B.H.8, the depth of excavation was found to be 10.0m and 13.0m. In B.H.7, the depth of excavation was found to be 19.0m. Original sand stratum exists below the depth of excavation.

Since the depth of excavation was not uniform at the site, bored cast in site pile is recommended at a depth of 23.0m based on results of exploration in B.H.7.

Upto the depth of 19.0m to 20.0m no foundation of any type is recommended at the site. Moreover the soil being mainly organic in nature of low N- value (<5), any form of ground improvement is also not feasible.

Design of End Bearing Pile Based On Soil Information In B.H.7:-

In B.H.7, the soil upto the depth of 19.0m consists of a mixture of soft organic and soft inorganic clayey soils. The corrected N- value of the soil is very poor, mostly less than 5. This indicates the site near B.H.7 is a filled up site filled up upto around 19.0m with municipal waste material.

Good sand stratum was encountered from 19.0m upto the explored depth of 23.0m.

In such a scenario, no foundation is to be constructed upto a depth of 20.0m.

Either the site can be avoided for construction purpose or end bearing piles at 23.0m depth can be considered.

End Bearing Pile at 23m Depth:-

Average N- value of the soil at depth around 23.0m is 28. This gives a Φ value of 36^0. For bored cast in situ pile, the Φ value is reduced by 3^0. Therefore design Φ value is taken as 33^0.

The formulae for ultimate bearing capacity Q_u is

$$Q_u = A_p(0.5B\gamma N_\gamma) - A_p(P_o N_q) + \sum_1^n kP_o \tan\delta A_{si}$$

Skin friction load is not calculated from the ground surface upto 20.0m, the soil being mainly soft organic and inorganic soil of very low N- value.

Skin friction is calculated only for a depth of 3m in the sand stratum.

Skin friction load from 20m to 23m

$Q_s = K\gamma D \tan\delta A Si$

γD = effective overburden pressure at 23m

$= 1.5\times1.5+(20-1.5)\times0.5+3\times0.9$

$= 14.2\ t/m^3$

[γ_t for soft organic and inorganic clay = 1.5 t/m^3 (average)

γ_t for sand layer = 1.9 t/m^3]

$\therefore Q_S$ for 30cm diameter pile

$= 1\times14.2\ \tan(33)\times\Pi\ (0.3)\times3$

$= 26.07$ t

(Taking K= 1)

Point bearing Q_p at 23m= $A_P\left[\frac{1}{2}\gamma B N_\gamma + \gamma D_f N_q\right]$

For $\phi = 33^0$, $N_q = 42$, $N_\gamma = 20$

$\therefore Q_P$ for 30cm diameter pile

$$Q_P = \frac{\pi(0.3)^2}{4}\left[\frac{1}{2}\times0.9\times(0.3)\times20+14.2\times42\right]$$

$= 42.34$ t

$$\therefore Q_a \text{ (allowable load)} = \frac{1}{2.5}[26.07+42.34]$$

$= 27.4$ t

Similar calculations are done for a 40cm and 50cm diameter pile. The results are shown in a tabular form in Table 5.

TABLE 5

Allowable Load on Single Piles (Tones)

Length(m)	Diameter(m)	Allowable load (tones)
23	30	27.4
23	40	44
23	40	64.6

CONCLUSION AND FINAL RECOMMENDATION

On the basis of a careful examination of the field and laboratory test results as well as the analysis of results as above, following recommendations are made:-

1) In BH-1,BH-2 &BH-3, the sub soil consists of filled up material consisting of municipal solid waste materials like polythene bags etc up to the maximum depth of about 3.5 m followed by organic soil up to about 4.5m depth. So for construction of isolated footing at 4.5m, excavation of trench through filled up and organic soil will be a problem as the water table is at a depth of about 1.6 m from the ground surface. Necessary side support of the trench together with drainage of water from the trench will be necessary. Therefore placing of shallow foundation at 4.5m is not recommended at the site.

2) It is observed that from about 9.0 m, a fine medium to dense state sand layer of good N-value exists upto 15.0m. Hence in BH-1, BH-2 &BH-3 bored cast in situ pile at 11.0 m depth is recommended. The load carrying capacity of single piles at 11.0 m and 13.0 m are shown in Tables -1, 3 & 4 respectively.

3) In BH-4, from ground surface upto 12.0m, the original soil was excavated and the site was used as a filling ground of municipal waste material. In such type of soil upto 12.0m, no foundation for any type of construction is recommended. From 13.0m upto the explored depth of 15.0m grey coloured sandy clay is encountered of N- value 16. B.H.5 and B.H.6 shows similar type of soil like B.H.4 except that original ground surface was not encountered upto 15.0m depth. From ground surface upto 15.0m in B.H.5 and 6, the soil consists of very soft silty clay or soft clay or black organic clay having recorded N-values less than 5.

4) In B.H.7, the sub-soil is found filled-up upto around 19.0m with municipal waste material and from 20.0m upto 23.0m depth of exploration, medium to dense sand stratum was encountered.

5) In BH-8 original ground surface consisting of sandy clay fpllowed by sand layer was encountered from around 10.0m below the ground surface.Fromground surface upto 10.0m depth,the soil is a soft clay filled up soil of very low N-value (≤ 5).

6) A careful study of the soil profile of B.H.4 to B.H.8 shows that in areas covering B.H.4 and 8, the original soil was excavated upto 10.0m to 13.0m. In areas covering B.H.5, 6 and 7, the original soil was excavated upto 19.0m to 20.0m depth. The pond created after excavation was used as a dumping ground for municipal waste material. Hence from a study of the soil profile of B.H.4 to B.H.8, it has been found that the original soil was excavated to create a pond to dump municipal waste. Original sand stratum exists below the depth of excavation. So either the site can be avoided for construction purpose or end bearing piles ean be considered at a depth of 23.0m.The results of allowable load on single piles are shown in Table 5.

7) The results of allowable load on piles are based on the static formulae. The results are to be verified by conducting by pile load test.

LABORATORY TEST RESULTS

Table No.-6

Physical properties of soil

B.H. No.	Depth (m)	Moisture Content (%)	Specific Gravity (G_s)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Soil Classification
1	1.5	-	-	-	-	-	-	Filled up Soil
	3	-	-	-	-	-	-	
	4.5	38.8	2.6	1.8	1.29	51.1	27.89	CH
	6	38	2.6	1.8	1.29	51.1	27	CH
	7.5	-	2.65	1.4	-	-	-	SC
	9	-	-	1.8	-	38	20	SC
	10.5	-	2.65	1.9	-	-	-	SM
	12	-	-	2	-	-	-	SM
	13.5	-	2.65	2	-	-	-	SM
	15	-	-	2	-	-	-	SM
2	1.5	-	-	-	-	-	-	-
	3	35.4	2.52	1.64	-	32	18.6	CL
	4.5	-	-	-	-	-	-	-
	5	40.2	2.58	1.9	-	45.6	22.7	CI
	6	-	-	-	-	-	-	-
	7.5	-	2.65	1.92	-	45.6	22	CI
	9	-	2.6	1.9	-	-	-	SP
	10.5	-	-	1.9	-	-	-	SP
	12	-	2.6	1.9	-	-	-	SP
	13.5	-	-	1.9	-	-	-	SP
	15	-	-	1.9	-	-	-	SP

B.H. No.	Depth (m)	Moisture Content (%)	Specific Gravity (G_s)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Soil Classification
	1.5	-	-	1.5	←	Organic	Material	→
	3	45.5	2.5	1.56	-	-	-	-
3	4.5	-	2.6	1.7	-	48	22.6	CI
	6	-	2.6	1.8	-	55	23.5	CH
	7.5	-	-	1.8	-	55	23.5	CH
	9	-	-	1.9	-	-	-	SP
	10.5	-	-	1.9	-	-	-	SP
	12	-	-	1.9	-	-	-	SP
	13.5	-	-	2	-	-	-	SP
	15	-	-	2	-	-	-	SP
	1.5	-	-	-	-	-	-	-
	2.5	28.23	2.65	1.66	-	43.5	22	CI
	3	-	-	-	-	-	-	-
4	4.5	-	-	-	-	-	-	-
	6	-	2.52	-	-	60	36	OH
	7.5	-	2.52	-	-	60	36	OH
	9	-	-	-	-	-	-	-
	9.5	33.33	2.6	1.59	-	63	22	CH
	10.5	-	-	-	-	-	-	-
	12	-	-	-	-	-	-	-
	13.5	-	-	-	-	-	-	SC
	15	-	-	-	-	-	-	SC

B.H. No.	Depth (m)	Moisture Content (%)	Specific Gravity (G_s)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Soil Classification
5	1.5	-	-	Filled	up	Soil	-	-
	3	-	-	-	-	51	19.8	CH
	4.5	-	-	-	-	-	-	-
	5	38.3	-	1.72	-	55	22.3	CH
	6	-	-	-	-	-	-	-
	7.5	-	-	-	-	-	-	-
	8	42.93	2.65	1.55	-	58	25	CH
	9	-	-	-	-	-	-	-
	10.5	-	-	-	-	-	-	-
	11	43.5	2.55	1.52	-	62	36	OH
	12	-	-	-	-	-	-	-
	13.5	-	2.55	-	-	62	36	OH
	15	-	2.55	-		62	36	OH
6	1.5	-	-	Filled	up	Soil	-	-
	2	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-
	4.5	-	-	-	-	-	-	-
	5	28.21	-	1.44	-	38	25	MI
	6	-	-	-	-	66.1	38	OH
	7.5	-	-	-	-	-	-	-
	8	-	-	-	-	58	25	CH
	10.5	-	-	-	-	-	-	SP
	12.5	38.3	-	1.67	-	58	26	CH
	15	-	-	-	-	58	39	CH-OH

B.H. No.	Depth (m)	Moisture Content (%)	Specific Gravity (G_s)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Soil Classification
	1.5	-	-	Filled	up	Soil	-	-
	3	22.8	1.76	-	-	33	19	CL
7	4.5	-	-	-	-	-	-	-
	6	43.5	1.42	-	-	66	-	OH
	7.5	-	-	-	-	-	-	-
	8	43.5	-	-	-	-	-	OH
	9	-	-	-	-	-	-	-
	10.5	-	-	-	-	55	23	CH
	12	-	-	-	-	-	-	OH
	13.5	-	-	-	-	-	-	OH
	15	-	-	-	-	-	-	OH
	16.5	-	-	-	-	54	19	CH
	18	-	-	-	-	-	-	CH
	19.5	-	-	-	-	-	-	SC
	21	-	-	-	-	-	-	SP
	22.5	-	-	-	-	-	-	SP
8.	1.5	-	-	Filled	up	Soil	-	-
	3	26.4	1.69	-	-	38	18	CI
	4.5	-	-	-	-	-	-	CI
	6	33.4	1.58	-	45.6	38	25	OI
	7.5	28.21	-	1.44	-	55	23	CH
	9	-	-	-	-	-	-	-
	10.5	-	-	-	-	-	-	CH
	12.0	-	-	-	-	-	-	SC
	13.5	-	-	-	-	58	-	SP
	15	-	-	-	-	-	-	SP

Table No. 7

Shear properties of the soils

B. H. No.	Depth (m)	Cohesion (t/m^2)	Angle of Internal Friction	Remarks
1.	4.00	4.02	0	Unconfined Compression Test
	5.00	4.18	0	
	9.00	-	30^0	From N- value of the Soil
	11.00	-	32^0	
	13.00	-	33^0	
	15.00	-	35^0	
2.	3.5	3.4	-	Unconfined Compression Test
	5	4.75	-	
	7	4.75	-	
	9	-	34^0	From N- value of the Soil
	11	-	34^0	
	13	-	34^0	
	15	-	35^0	
3.	3.5	4.07	-	Unconfined Compression Test
	5	4.28	-	
	11	-	32^0	From N- value of the Soil
	13	-	32^0	
	15	-	33^0	
4.	2.5	0.68	0	Unconfined Compression Test
	5 (Sample could not collected due to soft clay)			
	9.5	1.56	0	Direct Shear Test on disturb Sample (γ_t= 1.69 t/m^3)
	13.5	2.56	21	

B. H. No.	Depth (m)	Cohesion (t/m^2)	Angle of Internal Friction	Remarks
5.	2 5 8 11 (Cannot be collected due to softness)	2.08 2.56 1.88 -	0^0 0^0 0^0 -	Unconfine Compression Test
6.	2 (Sample cannot be collected due to softness) 5 8 12.5	- 1.39 0.84 1.18	- 0 0 0	Unconfine Compression Test
7.	3.00 6.00 (Sample could not be collected) 8 12.5 21 22.5	2.36 - 0.86 1.07 - -	0^0 - 0^0 0^0 36^0 36^0	From N- value of the Soil
8.	3.5 6.5 12 15	3.56 1.26 - -	0^0 0^0 35^0 35^0	Unconfined Compression Test From N- value of the Soil

APPENDIX-I

BORE HOLE LOG

BORE LOG 1 TO 8

BORE LOG 1

BORE HOLE NUMBER: 1 (One)

DATE OF START: 09-03-2010

DATE OF COMPLETION: 11-03-2010

NAME OF PROJECT: JNNURM FATASIL, GHY-09

G.W.L. = 2.20M

Description	Depth (m)	Strata	Sample D/S	Sample U/S	S.P.T. 15cm	S.P.T. 15cm	S.P.T. 15cm	Observed N-Value	Corrected N-Value	Remarks
Fill up Soil with bricks built in cement mortar& organic material upto 2.50M	1.00		1.50		-	-	-	-		• Loose organic material and plastic packet is found, so SPT can not be performed at 1.50m.
	2.00									
	3.00		3.00		1	2	2	4	5	
Greayish colour soil upto 3.50M	4.00			4.00						
	5.00		4.50		2	5	6	11	13	
Reddish grayish colour upto 7.00M (clay soil)	6.00		6.00	5.00	2	3	3	6	7	
	7.00									
	8.00		7.50		0	1	1	2	2	
Brownish clay with fine sand upto 10.00M	9.00		9.00		3	4	6	10	11	
	10.00									
	11.00		10.50		4	9	9	18	17	
	12.00		12.00		6	8	13	21	18	
	13.00									
Brownish sand with silt upto 15.00M	14.00		13.50		4	10	18	28	21	
	15.00		15.00		5	13	22	35	24	

N. B.:- Boring done from 0.3m below the ground surface.

7.5m: - Clayey sand (mostly sand)

3m: - Grey, Brown coloured clay (no organic content)

4.5m: - Reddish grey colour clay

BORE LOG 2

BORE HOLE NUMBER: 2 (Two)

DATE OF START: 11-03-2010

DATE OF COMPLETION: 12-03-2010

NAME OF PROJECT: JNNURM FATASIL, GHY-09

G.W.L. = 1.00M

Description	Depth (m)	Strata	Sample		S.P.T.			Observed N-Value	Corrected N-Value	Remarks
			D/S	U/S	15cm	15cm	15cm			
Fill up soil upto 1.60M	1.00									One bone piece found on the face of SPT sample at 7.5M
Organic material upto 3.00M	2.00		1.50		0	1	1	2	3	
Blackish organic soil upto 4.00M	3.00		3.00		2	3	5	8	11	
Reddish Brown clay soil upto 7.50M	4.00		4.50		4	7	9	16	20	
	5.00									
	6.00		6.00		4	6	7	13	16	
	7.00									
	8.00		7.50		3	6	7	13	15	
Brownish silty clay upto 8.50M	9.00		9.00		5	8	10	18	17	
	10.00									
	11.00		10.50		8	14	21	35	25	
Fine Sand upto 15.00M	12.00		12.00		7	14	20	34	24	
	13.00									
	14.00		13.50		8	16	18	34	23	
	15.00		15.00		9	20	24	44	27	

BORE LOG 3

BORE HOLE NUMBER: 3 (Three)

DATE OF START: 13-03-2010

DATE OF COMPLETION: 14-03-2010

NAME OF PROJECT: JNNURM FATASIL, GHY-09

G.W.L. = 1.50M

Description	Depth (m)	Strata	Sample D/S	Sample U/S	S.P.T. 15cm	S.P.T. 15cm	S.P.T. 15cm	Observed N-Value	Corrected N-Value	Remarks
Filled up soil upto 0.40	1.00									
Organic Material upto 2.00M	2.00		1.50		1	1	1	2	3	
	3.00		3.00	3.50	4	7	8	15	26	
Grey colour clay with organic material upto 3.00M	4.00									
	5.00		4.50		4	8	9	17	21	
	6.00		6.00		3	5	5	10	12	
Reddish Brown clay soil upto 5.50M	7.00									
	8.00		7.50		3	4	6	10	11	
	9.00		9.00		5	8	10	18	17	
Brownish clay soil upto 8.50M	10.00									
	11.00		10.50		4	7	10	17	16	
	12.00		12.00		5	8	13	21	17	
	13.00									
	14.00		13.50		7	12	16	28	20	
Fine Sand with Silica upto 15.00M	15.00		15.00		8	17	21	38	24	

7.5m: - Sandy Clay (Brownish)

BORE LOG 4

BORE HOLE NUMBER: 4 (Four)

DATE OF START: 15-03-2010

DATE OF COMPLETION: 16-03-2010

NAME OF PROJECT: SSI FOR FATASIL AMBARI (JNNURM), GHY-09 G.W.L. = 1.00M

Description	Depth (m)	Strata	Sample		S.P.T.			Observed N-Value	Corrected N-Value	Remarks
			D/S	U/S	15cm	15cm	15cm			
Fill up soil upto 0.20	0.50									
	1.00									
Blackish Organic Clayey Soil upto 2.15M	2.00		1.50		01	02	02	04	6	
	3.00		3.00	2.5	02	03	03	06	9	• U/S at 5.00M cannot be collected due to soft clay.
Bluish Silty Clay with Sand 4.00M	4.00		4.50		02	02	02	04	5	• D/S not found (soft soil)
	5.00			Lost						
Bluish Clay Silt upto 5.00M	6.00		6.00		02	01	02	03	4	
Blackish soft clay with organic material upto 9.00M	7.00		7.50		01	01	01	02	2	
	8.00									
	9.00		9.00		01	01	02	03	3	
Deep grey clayey soil upto 12.00M	10.00			9.50						
	11.00		10.50		02	02	02	04	4	
Bluish Silty Clay upto 13.00M	12.00		12.00		02	02	03	05	5	
	13.00		13.50		07	08	08	16	17	
	14.00									
Grayish Sandy Clay upto 15.00M	15.00		15.00		05	06	06	12	12	

❖ **Boring done at 0.20m below the ground level**

BORE LOG 5

BORE HOLE NUMBER: 5 (Five)

DATE OF START: 17-03-2010

DATE OF COMPLETION: 18-03-2010

NAME OF PROJECT: SSI FOR FATASIL AMBARI (JNNURM), GHY-09 G.W.L. = 1.70M

Description	Depth (m)	Strata	Sample		S.P.T.			Observed N-Value	Corrected N-Value	Remarks
			D/S	U/S	15cm	15cm	15cm			
Brick Soiling upto 0.40M	0.50									
	1.00									
Fill up Blackish Clay Soil upto 1.50M	2.00		1.50	2.00	02	03	03	06	9	
	3.00		3.00		02	04	04	08	11	• U/S cannot be collected on 11.00M
Grayish Silty Clay 2.5M	4.00									
	5.00		4.50	5.00	02	04	04	08	10	
Brownish Silty Clay with Sand upto 4.00M	6.00		6.00		01	01	01	02	2	
	7.00									
Greyish silty clay upto 5.50M	8.00		7.50	8.00	02	02	03	05	6	
	9.00		9.00		02	01	02	03	3	
Blackish organic clay upto 7.00M	10.00									
	11.00		10.50	11.00	02	02	03	05	5	
Grayish clay upto 8.00M	12.00		12.00		01	02	02	04	4	
Bluish Sandy Clay upto 9.00M	13.00									
	14.00		13.50		02	02	03	05	5	
Grayish Claycy soft soil with organic material upto 15.00M	15.00		15.00		03	04	04	08	8	

❖ **Boring done from ground surface**

BORE LOG 6

BORE HOLE NUMBER: 6 (Six)

DATE OF START: 19-03-2010

DATE OF COMPLETION: 20-03-2010

NAME OF PROJECT: SSI FOR FATASIL AMBARI (JNNURM), GHY-09 G.W.L. = Nil.

Description	Depth (m)	Strata	Sample		S.P.T.			Observed N-Value	Corrected N-Value	Remarks
			D/S	U/S	15cm	15cm	15cm			
Brick Soiling upto 0.20M	0.50									
	1.00									
Fill up Blackish Clay Soil upto 2.00M	2.00		1.50	Lost 2.00	02	02	02	04	6	
	3.00		3.00		01	02	02	04	6	
Bluish Silty Clay upto 3.00M	4.00		4.50		02	03	04	07	9	
	5.00			5.00						
Bluish Silty sand upto 4.00M	6.00		6.00		01	01	02	03	4	
Bluish silt upto 5.00M	7.00		7.50		01	02	02	04	5	
	8.00			8.00						
Blackish organic clayey soil upto 7.00M	9.00		9.00		02	18	26	44	33	
	10.00		10.50		02	02	03	05	5	
Bluish clayey soil upto 9.00M	11.00									
	12.00		12.00		02	02	02	04	4	
Coarse Sand upto 10.15M	13.00			12.50						
	14.00		13.50		01	02	02	04	4	
Grayish Clayey soil upto 14.00M	15.00		15.00		02	02	02	04	4	
Grayish Clayey soil with organic material upto 15.00M										

❖ **Boring done from ground level**

BORE LOG 7

BORE HOLE NUMBER: 7 (Seven)

DATE OF START: 25-03-2010
DATE OF COMPLETION: 26-03-2010

NAME OF PROJECT: SSI FOR FATASIL AMBARI (JNNURM), GHY-09 G.W.L. = 1.5M

Description	Depth (m)	Strata	Sample		S.P.T.			Observed N-Value	Corrected N-Value	Remarks
			D/S	U/S	15cm	15cm	15cm			
Fill up soil up to 2.00M	0.50									
	1.00									
Grayish silty soil up to 4.00M	2.00									
	3.00		3.00		02	02	05	07	12	
Blackish silty soil up to 5.00M	4.00									
	5.00		4.50		01	02	04	06	10	
Blackish organic soil	6.00		6.00		01	01	01	02	02	
	7.00									
Blackish organic soil up to 8.00M	8.00		7.50		01	01	02	03	05	
	9.00		9.00		04	02	02	04	06	
Blackish sandy clay to 9.20M	10.00		10.50		01	02	02	04	04	
	11.00									
Blackish clay up to 11.70M	12.00		12.00		02	02	02	04	04	
	13.00									
Blackish clay with organic	14.00		13.50		01	01	01	02	02	
	15.00		15.00		02	02	03	05	05	
Blackish clay with organic up to 15.00M	16.00		16.50		04	04	04	08	08	
	17.00									
Blackish clay silt.	18.00		18.00		02	03	03	06	06	
	19.00									
Blackish silty clay.	20.00		19.50		09	10	19	29	21	
	21.00		21.00		14	19	22	41	27	
Blackish silty clay to 19.50M	22.00		22.50		17	23	26	49	29	
	23.00									
Ash colour sand up to 20.5M										
Grayish sand up to 23.00M										

BORE LOG 8

BORE HOLE NUMBER: 8 (Eight)

DATE OF START: 26-03-2010

DATE OF COMPLETION: 27-03-2010

NAME OF PROJECT: SSI FOR FATASIL AMBARI (JNNURM), GHY-09 G.W.L. = Nil.

Description	Depth (m)	Strata	Sample		S.P.T.			Observed N-Value	Corrected N-Value	Remarks
			D/S	U/S	15cm	15cm	15cm			
Fill up soil up to 2.50M	0.50									
	1.00									
Grayish silty soil.	2.00		1.50							
Blackish silty soil to 5.50M	3.00		3.00		03	03	04	07	10	
	4.00									
Organic silty soil to 7.00M	5.00		4.50		02	03	03	06	8	
Blackish clayey silt	6.00		6.00		01	02	02	04	5	
Blackish clayey silt to 10.20M	7.00		7.50		02	02	02	04	5	
	8.00									
Blackish sandy clay to 11.00M	9.00		9.00		02	02	02	04	5	
	10.00									
Grayish sand	11.00		10.50		04	05	06	11	12	
Brownish sand	12.00		12.00		08	11	14	25	20	
Brownish sand up to 15.00M	13.00		13.50		10	14	19	33	24	
	14.00									
	15.00		15.00		12	16	19	35	25	

APPENDIX-II

SIEVE ANALYSIS WITH CURVES

(Sieve Analysis and Mean Particle Diameter)

B.H.:1

1.1 Source / Depth: 9.00 m

Table 1A Sieve Analysis and Mean Particle Diameter

Weight of sample taken for analysis: 179.00 gm

Depth	IS: Sieve Designation	Mass retained (gm)	% retained	Cum % retained	% passing the sieve by weight	Avg.size of sieve	Col.3 X Col.6	Mean diameter (D_m) in mm
	1	2	3	4	5	6	7	8=∑7/100
9.00 m	4.75 mm	0	0.000	0.000	100.000	7.375	0.000	0.12
	2.36 mm	0	0.000	0.000	100.000	3.555	0.000	
	1.18 mm	0.44	0.246	0.246	99.754	1.770	0.435	
	0.600 mm	0.16	0.089	0.335	99.665	0.890	0.080	
	0.300 mm	10.2	5.698	6.034	93.966	0.450	2.564	
	0.150 mm	43.94	24.547	30.581	69.419	0.225	5.523	
	0.075 mm	14.59	8.151	38.732	61.268	0.113	0.917	
	Pan	109.67	61.268	100.000	0.000	0.038	2.298	
							11.817	

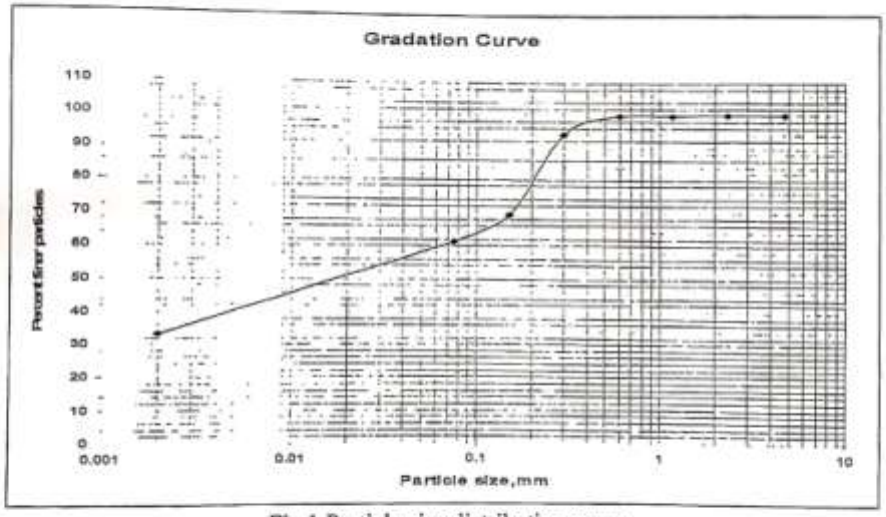


Fig 1 Particle size distribution curve

Clay,% < 0.002 m	Silt,% (0.002 – 0.075 mm	Sand ,% (0.075 – 4.75 mm)	Gravel ,% (4.75 - 80 mm)
33.45	27.818	38.732	-

1.2 Source / Depth: 12.0m

Table 1B Sieve Analysis and Mean Particle Diameter

Weight of sample taken for analysis: 242.00 gm

Depth	IS: Sieve Designation	Mass retained (gm)	% retained	Cum % retained	% passing the sieve by weight	Avg.size of sieve	Col.3 X Col.6	Mean diameter (D_m) in mm
	1	2	3	4	5	6	7	8=∑7/100
12.0m	4.75 mm	0	0.000	0.000	100.000	7.375	0.000	0.199
	2.36 mm	0	0.000	0.000	100.000	3.555	0.000	
	1.18 mm	0.68	0.281	0.281	99.719	1.770	0.497	
	0.600 mm	0.52	0.215	0.496	99.504	0.890	0.191	
	0.300 mm	47.05	19.442	19.938	80.062	0.450	8.749	
	0.150 mm	80.84	33.405	53.343	46.657	0.225	7.516	
	0.075 mm	37.11	15.335	68.678	31.322	0.113	1.725	
	Pan	75.8	31.322	100.000	0.000	0.038	1.175	
							19.853	

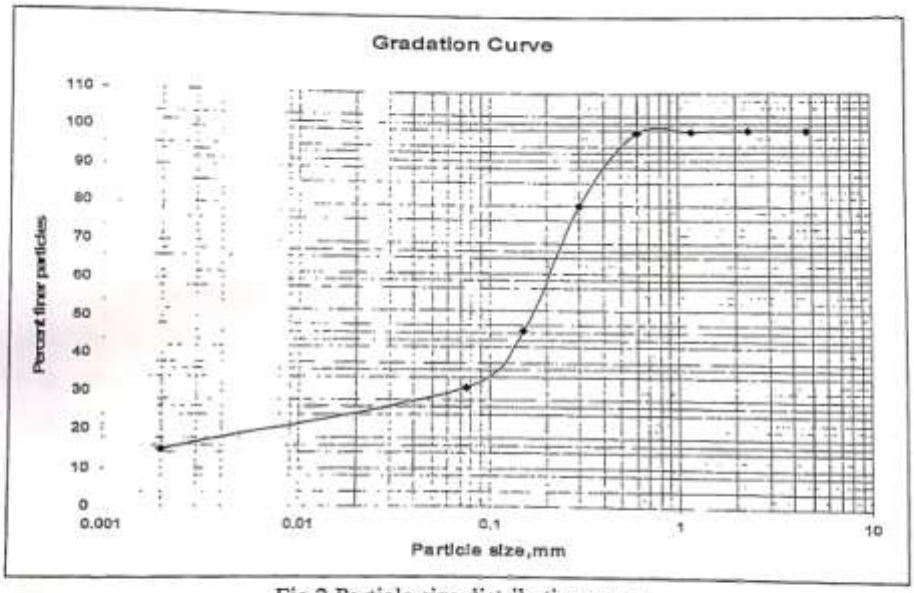


Fig 2 Particle size distribution curve

Clay,% < 0.002 m	Silt,% (0.002 – 0.075 mm	Sand ,% (0.075 – 4.75 mm)	Gravel ,% (4.75 - 80 mm)
15.00	16.322	68.678	-

B.H.:2

2.1 Source / Depth: 6.00 m

Table 2A Sieve Analysis and Mean Particle Diameter

Weight of sample taken for analysis: 170.00 gm

Depth	IS: Sieve Designation	Mass retained (gm)	% retained	Cum % retained	% passing the sieve by weight	Avg.size of sieve	Col.3 X Col.6	Mean diameter (D_m) in mm
	1	2	3	4	5	6	7	8=∑7/100
6.00 m	4.75 mm	0	0.000	0.000	100.000	7.375	0.000	0.051
	2.36 mm	0	0.000	0.000	100.000	3.555	0.000	
	1.18 mm	0	0.000	0.000	100.000	1.770	0.000	
	0.600 mm	0	0.000	0.000	100.000	0.890	0.000	
	0.300 mm	2.6	1.529	1.529	98.471	0.450	0.688	
	0.150 mm	5.25	3.088	4.618	95.382	0.225	0.695	
	0.075 mm	3.23	1.900	6.518	93.482	0.113	0.214	
	Pan	158.92	93.482	100.000	0.000	0.038	3.506	
							- 5.103	

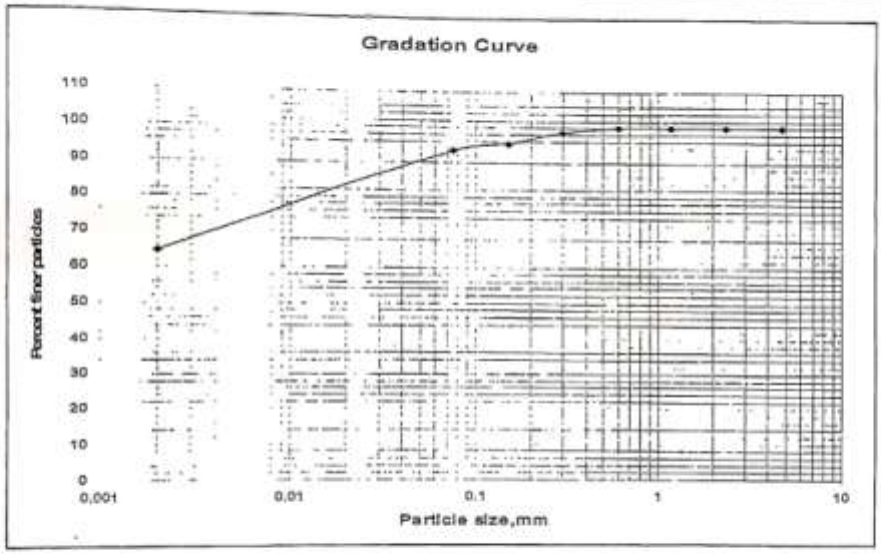


Fig 3 Particle size distribution curve

Clay,% < 0.002 m	Silt.% (0.002 – 0.075 mm	Sand ,% (0.075 – 4.75 mm)	Gravel ,% (4.75 - 80 mm)
64.53	28.852	6.518	-

2.2 Source / Depth: 10.50 m

Table 2B Sieve Analysis and Mean Particle Diameter

Weight of sample taken for analysis: 180.00 gm

Depth	IS: Sieve Designation	Mass retained (gm)	% retained	Cum % retained	% passing the sieve by weight	Avg.size of sieve	Col.3 X Col.6	Mean diameter (D_m) in mm
	1	2	3	4	5	6	7	8=∑7/100
	4.75 mm	0	0.000	0.000	100.000	7.375	0.000	
	2.36 mm	0	0.000	0.000	100.000	3.555	0.000	
10.50 m	1.18 mm	3.58	1.989	1.989	98.011	1.770	3.520	
	0.600 mm	6.48	3.600	5.589	94.411	0.890	3.204	
	0.300 mm	31.35	17.417	23.006	76.994	0.450	7.838	0.276
	0.150 mm	84.2	46.778	69.783	30.217	0.225	10.525	
	0.075 mm	32.73	18.183	87.967	12.033	0.113	2.046	
	Pan	21.66	12.033	100.000	0.000	0.038	0.451	
							27.584	

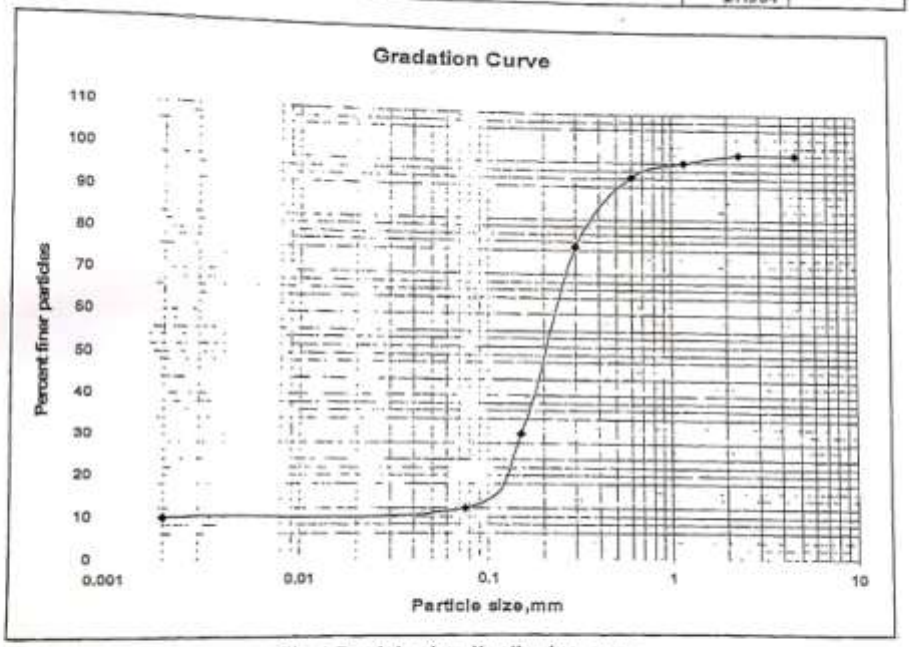


Fig 4 Particle size distribution curve

Clay,% < 0.002 m	Silt.% (0.002 – 0.075 mm	Sand ,% (0.075 – 4.75 mm)	Gravel ,% (4.75 - 80 mm)
10.05	1.983	87.967	-

B.H.:3

3.1 Source / Depth: 7.50 m

Table 3A Sieve Analysis and Mean Particle Diameter

Weight of sample taken for analysis: 170.00 gm

Depth	IS: Sieve Designation	Mass retained (gm)	% retained	Cum % retained	% passing the sieve by weight	Avg.size of sieve	Col.3 X Col.6	Mean diameter (D_m) in mm
	1	2	3	4	5	6	7	8=∑7/100
7.50 m	4.75 mm	0	0.000	0.000	100.000	7.375	0.000	0.158
	2.36 mm	0.45	0.265	0.265	99.735	3.555	0.941	
	1.18 mm	4.76	2.800	3.065	96.935	1.770	4.956	
	0.600 mm	2.75	1.618	4.682	95.318	0.890	1.440	
	0.300 mm	7.13	4.194	8.876	91.124	0.450	1.887	
	0.150 mm	17.51	10.300	19.176	80.824	0.225	2.318	
	0.075 mm	26.71	15.712	34.888	65.112	0.113	1.768	
	Pan	110.69	65.112	100.000	0.000	0.038	2.442	
							15.752	

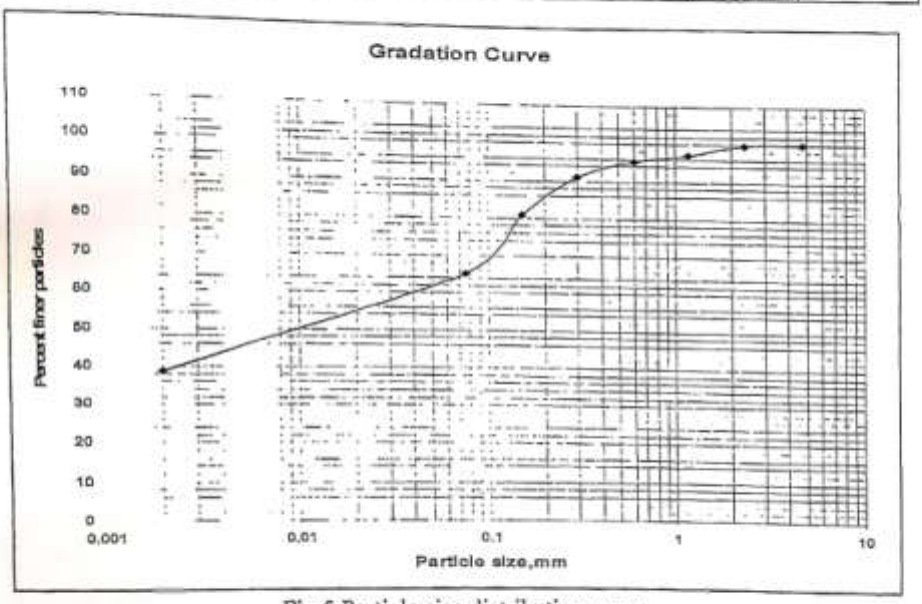


Fig 5 Particle size distribution curve

Clay,% < 0.002 m	Silt.% (0.002 – 0.075 mm	Sand ,% (0.075 – 4.75 mm)	Gravel ,% (4.75 - 80 mm)
38.675	26.437	34.888	-

3.2 Source / Depth: 10.50 m

Table 3B Sieve Analysis and Mean Particle Diameter

Weight of sample taken for analysis: 297.87 gm

Depth	IS: Sieve Designation	Mass retained (gm)	% retained	Cum % retained	% passing the sieve by weight	Avg.size of sieve	Col.3 X Col.6	Mean diameter (D_m) in mm
	1	2	3	4	5	6	7	8=∑7/100
	4.75 mm	0	0.000	0.000	100.000	7.375	0.000	
	2.36 mm	0	0.000	0.000	100.000	3.555	0.000	
10.50 m	1.18 mm	1.55	0.520	0.520	99.480	1.770	0.921	
	0.600 mm	2.67	0.896	1.417	98.583	0.890	0.798	0.0.307
	0.300 mm	118.89	39.913	41.330	58.670	0.450	17.961	
	0.150 mm	126.6	42.502	83.832	16.168	0.225	9.563	
	0.075 mm	34.86	11.703	95.535	4.465	0.113	1.317	
	Pan	13.3	4.465	100.000	0.000	0.038	0.167	
							30.727	

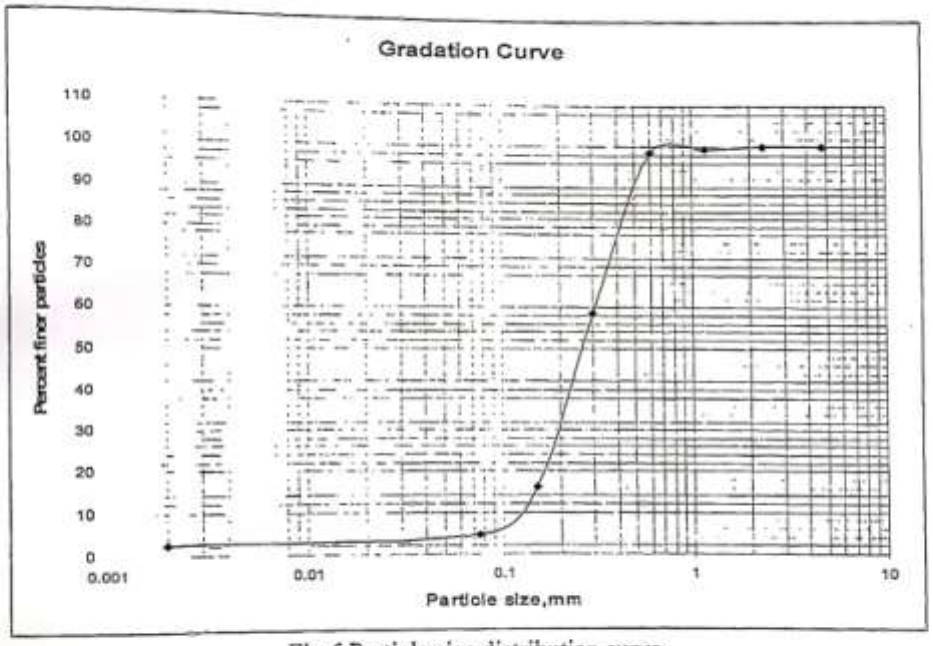


Fig 6 Particle size distribution curve

Clay,% < 0.002 m	Silt.% (0.002 – 0.075 mm	Sand ,% (0.075 – 4.75 mm)	Gravel ,% (4.75 - 80 mm)
2.344	2.121	95.535	-

B.H.:4

4.1 Source / Depth: 1.50 m

Table 4A Sieve Analysis and Mean Particle Diameter

Weight of sample taken for analysis: 200.00 gm

Depth	IS: Sieve Designation	Mass retained (gm)	% retained	Cum % retained	% passing the sieve by weight	Avg.size of sieve	Col.3 X Col.6	Mean diameter (D_m) in mm
	1	2	3	4	5	6	7	8=∑7/100
1.50 m	4.75 mm	23	11.5	11.5	88.5	7.375	84.8125	
	2.36 mm	3	1.5	13	87	3.555	5.3325	
	1.18 mm	15	7.5	20.5	79.5	1.77	13.275	
	0.600 mm	12	6	26.5	73.5	0.89	5.34	1.195
	0.300 mm	27	13.5	40	60	0.45	6.075	
	0.150 mm	19	9.5	49.5	50.5	0.225	2.1375	
	0.075 mm	19	9.5	59	41	0.1125	1.06875	
	Pan	82	41	100	0	0.0375	1.5375	
							119.57	

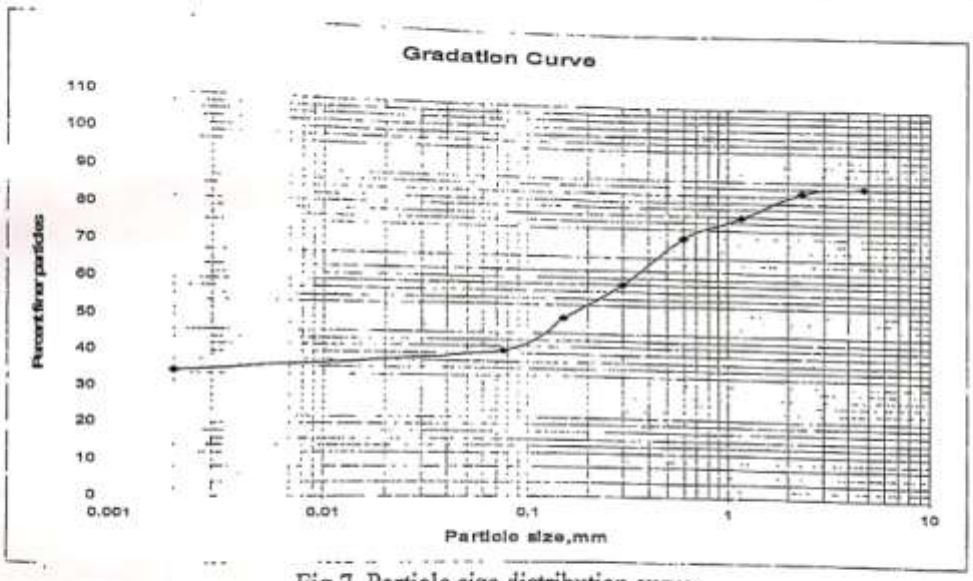


Fig 7 Particle size distribution curve

Clay,% < 0.002 m	Silt.% (0.002 – 0.075 mm	Sand ,% (0.075 – 4.75 mm)	Gravel ,% (4.75 - 80 mm)
35	6	47.5	11.5

4.2 Source / Depth: 4.50 m

Table 4B Sieve Analysis and Mean Particle Diameter

Weight of sample taken for analysis: 50.00 gm

Depth	IS: Sieve Designation	Mass retained (gm)	% retained	Cum % retained	% passing the sieve by weight	Avg.size of sieve	Col.3 X Col.6	Mean diameter (D_m) in mm
	1	2	3	4	5	6	7	8=∑7/100
4.50 m	4.75 mm	0	0	0	100	7.375	0	0.0458
	2.36 mm	0	0	0	100	3.555	0	
	1.18 mm	0	0	0	100	1.77	0	
	0.600 mm	0	0	0	100	0.89	0	
	0.300 mm	0	0	0	100	0.45	0	
	0.150 mm	1	2	2	98	0.225	0.45	
	0.075 mm	3	6	8	92	0.1125	0.675	
	Pan	46	92	100	0	0.0375	3.45	
							4.575	

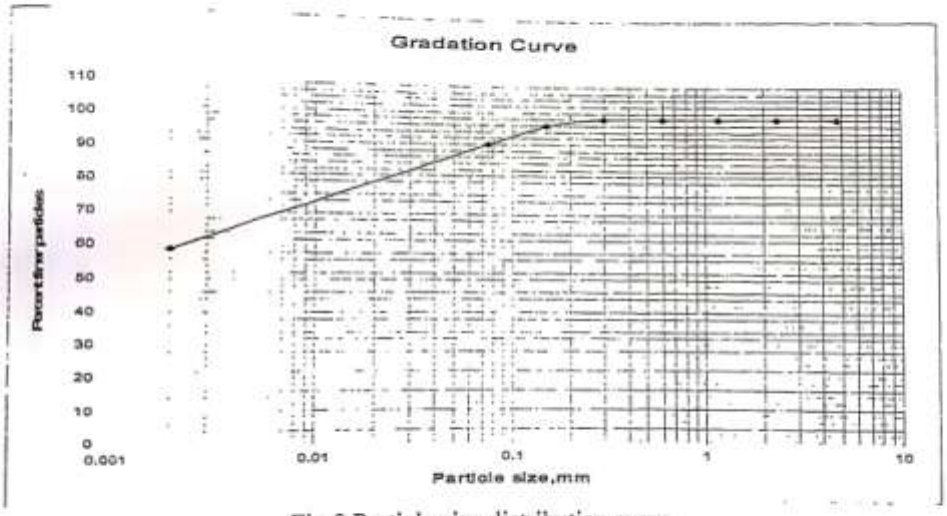


Fig 8 Particle size distribution curve

Clay,% < 0.002 m	Silt.% (0.002 – 0.075 mm	Sand ,% (0.075 – 4.75 mm)	Gravel ,% (4.75 - 80 mm)
59	33	8	-

4.3 Source / Depth: 6.0 m

Table 4C Sieve Analysis and Mean Particle Diameter

Weight of sample taken for analysis: 50.00 gm

Depth	IS: Sieve Designation	Mass retained (gm)	% retained	Cum % retained	% passing the sieve by weight	Avg.size of sieve	Col.3 X Col.6	Mean diameter (D_m) in mm
	1	2	3	4	5	6	7	8=∑7/100
	4.75 mm	0	0	0	100	7.375	0	
6.0 m	2.36 mm	0	0	0	100	3.555	0	
	1.18 mm	0	0	0	100	1.77	0	
	0.600 mm	0	0	0	100	0.89	0	0.0439
	0.300 mm	0	0	0	100	0.45	0	
	0.150 mm	0.5	1	1	99	0.225	0.225	
	0.075 mm	3	6	7	93	0.1125	0.675	
	Pan	46.5	93	100	0	0.0375	3.4875	
							4.3875	

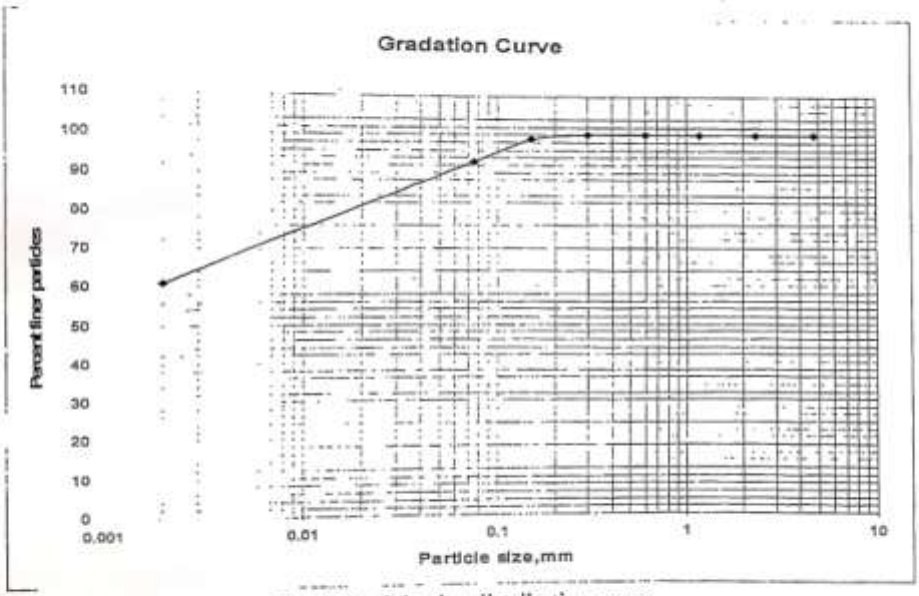


Fig 9 Particle size distribution curve

Clay,% < 0.002 m	Silt.% (0.002 – 0.075 mm	Sand ,% (0.075 – 4.75 mm)	Gravel ,% (4.75 - 80 mm)
61	32	7	-

B.H.:5

5.1 Source / Depth: 4.50 m

Table 5A Sieve Analysis and Mean Particle Diameter

Weight of sample taken for analysis: 50.00 gm

Depth	IS: Sieve Designation	Mass retained (gm)	% retained	Cum % retained	% passing the sieve by weight	Avg.size of sieve	Col.3 X Col.6	Mean diameter (D_m) in mm
	1	2	3	4	5	6	7	8=∑7/100
	4.75 mm	0	0	0	100	7.375	0	
	2.36 mm	0	0	0	100	3.555	0	
4.5 m	1.18 mm	0	0	0	100	1.77	0	
	0.600 mm	0	0	0	100	0.89	0	0.0473
	0.300 mm	0	0	0	100	0.45	0	
	0.150 mm	1	2	2	98	0.225	0.45	
	0.075 mm	4	8	10	90	0.1125	0.9	
	Pan	45	90	100	0	0.0375	3.375	
							4.725	

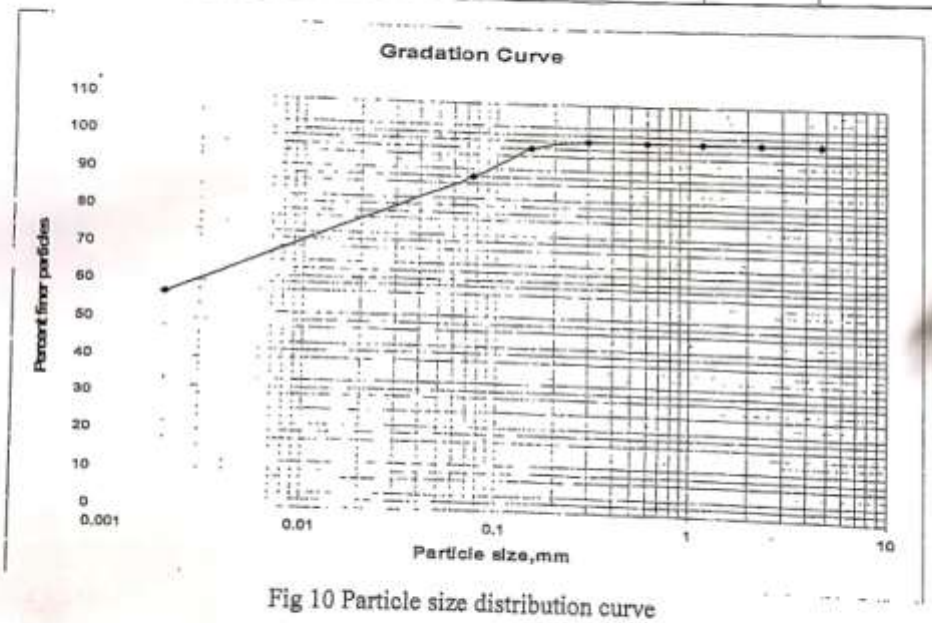


Fig 10 Particle size distribution curve

Clay,% < 0.002 m	Silt.% (0.002 – 0.075 mm	Sand ,% (0.075 – 4.75 mm)	Gravel ,% (4.75 - 80 mm)
57	33	10	-

B.H.:6

6.1 Source / Depth: 10.50 m

Table 6A Sieve Analysis and Mean Particle Diameter

Weight of sample taken for analysis: 200.00 gm

Depth	IS: Sieve Designation	Mass retained (gm)	% retained	Cum % retained	% passing the sieve by weight	Avg.size of sieve	Col.3 X Col.6	Mean diameter (D_m) in mm
	1	2	3	4	5	6	7	8=∑7/100
10.5 m	4.75 mm	0	0	0	100	7.375	0	0.0409
	2.36 mm	0	0	0	100	3.555	0	
	1.18 mm	0	0	0	100	1.77	0	
	0.600 mm	0	0	0	100	0.89	0	
	0.300 mm	0	0	0	100	0.45	0	
	0.150 mm	2	1	1	99	0.225	0.225	
	0.075 mm	4	2	3	97	0.1125	0.225	
	Pan	194	97	100	0	0.0375	3.6375	
							4.0875	

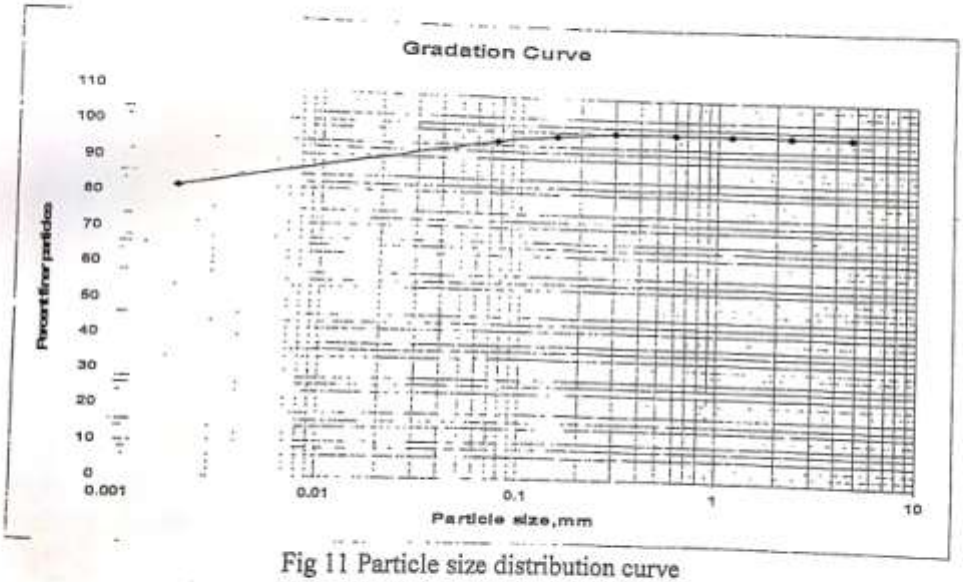


Fig 11 Particle size distribution curve

Clay,% < 0.002 m	Silt,% (0.002 – 0.075 mm	Sand ,% (0.075 – 4.75 mm)	Gravel ,% (4.75 - 80 mm)
82	15	3	-

B.H.:7

7.1 Source / Depth: 21.00 m

Table 7A Sieve Analysis and Mean Particle Diameter

Weight of sample taken for analysis: 150.00 gm

Depth	IS: Sieve Designation	Mass retained (gm)	% retained	Cum % retained	% passing the sieve by weight	Avg.size of sieve	Col.3 X Col.6	Mean diameter (D_m) in mm
	1	2	3	4	5	6	7	8=Σ7/100
	4.75 mm	0	0	0	100	7.375	0	
21.00 m	2.36 mm	0	0	0	100	3.555	0	
	1.18 mm	0	0	0	100	1.77	0	
	0.600 mm	1	0.666	0.666	99.33	0.89	0.593	0.2019
	0.300 mm	5	3.333	4	96	0.45	1.5	
	0.150 mm	106	70.666	74.666	25.33	0.225	15.9	
	0.075 mm	25	16.66	91.333	8.66	0.1125	1.875	
	Pan	13	8.666	100	0	0.0375	0.325	
							20.193	

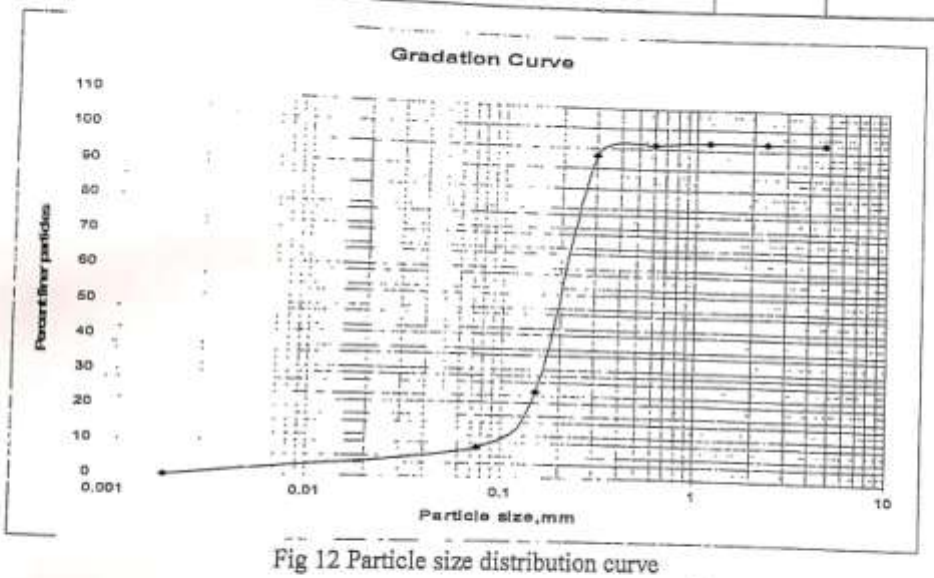


Fig 12 Particle size distribution curve

Clay.% < 0.002 m	Silt.% (0.002 – 0.075 mm	Sand ,% (0.075 – 4.75 mm)	Gravel ,% (4.75 - 80 mm)
-	8.66	91.34	-

Uniformity coefficient, $Cu = D_{60}/D_{10}$

$= 0.215 / 0.09 = 2.39$

Curvature coefficient $Cc = (D_{30})^2/D_{10} \times D_{60} = 0.16^2/0.09 \times 0.215 = 1.32$

B.H.:8

8.1 Source / Depth: 13.5 m

Table 8A Sieve Analysis and Mean Particle Diameter

Weight of sample taken for analysis: 213.00 gm

Depth	IS: Sieve Designation	Mass retained (gm)	% retained	Cum % retained	% passing the sieve by weight	Avg.size of sieve	Col.3 X Col.6	Mean diameter (D_m) in mm
	1	2	3	4	5	6	7	8=∑7/100
	4.75 mm	1	0.469	0.469	99.531	7.375	3.462	
13.5 m	2.36 mm	1	0.469	0.939	99.061	3.555	1.669	
	1.18 mm	11	5.164	6.1033	93.897	1.77	9.141	
	0.600 mm	8	3.756	9.859	90.141	0.89	3.343	0.382
	0.300 mm	30	14.085	23.944	76.056	0.45	6.338	
	0.150 mm	115	53.991	77.934	22.065	0.225	12.148	
	0.075 mm	35	16.432	94.366	5.64	0.1125	1.848	
	Pan	12	5.634	100	0	0.0375	0.211	
							38.161	

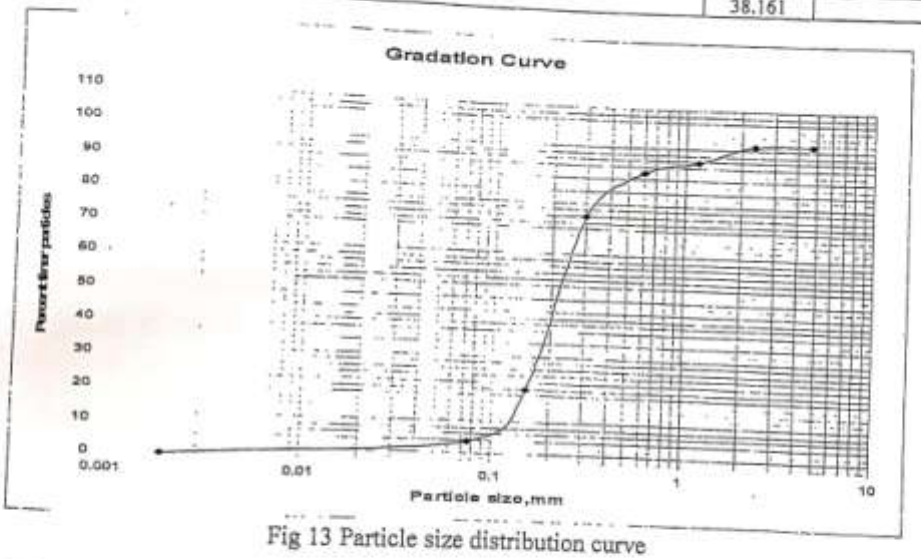


Fig 13 Particle size distribution curve

Clay,% < 0.002 m	Silt,% (0.002 – 0.075 mm	Sand ,% (0.075 – 4.75 mm)	Gravel ,% (4.75 - 80 mm)
-	5.64	93.891	0.469

Uniformity coefficient, $Cu = D_{60}/D_{10}$

$= 0.24 / 0.13 = 1.85$

Curvature coefficient $Cc = (D_{30})^2/D_{10} \times D_{60} = 0.17^2/0.13 \times 0.24 = 0.93$

APPENDIX-III

CONSOLIDATION TEST RESULTS WITH CURVES

(Co-efficient of compressibility a_v, Co-efficient of volume compressibility m_v and Compression Index C_c)

(Oedometer Test)
1) Sample No1
B.H.:1, Depth: 4.0m

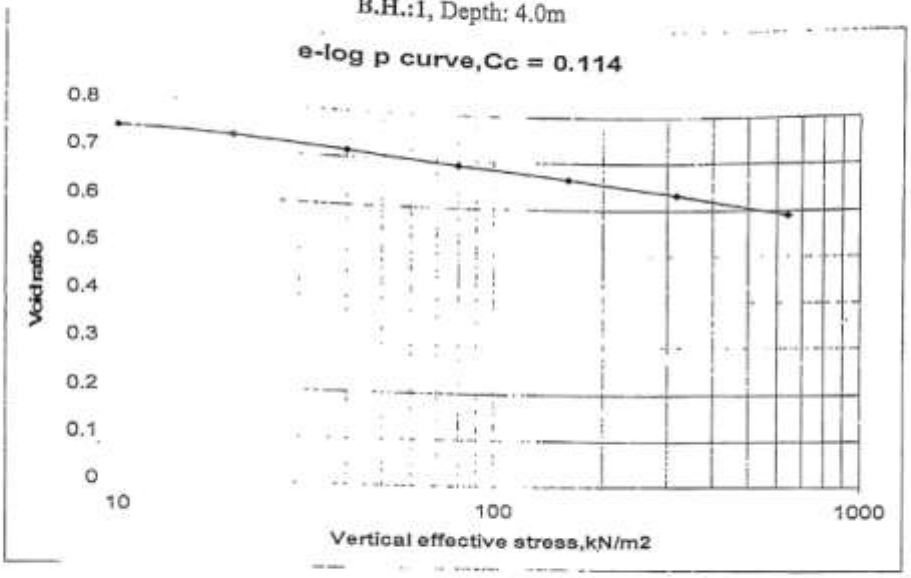


Fig 1: Consolidation Curves

Table 1: Consolidation Parameters

Applied Pressure p',kN/m^2	Void Ratio e	Co-efficient of compressibility,a_v,m^2/kN	Co-efficient of volume compressibility,m_v,m^2/kN	Compression Index C_c
10	0.741	10×10^{-3}	5.74×10^{-3}	**0.114**
20	0.731	8.5×10^{-4}	4.9×10^{-4}	
40	0.714	5.5×10^{-4}	3.21×10^{-4}	
80	0.692	3.25×10^{-4}	1.92×10^{-4}	
160	0.666	2.13×10^{-4}	1.28×10^{-4}	
320	0.632	1.34×10^{-4}	8.21×10^{-5}	
640	0.589			

2) Sample No2
B.H.:1, Depth: 5.0m

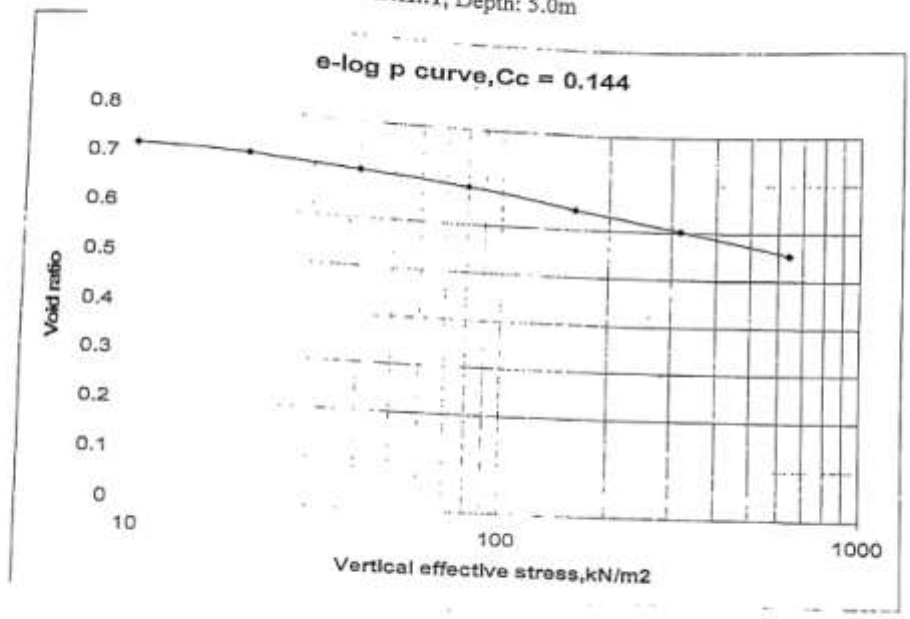


Fig 2: Consolidation Curves

Table 2: Consolidation Parameters

Applied Pressure p',kN/m^2	Void Ratio e	Co-efficient of compressibility,a_v,m^2/kN	Co-efficient of volume compressibility,m_v,m^2/kN	Compression Index C_c
10	0.718	5.0×10^{-4}	2.91×10^{-4}	0.144
20	0.713	6.5×10^{-4}	3.79×10^{-4}	
40	0.700	5.5×10^{-4}	3.24×10^{-4}	
80	0.678	4.63×10^{-4}	2.76×10^{-4}	
160	0.641	2.5×10^{-4}	1.52×10^{-4}	
320	0.601	1.53×10^{-4}	9.56×10^{-5}	
640	0.552			

3) Sample No 3
B.H.:2, Depth: 3.5 m

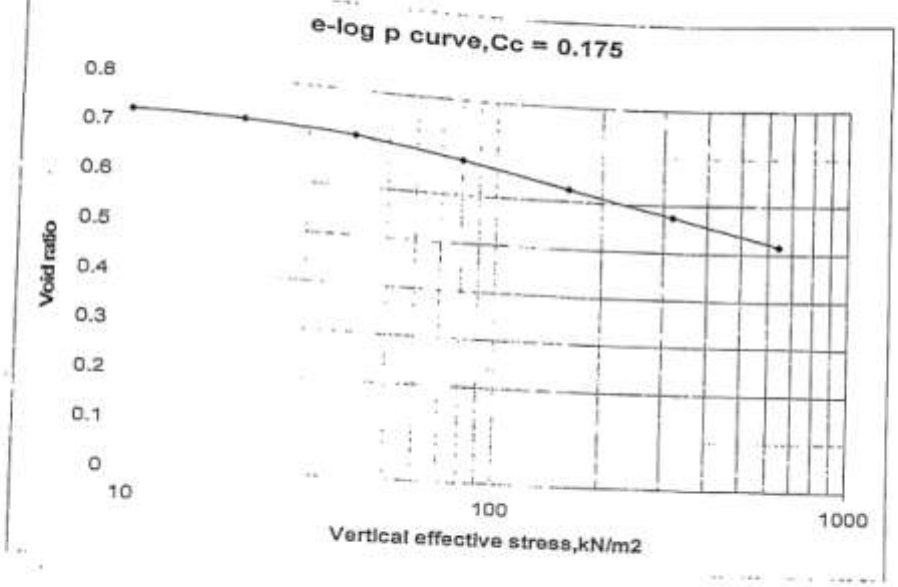


Fig 3: Consolidation Curves

Table 3: Consolidation Parameters

Applied Pressure p',kN/m^2	Void Ratio e	Co-efficient of compressibility,a_v,m^2/kN	Co-efficient of volume compressibility,m_v,m^2/kN	Compression Index C_c
10	0.722	3.0×10^{-4}	1.74×10^{-4}	**0.175**
20	0.719	6.0×10^{-4}	3.49×10^{-4}	
40	0.707	8.25×10^{-4}	4.83×10^{-4}	
80	0.674	6.0×10^{-4}	3.58×10^{-4}	
160	0.626	3.25×10^{-4}	1.999×10^{-4}	
320	0.574	1.81×10^{-4}	1.15×10^{-4}	
640	0.516			

4) Sample No 4
B.H.:3, Depth: 3.5 m

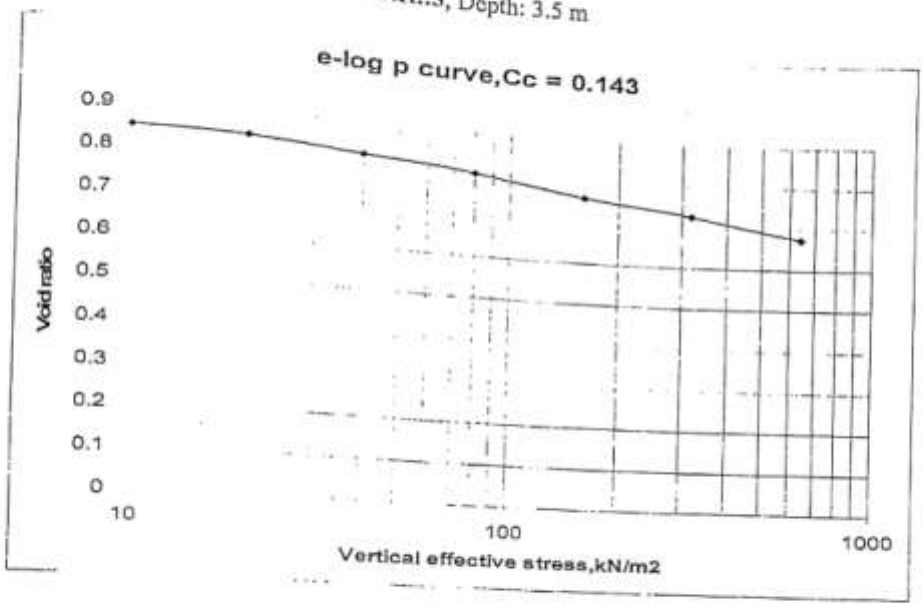


Fig 4: Consolidation Curves

Table 4: Consolidation Parameters

Applied Pressure p',kN/m^2	Void Ratio e	Co-efficient of compressibility,a_v,m^2/kN	Co-efficient of volume compressibility,m_v,m^2/kN	Compression Index C_c
10	0.848	6.0×10^{-4}	3.25×10^{-4}	0.143
20	0.842	8.5×10^{-4}	4.61×10^{-4}	
40	0.825	5.5×10^{-4}	3.01×10^{-4}	
80	0.803	5.38×10^{-4}	2.98×10^{-4}	
160	0.760	2.00×10^{-4}	1.14×10^{-4}	
320	0.728	1.68×10^{-4}	9.77×10^{-5}	
640	0.674			

5) Sample No 5
B.H.:3, Depth: 5.0m

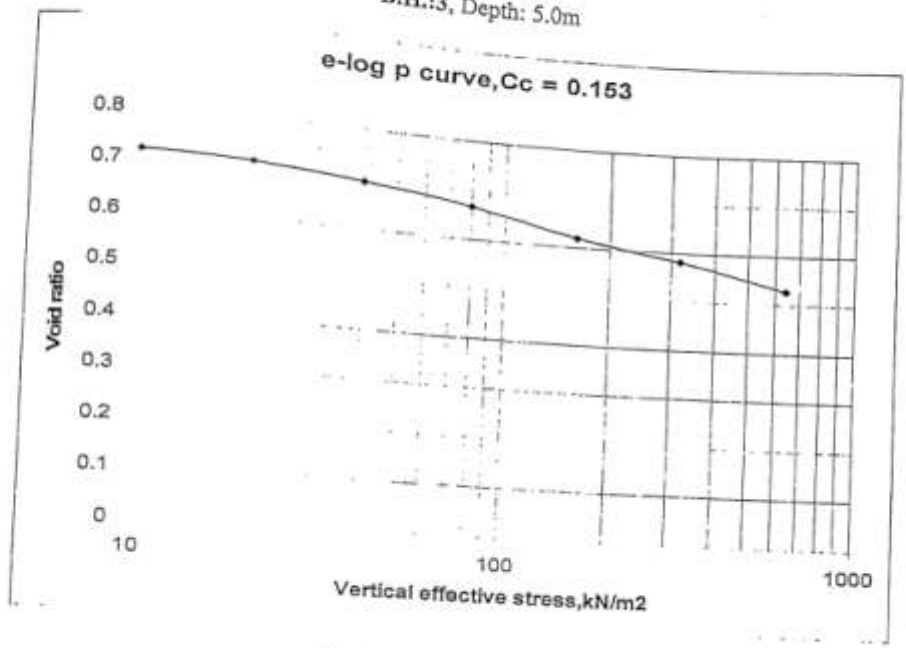


Fig 5: Consolidation Curves

Table 5: Consolidation Parameters

Applied Pressure p',kN/m^2	Void Ratio e	Co-efficient of compressibility,a_v,m^2/kN	Co-efficient of volume compressibility,m_v,m^2/kN	Compression Index C_c
10	0.719	7.0×10^{-4}	1.69×10^{-4}	**0.153**
20	0.712	8.5×10^{-4}	4.96×10^{-4}	
40	0.695	7.25×10^{-4}	4.28×10^{-4}	
80	0.666	5.88×10^{-4}	3.53×10^{-4}	
160	0.619	2.38×10^{-4}	1.47×10^{-4}	
320	0.581	1.69×10^{-4}	1.07×10^{-4}	
640	0.527			

6) Sample No 6
B.H.:5, Depth: 5.0 m

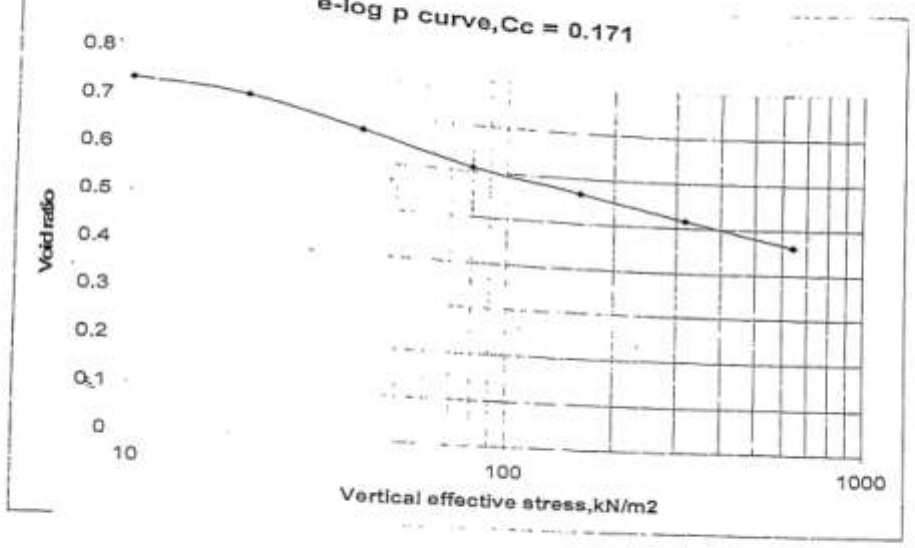
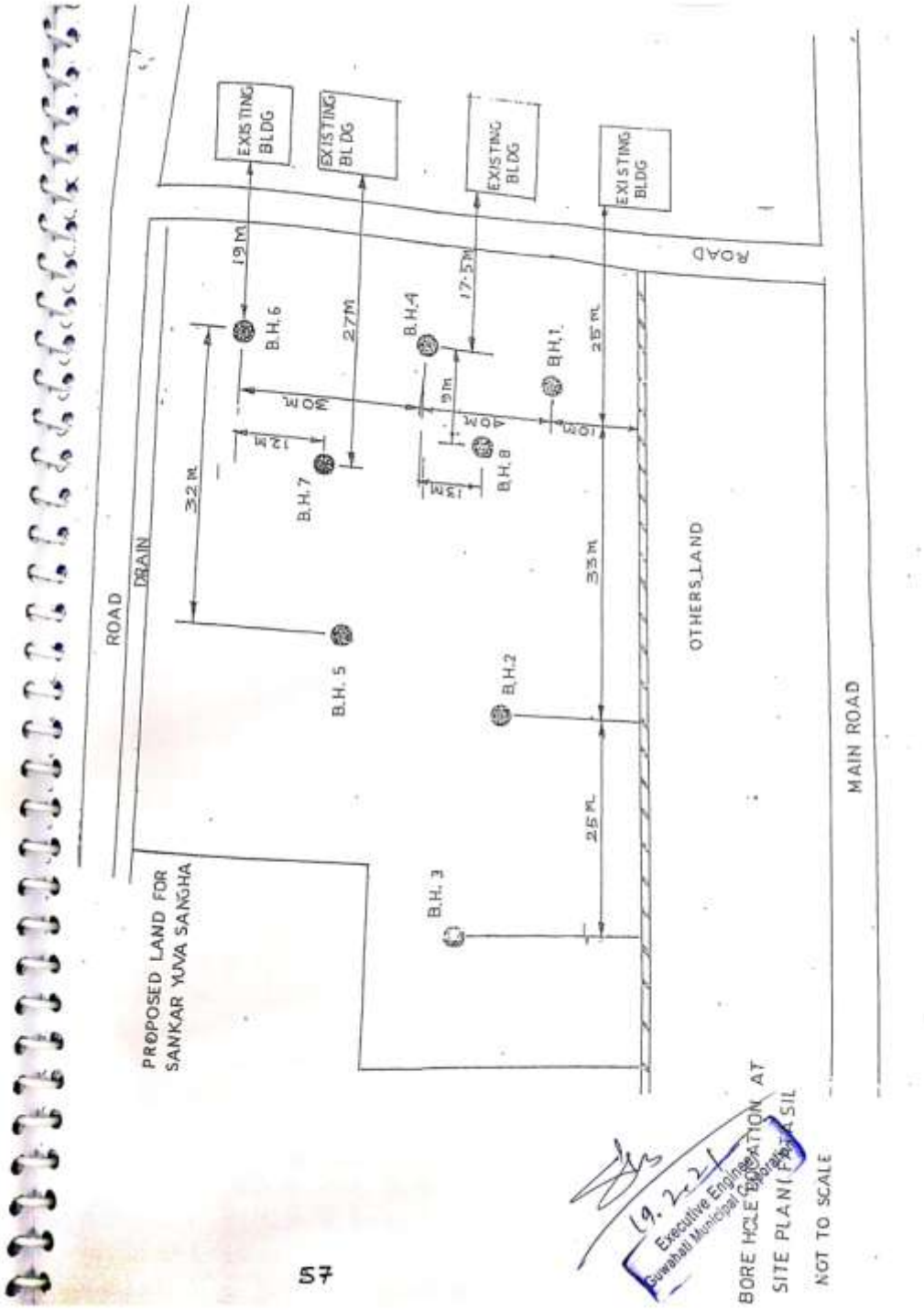


Fig 6: Consolidation Curves

Table 6: Consolidation Parameters

Applied Pressure p',kN/m^2	Void Ratio e	Co-efficient of compressibility,a_v,m^2/kN	Co-efficient of volume compressibility,m_v,m^2/kN	Compression Index C_c
10	0.735	1.8×10^{-3}	1.04×10^{-3}	**0.171**
20	0.717	2.45×10^{-3}	1.43×10^{-3}	
40	0.668	1.5×10^{-3}	8.99×10^{-4}	
80	0.608	5.25×10^{-4}	3.26×10^{-4}	
160	0.566	3.125×10^{-4}	1.996×10^{-4}	
320	0.516	1.688×10^{-4}	1.11×10^{-4}	
640	0.462			

APPENDIX-IV
SKETCH SHOWING LOCATION OF BORE HOLES



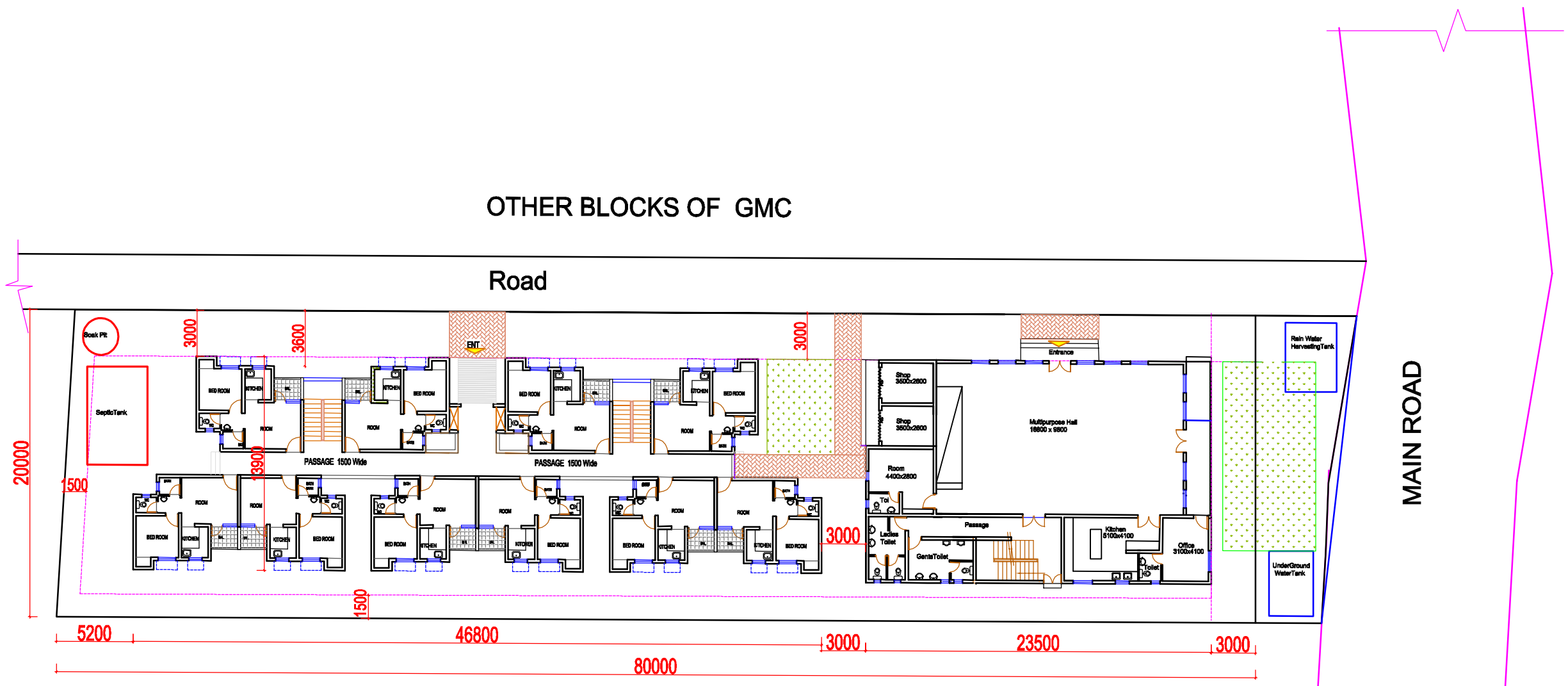
Part-7

Architectural Drawings

List of Architectural Drawings

SL. NO	TITLE
1.	LAYOUT PLAN
2.	GROUND FLOOR PLAN
3.	TYPICAL FLOOR PLAN
4.	TYPICAL UNIT PLAN
5.	ELEVATIONS - A
6.	ELEVATIONS - B
7.	SECTION
8.	FLOOR PLAN – COMMUNITY CENTRE
9.	ELEVATION – COMMUNITY CENTRE
10.	SEWER LAYOUT PLAN
11.	WATER SUPPLY LAYOUT PLAN
12.	DRAINAGE LAYOUT PLAN
13.	EXTERNAL ELECTRICAL LAYOUT PLAN

NOTES:
- ALL DIMENSIONS ARE IN MM.
- ALL LEVELS ARE IN MM.
- ALL LEVELS ARE TAKEN W.R.T INTERNAL ROAD LEVEL AS ±00 .
- PROVISION FOR SUNKEN AREA WILL BE AS PER TECHNOLOGY DETAIL
- AI DRAWINGS ARE INDICATIVE ONLY.
- ACTUAL PLAN AND LAYOUT MAY CHANGE AS PER NORMS.



LAYOUT PLAN

Area of Plot (80.0 x20.0 M)	=	1600.0 sqmts
Area of Residential Block	=	1875.2 sqmts
Area of Community Center	=	340.7 sqmts
Total Area	=	2215.9 sqmts

PROJECT

PROPOSED DEMONSTRATION HOUSING PROJECT AT FATASIL AMBARI GUWAHATI, ASSAM

DRG.TITLE

LAYOUT PLAN
ROAD & PAVEMENT

DATE	SCALE	NORTH
MAY 2021		North
DEALT BY	APP. BY	

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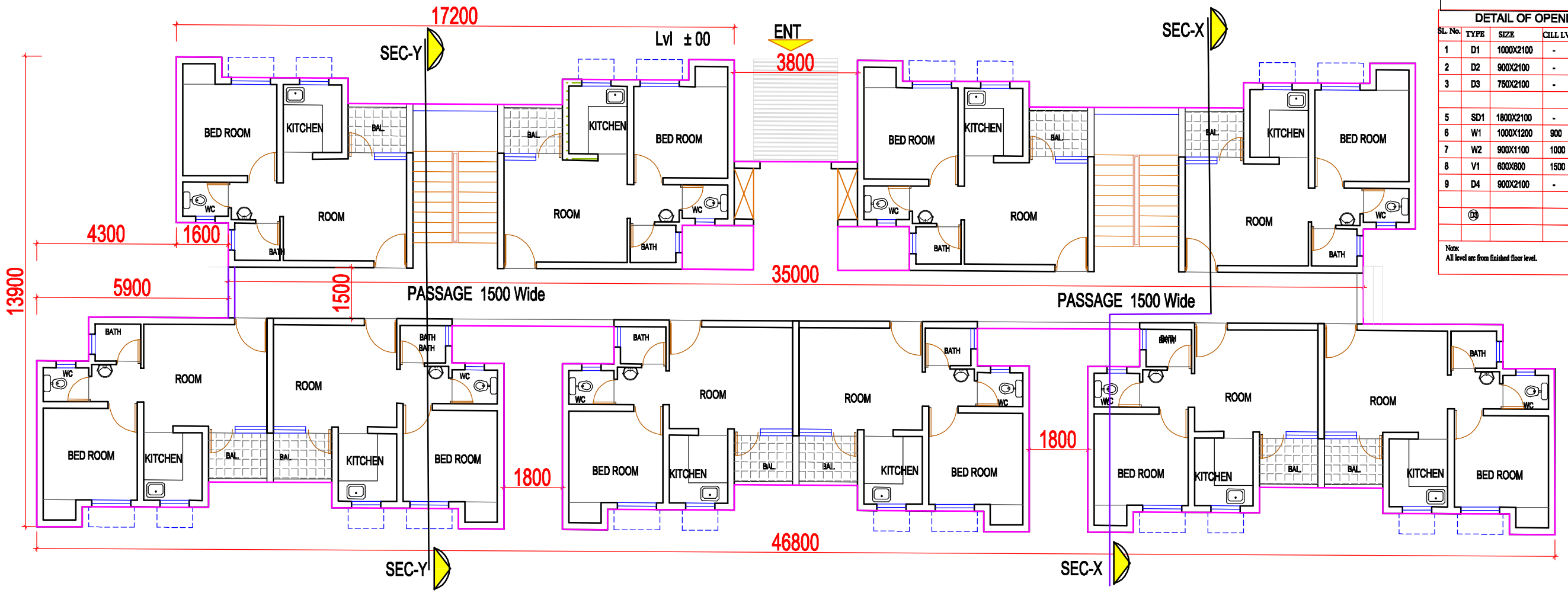
DETAIL OF OPENINGS

SL. No.	TYPE	SIZE	CILL LVL	LIN.LVL	REMARK
1	D1	1000X2100	-	2100	Ent.Door
2	D2	900X2100	-	2100	Typ. Room
3	D3	750X2100	-	2100	Toilet
5	SD1	1800X2100	-	2100	Glazed Door
6	W1	1000X1200	900	2100	Typical
7	W2	900X1100	1000	2100	Typical
8	V1	600X600	1500	2100	Typical
9	D4	900X2100	-	2100	MS Door
	D3				

Note:
All level are from finished floor level.



GROUND FLOOR PLAN

Area of Block on Gr. Floor	=468.8 Sqmts
Area of Block on 1st Floor	=468.8 Sqmts
Area of Block on 2nd Floor	=468.8 Sqmts
Area of Block on 3rd Floor	=468.8 Sqmts
Area of Residential Block	=1875.2 Sqmts

PROJECT

PROPOSED DEMONSTRATION HOUSING PROJECT AT FATASIL AMBARI GUWAHATI, ASSAM

DRG.TITLE

GROUND FLOOR PLAN

DATE	SCALE	NORTH
MAY 2021		
DEALT BY	APP. BY	

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- ALL DIMENSIONS ARE IN MM.
- ALL LEVELS ARE IN MM.
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- PROVISION FOR SUNKEN AREA WILL BE AS PER TECHNOLOGY DETAIL
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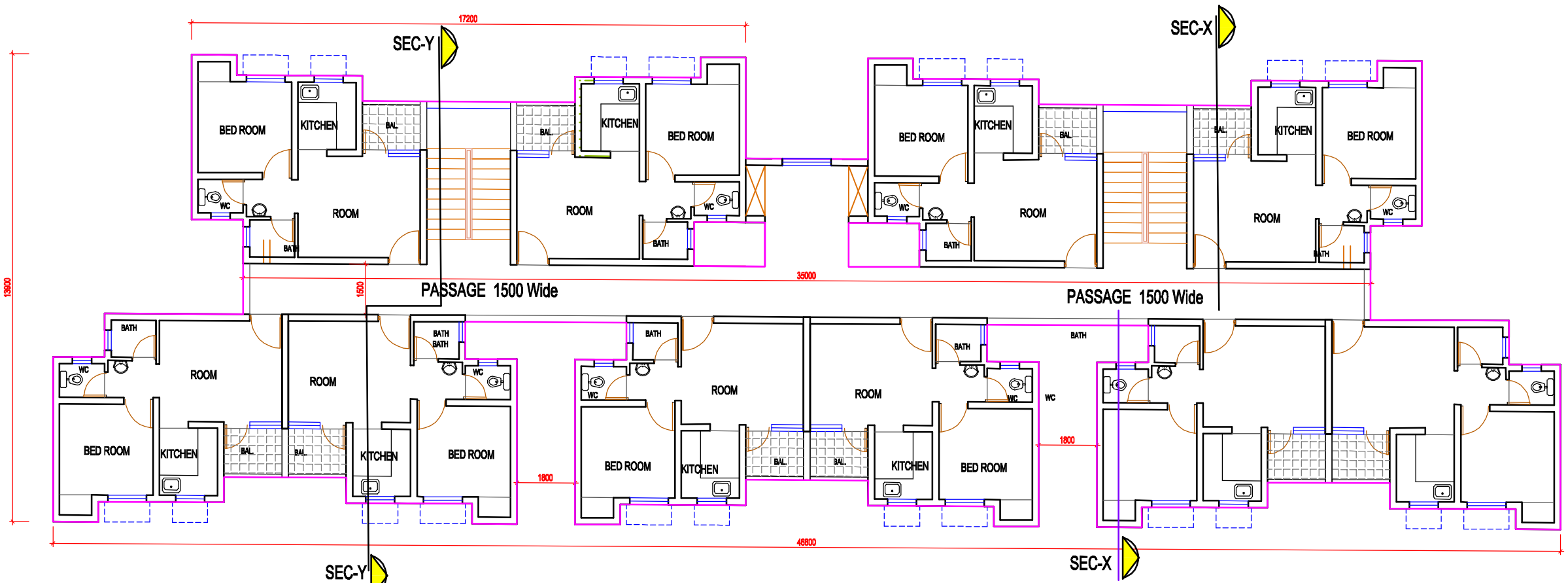
- ACTUAL PLAN AND LAYOUT MAY CHANGE AS PER NORMS.



TYPICAL FLOOR PLAN

Area of Block on Typ. Floor =468.8 Sqmts

PROJECT

PROPOSED DEMONSTRATION HOUSING PROJECT AT FATASIL AMBARI GUWAHATI, ASSAM

DRG.TITLE

TYPICAL FLOOR PLAN

DATE	SCALE	NORTH
MAY 2021		
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- ALL LEVELS ARE IN MM.
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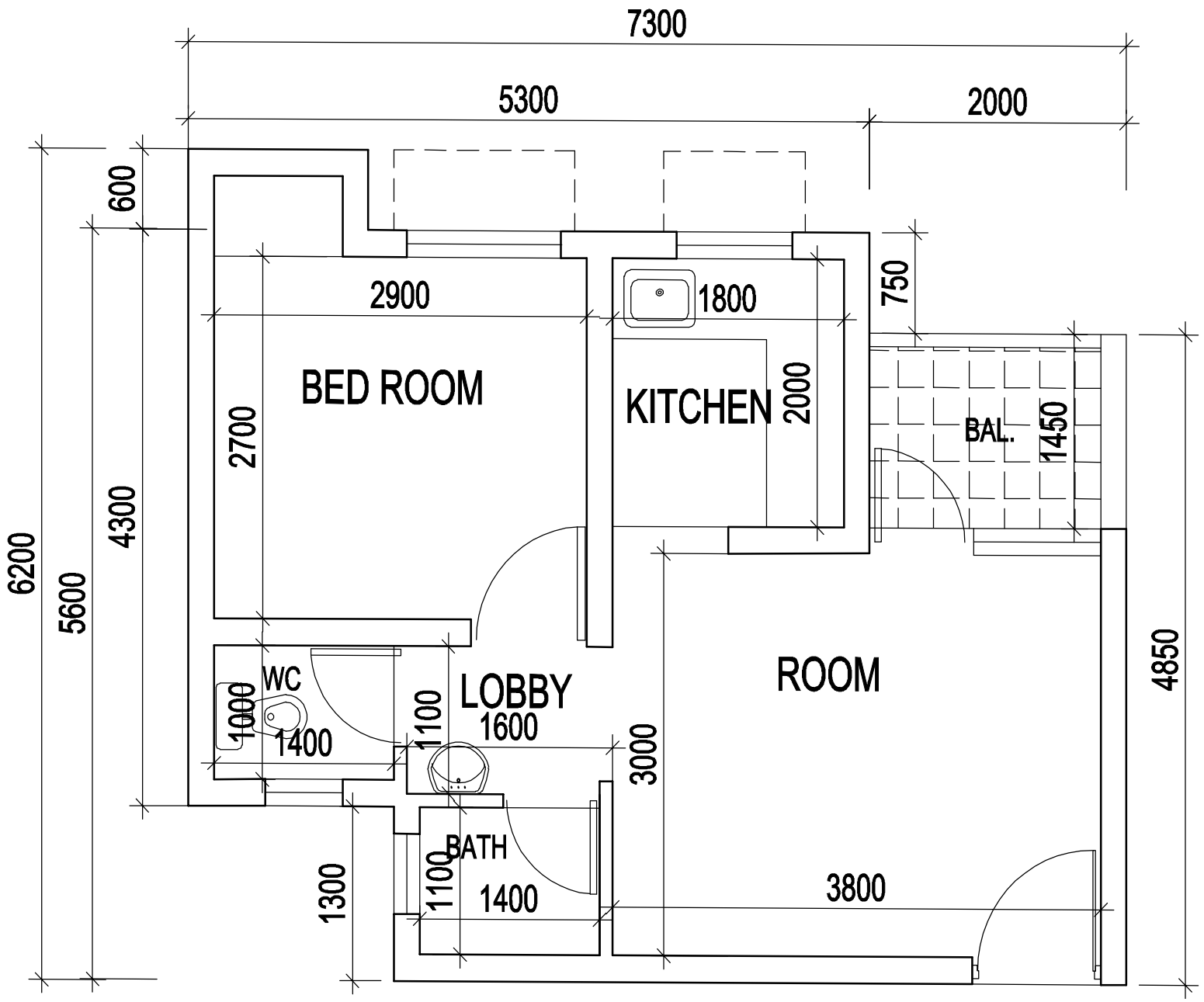

TYPICAL UNIT PLAN

AREA DETAIL OF TYPICAL UNIT

LIVING ROOM	= 3.80 x 3.00	=	11.40	sq.mts
BED ROOM	= 2.90 x 2.70	=	7.83	sq.mts
KITCHEN	= 1.80 x 2.00	=	3.60	sq.mts
BATH ROOM	= 1.40 x 1.10	=	1.54	sq.mts
W.C	= 1.40 x 1.00	=	1.40	sq.mts
LOBBY	= 1.60 x 1.10	=	1.65	sq.mts
VERANDHA	= 2.00 x 1.45	=	2.90	sq.mts
CUPBOARD	= 1.00 x 0.60	=	0.60	sq.mts
CARPET AREA		=	31.03	sq.mts
PLINTH AREA OF UNIT		=	38.14	sq.mts

PROJECT

PROPOSED DEMONSTRATION HOUSING PROJECT AT FATASIL AMBARI GUWAHATI, ASSAM

DRG.TITLE

TYPICAL UNIT PLAN

DATE MAY 2021	SCALE	NORTH
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- All DRAWINGS ARE INDICATIVE ONLY.
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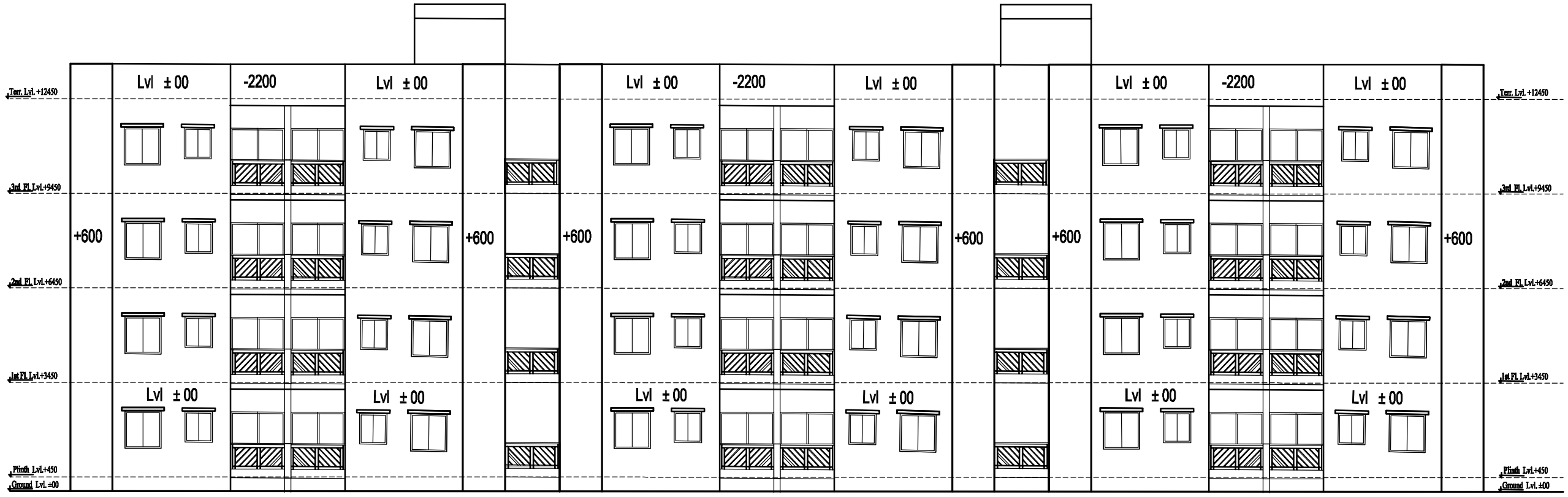

ELEVATION -A

PROJECT

PROPOSED DEMONSTRATION HOUSING PROJECT AT FATASIL AMBARI GUWAHATI, ASSAM

DRG.TITLE

ELEVATION -A

DATE	SCALE	NORTH
MAY 2021		
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- ALL LEVELS ARE IN MM.
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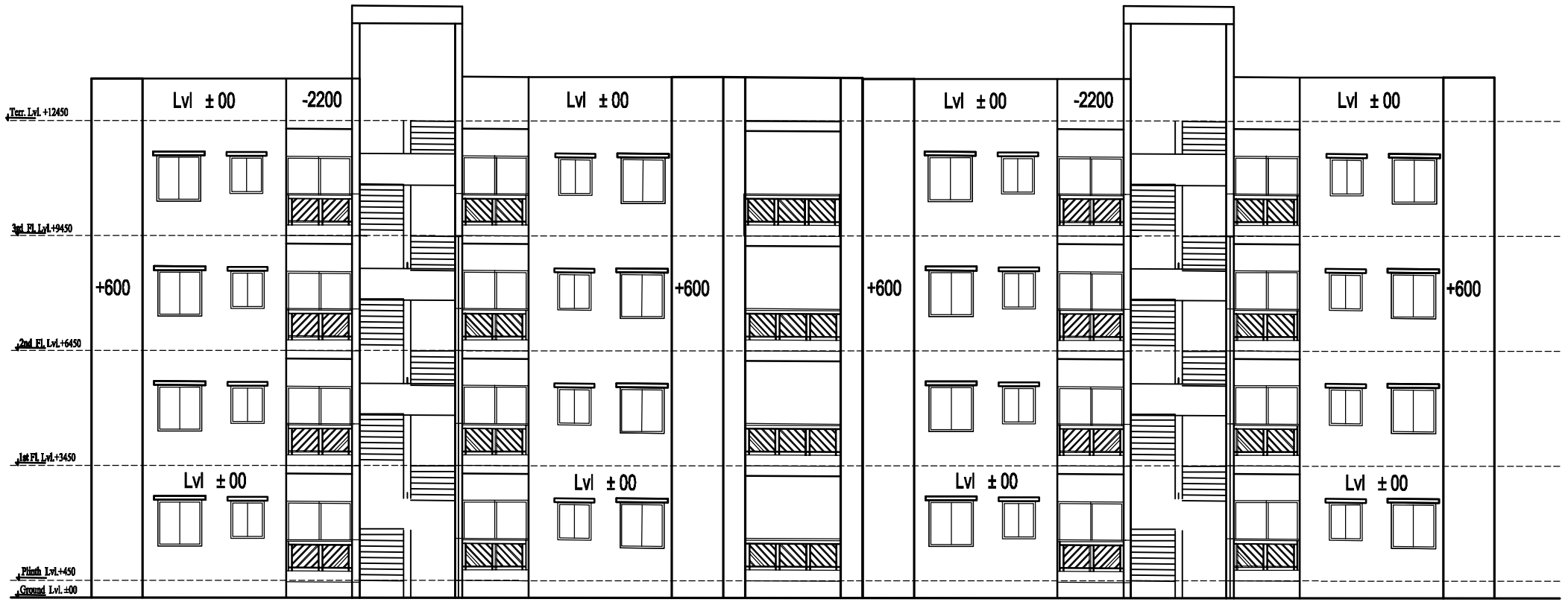

ELEVATION -B

PROJECT

PROPOSED DEMONSTRATION HOUSING PROJECT AT FATASIL AMBARI GUWAHATI, ASSAM

DRG.TITLE

ELEVATION -B

DATE MAY 2021	SCALE	NORTH
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NOTES:
- ALL DIMENSIONS ARE IN MM.
- ALL LEVELS ARE IN MM.
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- PROVISION FOR SUNKEN AREA WILL BE AS PER TECHNOLOGY DETAIL
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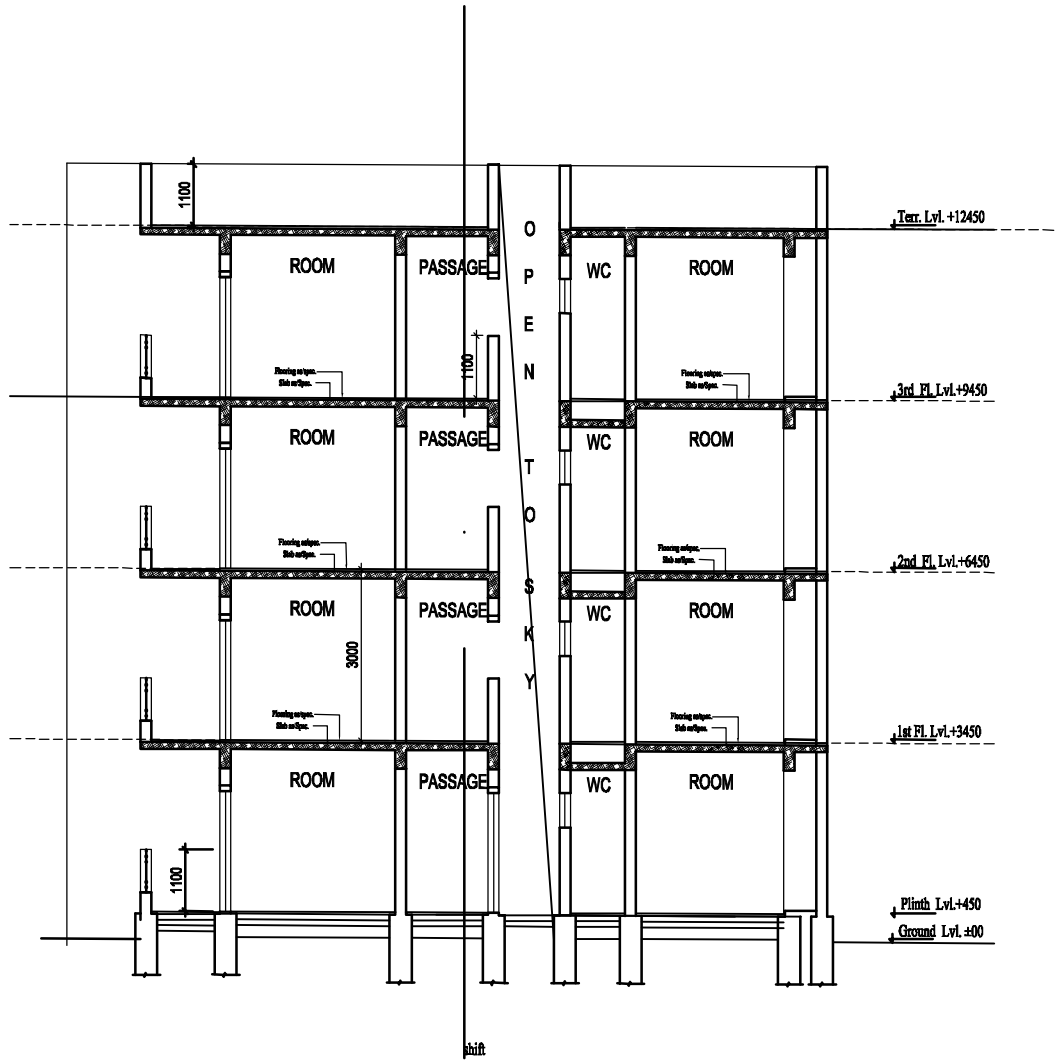
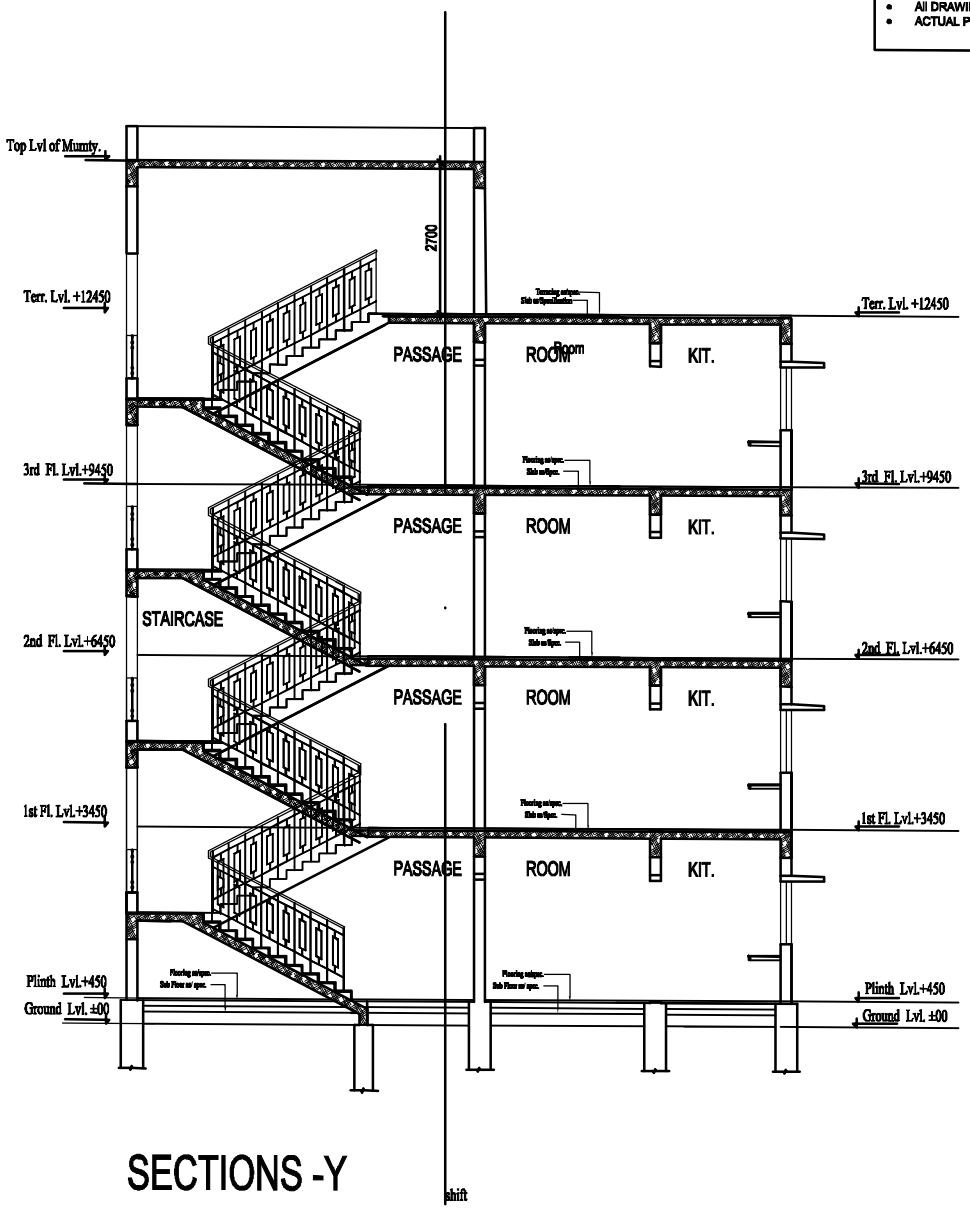


SECTIONS -X



SECTIONS -Y

PROJECT

PROPOSED DEMONSTRATION HOUSING PROJECT AT FATASIL AMBARI GUWAHATI, ASSAM

DRG.TITLE

SECTIONS

DATE	SCALE	NORTH
MAY 2021		
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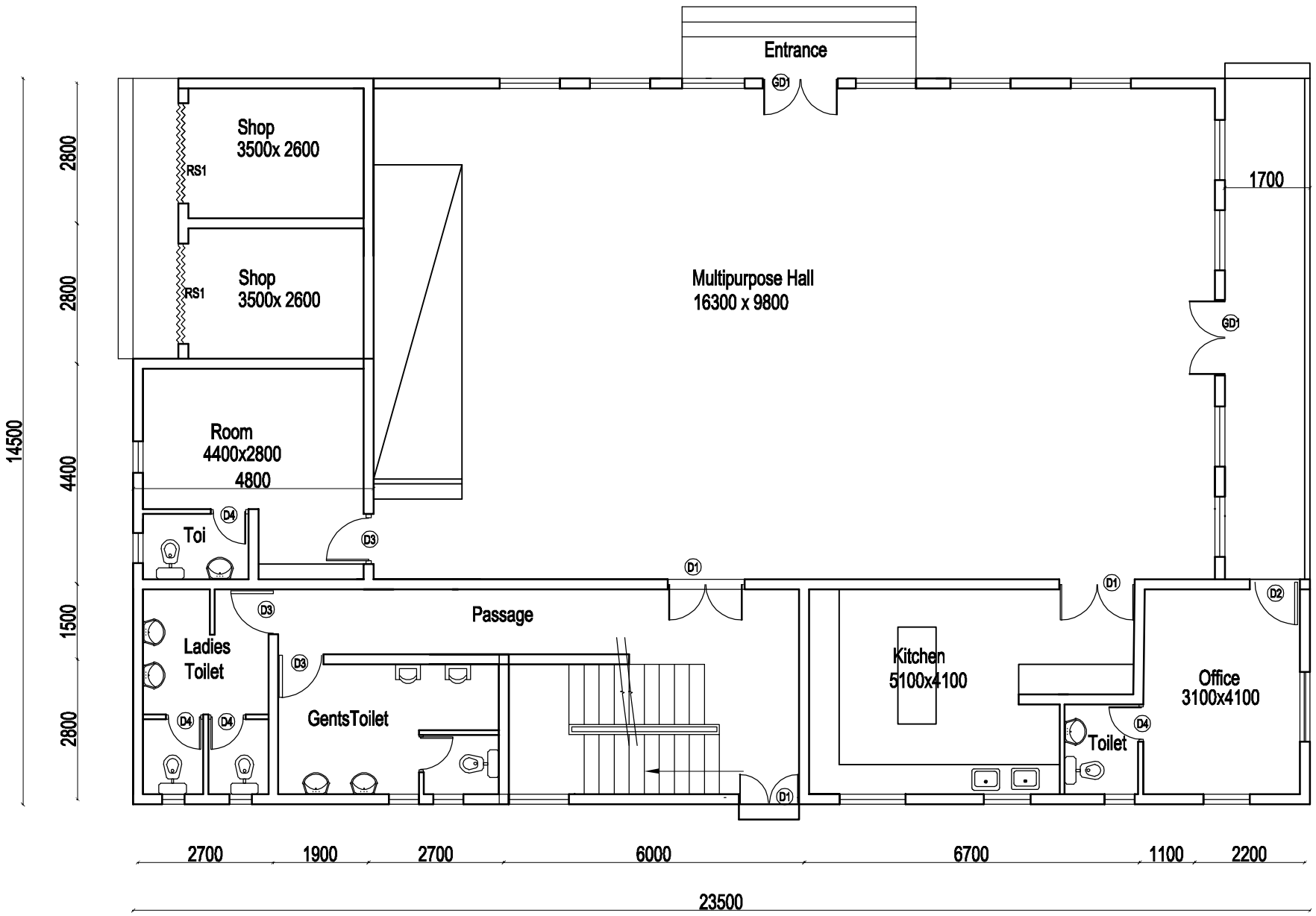
- ALL DIMENSIONS ARE IN MM.
- ALL LEVELS ARE IN MM.
- ALL LEVELS ARE TAKEN W.R.T INTERNAL ROAD LEVEL AS ±00 .
- PROVISION FOR SUNKEN AREA WILL BE AS PER TECHNOLOGY DETAIL

DETAIL OF OPENINGS

SL. No.	TYPE	SIZE	CILL LVL	LIN.LVL.	REMARK
1	D1	1500X2550	-	2550	Ent.Door
2	D2	900X2100	-	2550	Typ. Room
2	D3	900X2100	-	2100	Typ. Room
3	D4	750X2100	-	2100	Toilet
5	GD1	1800X2550	-	2550	Glazed Door
6	W1	1200X1200	900	2550	Typical
7	W2	900X1100	1000	2550	Typical
8	V1	600X600	1500	2100	Typical
9	D4	900X2100	-	2100	MS Door

Note:
All level are from finished floor level.



Ground Floor Plan

Area of Comm. Center=340.77 Sq.mts

PROJECT

PROPOSED COMMUNITY CENTER FOR DEMONSTRATION HOUSING PROJECT AT FATASIL AMBARI GUWAHATI, ASSAM

DRG.TITLE

FLOOR PLAN
COMMUNITY CENTER

DATE	SCALE	NORTH
MAY 2021		
DEALT BY	APP. BY	

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NOTES:
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- ALL LEVELS ARE IN MM.
- ALL LEVELS ARE TAKEN W.R.T INTERNAL ROAD LEVEL AS ±00 .
- PROVISION FOR SUNKEN AREA WILL BE AS PER TECHNOLOGY DETAIL

23500

ELEVATION

PROJECT

PROPOSED COMMUNITY CENTER FOR DEMONSTRATION HOUSING PROJECT AT FATASIL AMBARI GUWAHATI, ASSAM

DRG.TITLE
ELEVATION
COMMUNITY CENTER

DATE	SCALE	NORTH
MAY 2021		
DEALT BY	APP. BY	

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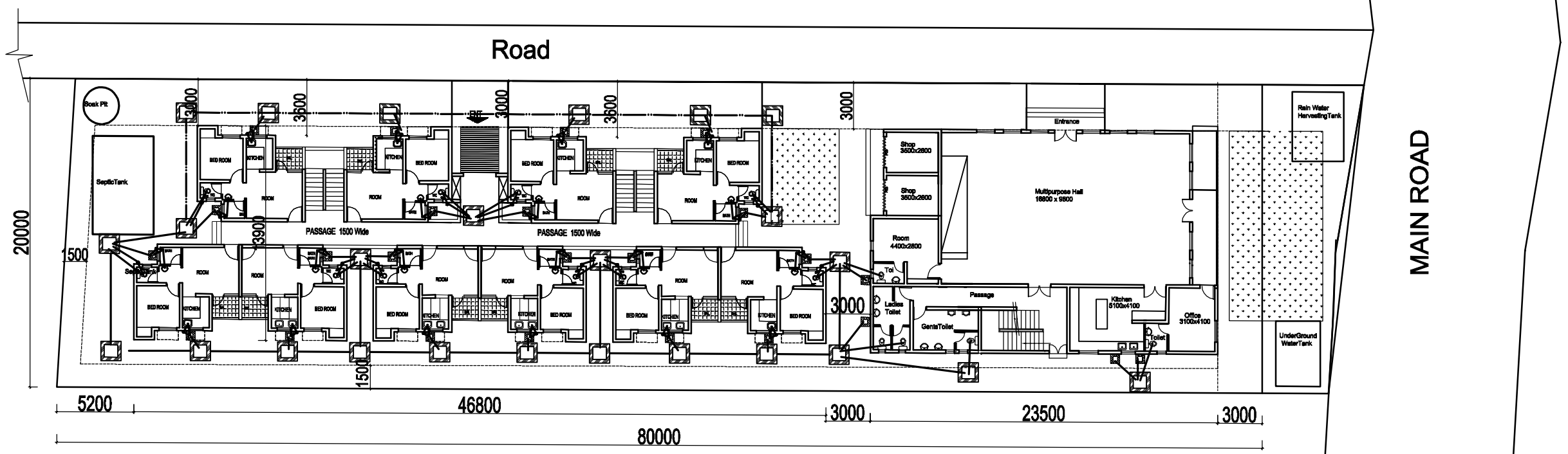

LAYOUT PLAN

Area of Plot (80.0 x20.0 M)	= 1600.0 sqmts
Area of Residential Block	= 1875.2 sqmts
Area of Community Center	= 340.7 sqmts
Total Area	= 2215.9 sqmts

PROJECT

PROPOSED DEMONSTRATION HOUSING PROJECT AT FATASIL AMBARI GUWAHATI, ASSAM

DRG.TITLE

SEWER LAYOUT PLAN

DATE MAY 2021	SCALE	NORTH
DEALT BY	APP. BY	

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NOTES:
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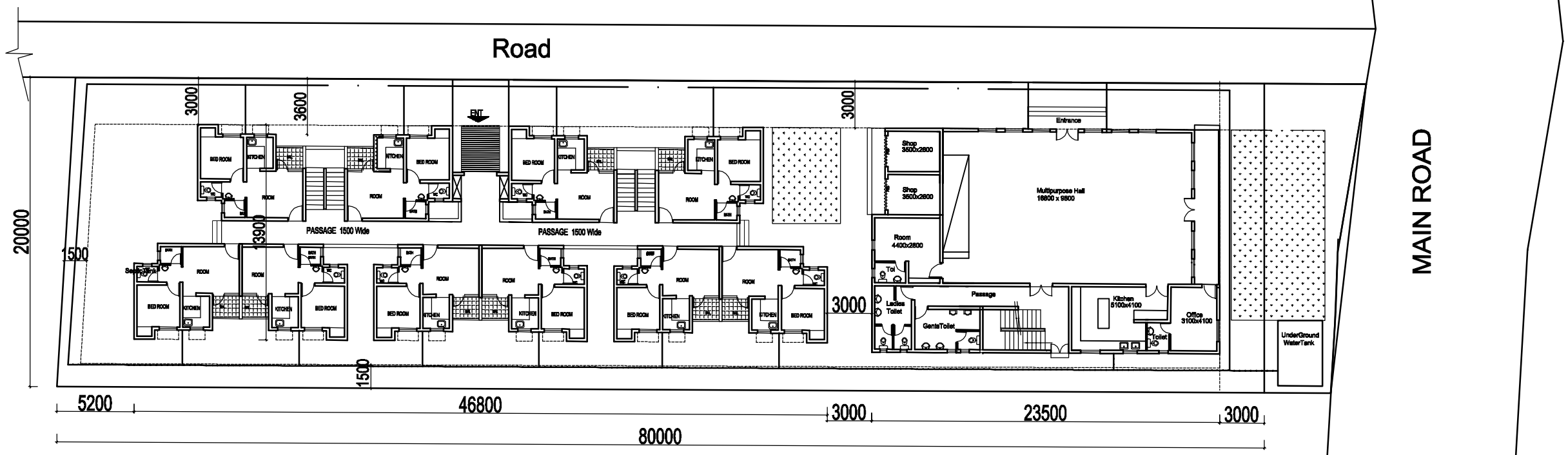

LAYOUT PLAN

Area of Plot (80.0 x20.0 M)	= 1600.0 sqmts
Area of Residential Block	= 1875.2 sqmts
Area of Community Center	= 340.7 sqmts
Total Area	= 2215.9 sqmts

PROJECT

PROPOSED DEMONSTRATION HOUSING PROJECT AT FATASIL AMBARI GUWAHATI, ASSAM

DRG.TITLE

WATER SUPPLY LAYOUT PLAN

DATE	SCALE	NORTH
MAY 2021		North
DEALT BY	APP. BY	

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DRG.FOR	☐ APPROVAL ■ TENDER	☐ CONSTRUCTION

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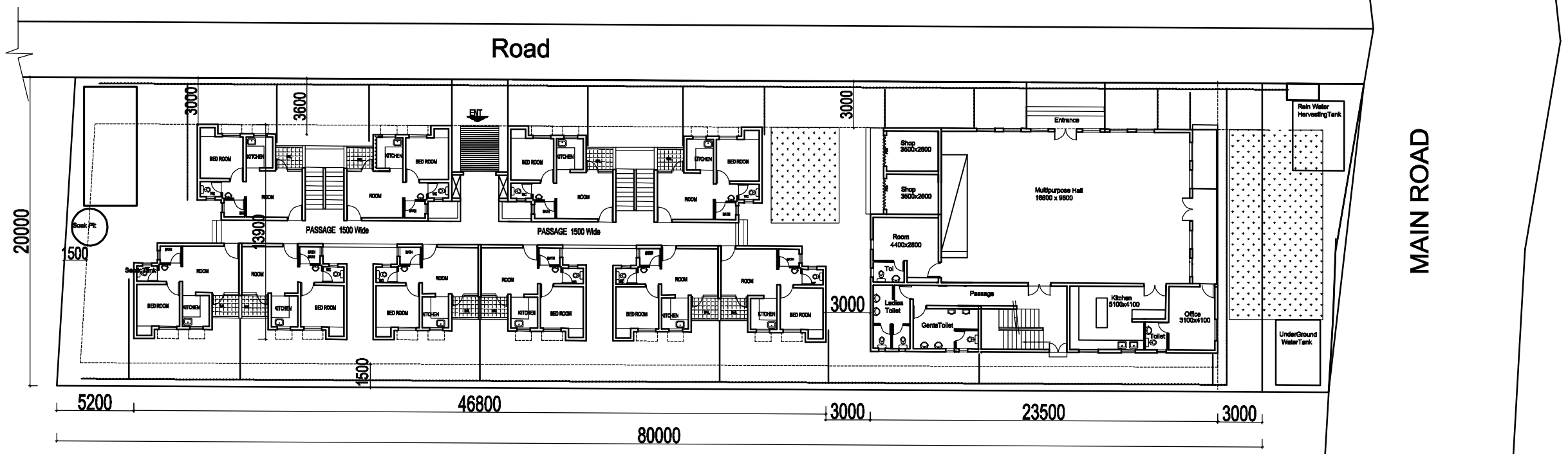

LAYOUT PLAN

Area of Plot (80.0 x20.0 M)	=	1600.0 sqmts
Area of Residential Block	=	1875.2 sqmts
Area of Community Center	=	340.7 sqmts
Total Area	=	2215.9 sqmts

PROJECT

PROPOSED DEMONSTRATION HOUSING PROJECT AT FATASIL AMBARI GUWAHATI, ASSAM

DRG.TITLE

DRAINAGE LAYOUT PLAN

DATE	SCALE	NORTH
MAY 2021		North
DEALT BY	APP. BY	

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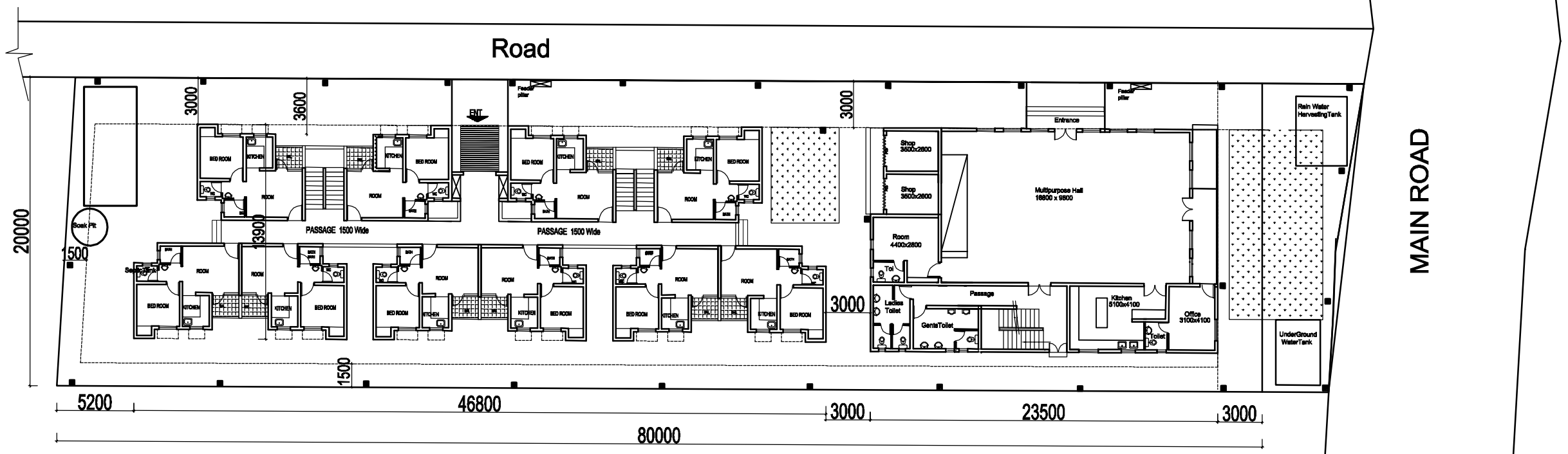
- AI DRAWINGS ARE INDICATIVE ONLY.
- ACTUAL PLAN AND LAYOUT MAY CHANGE AS PER NORMS.



LAYOUT PLAN

Area of Plot (80.0 x20.0 M)	=	1600.0 sqmts
Area of Residential Block	=	1875.2 sqmts
Area of Community Center	=	340.7 sqmts
Total Area	=	2215.9 sqmts

PROJECT

PROPOSED DEMONSTRATION HOUSING PROJECT AT FATASIL AMBARI GUWAHATI, ASSAM

DRG.TITLE

EXTERNAL ELECTRICAL LAYOUT PLAN

DATE	SCALE	NORTH
MAY 2021		North
DEALT BY	APP. BY	

BUILDING MATERIALS & TECHNOLOGY PROMOTION COUNCIL
MINISTRY OF HOUSING & URBAN AFFAIRS,(Govt.of India)
CORE-5A , Ist. FLOOR , INDIA HABITAT CENTRE ,
LODHI ROAD , NEW DELHI -110003
PHONE-011-24638096,011-24638097: Website:www.bmtpc.org.

DRG.NO.	2021/DHP-AS/AR-13	REVISION
DRG.FOR	☐ APPROVAL ■ TENDER	☐ CONSTRUCTION

Part-8

Technical Specifications of Emerging Technologies

DETAILS OF TECHNOLOGIES

RECOMMENDED UNDER

GHTC-INDIA

BY MINISTRY OF HUA

DETAILED TECHNICAL SPECIFICATIONS

A. PRECAST CONCRETE CONSTRUCTION SYSTEM - 3D PRECAST VOLUMETRIC

(1. M/s Katerra India Private Limited, 2. M/s Moducast Pvt. Ltd., 3. M/s Magicrete Building Solutions, 4. M/s Ultratech Cement Ltd.)

1. Manufacturing of 3D Volumetric Components

Fabrication and manufacturing of solid precast concrete modules (room, toilet ,kitchen, bathroom, stairs etc.) through 3D volumetric casting or structural modules cast in Plant/Casting yard assembled together through casting of wall and floor panels. Modules shall be manufactured in controlled factory environment with approved methodology including moulds, mixing, transporting and placing of concrete, vibrating, curing, finishing, making necessary cutout/holes of required sizes for services, yard handling & stacking all complete as per approved shop drawings and design mix as per the direction of Engineer-in-Charge.

2. Transportation of Modules

Transportation of Precast Elements by flat bed Trailor (Double / Triple axle 40ft Length with proper accessories like A frame etc.) from factory, including loading, unloading & stacking at site with the help of required capacity cranes.

3. Erection & Installation of Modules

Erection & Installation of Precast Concrete modules in correct & final position with proper line level and plumb at site making all arrangements (i.e cranes, push-pull jacks & all another T & P for lifting Placing & Alignment of elements, within erection tolerance as per IS 15916 (Building Design and Erection Using Prefabricated Concrete - Code of Practice) shall be as per approved shop drawings and all complete as per the direction of Engineer-in-Charge including all accessories, jointing, grouting complete. The structure shall be complete in all respect with all internal and external finishing as per approved drawings.

All relevant Indian Standards/ requirement of NBC shall be conformed for designing, casting, prefabrication ,erection and installation.

B. PRE-CAST CONCRETE CONSTRUCTION SYSTEM –PRE-CAST COMPONENTS ASSEMBLED AT SITE

(1. M/s Larsen & Toubro, 2. M/s B.G. Shirke Construction Technology Pvt. Ltd., 3. M/s Elematic India , 4. M/s PG Setty Construction Technology Pvt. Ltd. 5. M/s Teemage Builders Pvt. Ltd. 6. M/s Nordicflex House 7. M/s Adlakha Associates Pvt. Ltd. 8. M/s William Ling)

1. Manufacturing of Solid Pre-cast concrete Elements

Solid precast concrete elements shall be fabricated and manufactured with provisions of shear keys, connecting loops, dowel tubes and proper lifting accessories for walls, beams, slabs, stairs, column etc, of various thickness, shape and size of different concrete grades manufactured in controlled factory environment with approved methodology including moulds (Pallet system, Tilts form, table moulds, battery moulds, vertical moulds, beam moulds, column moulds, staircase moulds, Facade mould, etc.), mixing, transporting and placing of concrete, vibrating, curing, finishing, making necessary cutout/holes of required sizes for services, yard handling & stacking all complete as per IS 11447:1985 (Code of practice for construction with large panel prefabricates) and as per approved shop drawings and design mix as per the direction of Engineer-in-Charge. Minimum grade of Concrete for solid structural components shall be M-35.

2 Manufacturing of Pre-stressed Hollow core Slab

Prestressed Hollow Core slab (Hollow area 25 to 30%) of different thickness & modular width 1200 mm shall be fabricated & manufactured in controlled Factory Environment with approved methodology by using long line casting method having arrangement of proper steel bed. Concreting should be done by batch mixing plant capable of producing zero slump concrete, transported through automatic shuttels of standard make & layed on bed with the help of extruder/Slipformer, finishing, curing and also provision of steam curing. Cutting, making necessary cutout/holes of required sizes for services in slab element after achieving required strength, yard handling & stacking all complete as per approved shop drawings & design mix as per the direction of the Engineer-in-charge. Minimum grade of Concrete for prestressed hollow slab is to be M-40.

Prestressing steel strands (low relaxation) shall be provided & laid in position on hollow core bed by using mechanical pulling arrangement like Rabbit/ Bed master including all accessories for Stressing & destressing operations as per approved make conforming to IS1343 (Prestressed Concrete — Code of Practice) & grade FY-1860 etc, complete as per drawings and direction of Engineer -in-charge.

All relevant Indian Standards/ requirement of NBC shall be conformed.

2. Transportation of Pre-cast elements

Transportation of Precast Elements by flat bed Trailor (Double / Triple axle 40ft Length with proper accessories like A frame etc) from factory, including loading, unloading & stacking at site with the help of required capacity cranes.

3. Erection & Installation of Pre-cast elements

Precast/ Prestressed Concrete elements shall be erected & Installed in correct & final position with proper line level and plumb at site making all arrangements (i.e cranes, push-pull jacks & all another T & P for lifting placing & alignment of elements, within erection tolerance as per IS 15916 as per approved shop drawings and all complete as per the direction of Engineer-in-Charge Weather proof sealant shall be applied on outer joints of approved make confirming to relevant Indian Standard. Levelling sim pads of required sizes (5x5cm to 10x10cm) of PVC / Rubber to adjust level of bearing surface of supporting members shall be applied.

Grouting of dowel tubes / Shear keys / Joints of precast members with M-60 grade cementations grout (Non Shrink) of approved make by suitable means (Free flowing /pump) shall be done including curing etc.

C. LIGHT GAUGE STEEL STRUCTURAL SYSTEM & PRE ENGINEERED STEEL STRUCTURAL SYSTEM (LIGHT GAUGE STEEL FRAME STRUCTURE WITH FIBRE CEMENT BOARD ON BOTH SIDE AND ROCKWOOL AS INFILL WILL)

C-1) LIGHT GAUGE STEEL STRUCTURAL SYSTEM

(1. M/s Mitsumi Housing Pvt. Ltd., 2. M/s Everest Industries Ltd., 3. M/s JSW Steel Ltd., 4. Society for Development Composites, 5. Elemente Designer Home 6. M/s MGI InfraPvt. Ltd., 7. M/s RCM Prefab Pvt. Ltd., 8. M/s Nipani Infra and Industries Pvt. Ltd., 9. M/s Strawture Eco, 10. M/s Visakha Industries Ltd.)

1. Fabrication & Installation of LGSF Framing Components

Designing, providing, installing and fixing factory finished custom designed cold form Light Gauge Steel Framed super structure comprising of steel wall panel, trusses, purlins etc manufactured out of minimum 0.75 mm thick steel sheet as per design requirements. The steel sheet shall be galvanized (AZ-150 gms Aluminium Zinc Alloy coated steel having yield strength 300- 550 Mpa) conforming to AISI specifications and IBC 2009 for cold formed steel framing and construction and also as per IS: 875- 1987 (Part-I; Dead Load , Part-II; Imposed load, Part-III; wind load , Part-IV; Snow load, and Part-V; Special load & load combinations), IS 800-1984 (Code of practice for general construction in steel) and IS: 801- 1975 (Code of Practice for Use of Cold Formed Light Gauge Steel Structural Members In General Building Construction). The wind load shall be as per provisions of IS 875 (part -III). LGSFS frame shall be designed as per IS: 801 using commercially available software such as Frame CAD Pro-11.7/ STAAD PRO-V8i/ArchitekV2.5.16/ Revit architecture2011 or equivalent.

The framing section shall be cold form C-type having minimum web depth 89 mm x 39mm flange x 11mm lip in required length as per structural design requirement duly punched with dimple/slot at required locations as per approved drawings. The slots will be along centre line of webs and shall be spaced minimum 250mm away from both ends of the member. The frame can be supplied in panelized or knock down condition in specific dimensions and fastened with screws extending through the steel beyond by minimum of three exposed threads. All self drilling tapping screws for joining the members shall have a Type II coating in accordance with ASTM B633(13) or equivalent corrosion protection of gauge 10 & 12, TPI 16 & 8 of length 20mm. The frames shall be fixed to RCC slab or Tie beam over Neoprene rubber using self expanding carbon steel anchor bolt of dia as per approved drawings, design subject to minimum 12mm diameter and 121mm length conforming to AISI 304 and 316 at 500mm c/c with minimum embedment of 100mm in RCC and located not more than 300mm from corners or termination of bottom tracks complete in all respects.Hot rolled Steel sections as per design & conforming to IS 800 can be used for buildings higher than G+3.

2. Connections

Proper usage of Connection Accessories like Heavy duty tension Ties, Light duty Hold-ons, Twist Straps (to connect truss with wall frames), Strong Tie, Tie Rod, H-Brackets, Boxing Sections, L-Shaped Angles shall be ensured for required structural integrity & stability.

3. Walling Components

Walling with Fibre Cement board & Gypsum plaster board

Providing and fixing of external wall system on Light gauge steel frame work with outer face having 6mm thick heavy duty fiber cement board fixed on 9mm thick heavy duty fiber cement board confirming to IS 14862:2000, category IV type A (High pressure steam cured)as per standard sizes fixed with self-drilling / taping screws / fasteners@ 60cm c/c of approved make. A grove of 2 mm to 3mm shall be maintained and groves shall be sealed with silicon based sealant.

The board shall be fixed in a staggered pattern. Screws shall be of ounter sunk rib head of 1.60mm to 4 mm thick of 8 to 10 gauge of length varying from 25 to 45 mm and internal face 12.5mm thick gypsum plaster board fixed on 8mm thick fiber cement board confirming to IS 14862:2000 of category III type B (High pressure steam cured) as per standard sizes fixed with self-drilling / taping screws / fasteners @ 60cm c/c of approved make, proper taping and jointing to be done using fiber mesh tape and epoxy and acrylic based jointing compound for seamless finish.A breathable vapour barrier underneath the cement fiber board as per National Building Code2009 is to be provided complete as per direction of Engineer-in-charge.

Any other suitable in-fill walling materials can be used in the system, however it shall be such that the completed wall provides fire resistant & other properties as per the requirements given in National Building Code 2016.

4. Floor/ Slab

RCC floor/ roof slab as per design conforming IS 456 over deck sheet shall be provided. The thickness and profile of decking sheet shall be verified with the erection drawings. These are normally used as temporary supports for the concrete till hardens. Decking sheet has to be screwed to the joist with maximum spacing of 600 mm c/c for uniform action of concrete and joist. All the joints of decking sheets longitudinal direction require a minimum lap of 100 mm.

C-2) PRE-ENGINEERED STEEL STRUCTURAL SYSTEM (PEB)

(1. M/s RCC Infra Ventures Ltd.)

Pre-engineered Building (PEB) shall be of structural steel construction with columns, rafters, beams etc. as per design & conforming to and walls shall be of Autoclaved Aerated Concrete (AAC) blocks of approved composition, size and strength. Building shall be designed, manufactured, supplied and erected by the agency. The structural design shall be done as per the prevailing Indian standards and conforming to NBC 2016. Floor/roof slab shall be of RCC as per approved structural design. The structure will be complete in all respect with all plumbing, sanitary, electrical installations, painting and finishing as per approved drawings.

C-3) PRE-ENGINEERED STEEL STRUCTURAL SYSTEM (PEB) WITH SPEED FLOOR SYSTEM

(1. M/s Jindal Steel & Power Ltd.)

Pre-engineered Building (PEB) shall be of structural steel construction with columns, rafters, beams etc. and walls shall be of Autoclaved Aerated Concrete (AAC) blocks of approved composition, size and strength. Building shall be designed, manufactured, supplied and erected by the agency. The structural design shall be done as per the prevailing Indian standards and conforming to NBC 2016. Floor/roof slab shall be of Speed Floor system which is a suspended concrete flooring system using a roll formed steel joist as an integral part of the final concrete and steel composite floor as per approved structural design. The Speed floor system is a hybrid concrete/steel tee-beam in one direction and an integrated continuous one-way slab in other direction. The joists of different depths are manufactured from pre- galvanized high tensile steel. The joist depth and the concrete thickness are varied depending on the span, imposed loads and other functional considerations. The structure will be complete in all respect with all plumbing, sanitary, electrical installations, painting and finishing as per approved drawings.

C-4) Aerated Cement Concrete Panel System With Steel Structural Framing System

(1. M/s HIL Ltd.,
(2. M/s Biltech Building Elements Ltd.,.
(3. M/s SCG International India Pvt. Ltd.)

1 Manufacturing & Fixing of Aerated Concrete Panel

Providing and fixing in position factory made non asbestos fibre reinforced aerated cement sandwich wall/roof/floor light weight solid core panels made of light weight cement concrete core composed of OPC cement, pulverized flyash, quick lime, cotton pulp & Gypsum in mortar state mixed with aeration agent in a preset mould. The outer face on both sides of the panels shall be non asbestos fibre cement board conforming to IS 14862:2000. These solid wall panels shall be installed using Galvanized iron steel tracks/C channel of 1mm thick of required sizes as recommended by manufacturer's and fixed to floor and RCC/ steel soffit in plumb to each other with steel screw/fasteners. The panel shall be fixed vertically with tongue & groove joint with cement based polymer modified jointing compound. The exposed surface finished with fibre mesh/glass fibre tape with polymer based jointing compound having superior flexibility. Panels should be used as floor & roofing with additional structural support, steel or RCC depending upon the design. All the operation shall be completed in all respect as per drawings, Manufacturers specifications and under the overall direction of Engineer-in-Charge

2 STEEL STRUCTURAL FRAMING SYSTEM

Steel structure frame as per design & conforming to IS: 800 shall be used in the construction. Steel tracks/ C channels as per manufacturer’s specification should be used to hold the panels with the structure firmly. All jointing need to ensure required structural stability & integrity.

All relevant Indian Standards/ requirements of NBC shall be conformed.

C-5) Pre-Cast Light Weight Hollow core wall panel

(1. M/s Pioneer Precast Solutions Pvt. Ltd.)

1. Manufacture of Hollow Core Panel

   Construction using "Hollow Core light weight concrete non-load bearing wall panels manufactured in controlled factory conditions using battery moulds, light weight concrete (density 675 to 750 kg/m^3) and other additives as per manufacturer's specification. Panels are pre-cured naturally for 12-24 hrs and then water cured for seven days before installation. Panels are provided with tongue and groove joints for easy assembly. Panels are Battery mould panels. Panels are produced in standard widths & thickness and in lengths suitable to room height. Standard width is 611 mm, height 2900 and thickness 65 mm, 80 & 100mm. Panels shall conform to tolerances w.r.t. Length : **+** 3mm, Width : **+** 2mm, Thickness : **+** 1mm, Squareness of end : **+**3mm. The structure will be complete in all respect with all plumbing, sanitary, electrical installations, painting and finishing as per approved drawings.

2. Structure Framing Section & Connection
   Being non-load bearing, these panels are used with structural steel frame designed as per relevant Indian Standards and conforming to NBC 2016. The connection to framing section shall ensure required structural integrity & stability.

3. Floor/ Roof slab
   RCC floor/ roof slab as per design conforming IS 456 over deck sheet shall be provided. The thickness and profile of decking sheet shall be verified with the erection drawings. Decking sheet has to be screwed to the joist with maximum spacing of 600 mm c/c for uniform action of concrete and joist. All the joints of decking sheets longitudinal direction require a minimum lap of 100 mm.

   All relevant Indian Standards/ requirement of NBC shall be conformed.

D PREFABRICATED SANDWICH PANEL SYSTEM

D-1) REINFORCED EXPANDED POLYSTYRENE CORE PANEL SYSTEM

(1. M/s Worldhaus, 2. M/s Bau Panel Systems India Pvt Ltd, 3. M/s BK Chemtech Engineering, 4. M/s MSN Construction, 5. M/s Beardshell Ltd.)

The technical specifications would be entirely based on design parameters, however, the minimum specification as given below is recommended to be adhered to;

1. Specifications of Raw Materials for EPS Panel

i) Zinc Coated cold drawn Steel Wire – Shall be of 2.5/3.0 mm dia and zinc coating galvanizing shall be of 60 gm/m2 ± 5 gm/m2

Mechanical characteristics

Yield stress	: > 600 N/mm2
Breaking load	: > 680 N/mm2
Elongation	: > 8%

Chemical characteristics

% C	: < 0.24
% P	: < 0.055
% S	: < 0.055
% Ceq	: < 0.52

ii) Expanded Polystyrene – Self-extinguishing type EPS 80 in accordance to UNI EN 13163:2013 (IS 4671: 1984) having density not less than 15 kg/m3

2. EPS Panels for wall

Walling shall be completed using factory made Expanded Polystyrene Core Panel (EPS) based electro welded wire mesh 3D panels manufactured using the specified EPS and Cold drawn wire and sprayed structural plaster. The specification of panel shall not be less than the values given in **fig. 1 & 2** below. Both the outer faces of the panel shall be finished by applying the layer of minimum 35 mm thick cement mortar 1:3 {1 cement: 3 coarse sand (not having more than 40% stone chips of size upto 6 mm)} with the help of shotcreting / guniting equipment etc at a pressure not less than 1 bar (100Kn/m2) and both surfaces finished with trowel. The composition of spray/ mortar shall be such as to give minimum characteristic strength of 25

N/mm^2. The maximum w/c ratio shall be 0.45. The thickness of the sprayed concrete & EPS wall shall be based on design requirements.

Single panel for structural uses

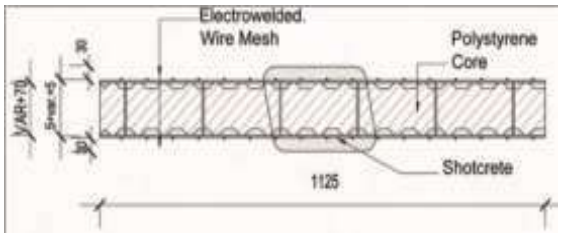
Longitudinal wire	Min 2.5 mm ø spaced @ 70 mm (Max.)	 Typical Drawing
Transverse wire	Min 2.5 mm ø spaced @ 70 mm (Max.)	
Cross steel wire	Min 3.0 mm ø approx 68 nos. / m^2	
polystyrene Core	Density >15 Kg/m^3, Thickness not less than 80 mm	
Finished Masonry	Not less than 150 mm thick	
Grade of Shotcrete	Minimum M-25	

Fig.1

Single panel for internal partition and insulation

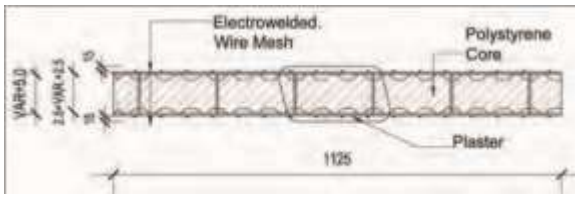
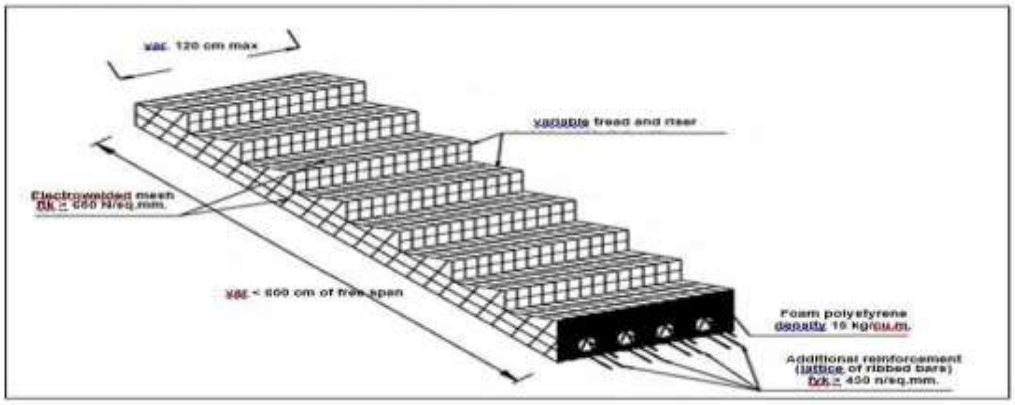
Longitudinal wire	Min 2.5 mm ø spaced @ 80 mm (Max.)	 Typical Drawing
Transverse wire	Min 2.5 mm ø spaced @ 75 mm (Max.)	
Cross steel wire	3.0 mm ø approx 45 nos. / m^2	
polystyrene Core	Density > 15 Kg/m^3, Thickness 40 mm to 320 mm	
Finished Masonry	Min 90 mm	

Fig 2

3. Staircase panel

The EPS panel based staircase would be preferred as per minimum specification given in **Fig.3**. However, the Agency can propose for construction of staircase in RCC or steel frame based staircase for approach on all floors up to terrace floor. The concrete thickness shall be as per as per design requirement & spary/mortar shall be minimum 30 mm.



Galvanized steel wire mesh:

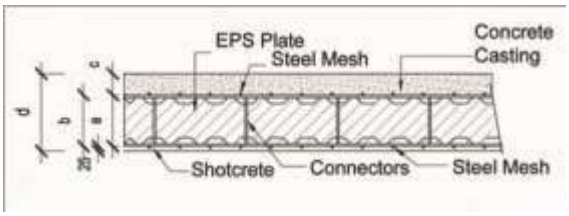
Longitudinal wires:	2.5 mm dia
Transversal wires:	2.5 mm dia
Cross steel wire:	3.0 mm dia
Polystyrene slab density:	> 15 kg/m³

Fig 3

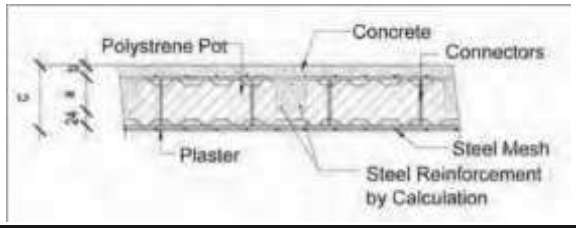
4. Flooring & Roofing

Intermediate floor shall be composite EPS as per specification and shall be designed for combined effect of dead load, imposed load & other loading conditions. The specification of panel shall not be less than the values given in below

Single Panel for horizontal structure for floor/ roof

Longitudinal wire	Min 2.5 mm ø spaced @ 80 mm	
Transverse wire	Min 2.5 mm ø spaced @ 75 mm	
Cross steel wire	Min 3.0 mm ø approx 68 nos. / m^2	
polystyrene Core	Density Min15 Kg/m^3 Thickness Min 80 mm	
Finished Masonry	Min 160 mm thick	
Grade of Shotcrete/ concrete	Min M-25	

Floor panel with reinforcement at joist

Longitudinal wire	Min 2.5 mm ø spaced @ 80 mm	
Transverse wire	Min 2.5 mm spaced @ 70 mm	
Cross steel wire	Min 3.0 mm ø approx. 68 nos. /m^2	
polystyrene Core	Density > 15 kg/m^3	

a = thickness of core; b = thickness of concrete; c = overall thickness

The Panels to be used for the floor and the roof system and reinforced in the joists with concrete casting on the site. The reinforcement of the panel can be integrated during the panel assembly by additional reinforcing bars inside the joists as per the design.

5. Connections;

Jointing of the panels shall be ensured in such a way to make it safe from vertical load, lateral loads and impact loads & to provide required structural integrity & stability. Jointing shall be sealed properly.

D-2) EPS CEMENT SANDWICH PANEL SYSTEM

(1. M/s Bhargav Infrastructure Pvt.Ltd, 2. M/s Rising Japa Infra Private Limited)

1. Manufacturing & Fixing of EPS (Beads) based Cement Panel

Providing and fixing in position factory made EPS cement sandwich wall/roof/floor light weight solid core panels made of core material of EPS granule balls/beads (conforming to IS 4671:1984 and shall have density not less than 15 kg per cum) adhesive, cement, sand, flyash and other bonding material in mortar state processed to form in a preset mould. The outer face on both sides of the panels shall be non asbestos fiber cement board conforming to IS 14862:2000 or Calcium silicate board conforming to EN 14306:2009 of 5mm thick each. Panel shall be laid on 6mm thick cement mortar (1 cement: 2 fine sand) mixed with chemical adhesive of 0.5kg per 50kg of cement or shall be preferably fixed into 'C' channel made of 1.2mm thick MS plate screwed/fastenened to the slab/column/beam etc. The panel shall fixed vertically with tongue and groove joint and horizontally locked with steel bar between each other and floors and filled with cement mortar and adhesive. Panels should be used as floor & roofing with additional structural support, steel or RCC depending upon the design. All the operation shall be completed in all respect as per drawings, manufacturers specifications and under the overall direction of Engineer-in-Charge

2. Steel Structural System

Steel structure frame as per design & conforming to IS: 800 shall be used in the construction. U type channels as per manufacturer's specification should be used to hold the panels with the structure. Additional clips may be welded with the frame pillars and beams to hold the U channel firmly with the pillars/beans and floor, to ensure structural integrity. PU glue may be applied to hold the panels firmly.

All relevant Indian Standards/ requirements of NBC shall be conformed for materials,design ,fabrication and erection.

D-3) Pre-fab PIR (Polyisocyanurate) based Dry Wall Panel System
(1. M/s Covestro India Pvt. Ltd.)

1. PIR Dry Wall Pre-Fab Panel raw material & Structural System

Construction with PIR Dry Wall Pre-Fab Panel non-load bearing walling system where two fibre cement boards (FCB) of 10 mm thickness shall be filled with insulation foam material namely Poly Isocyanurate (PIR) in-situ and erected to produce straight to finish walls.

Fibre Cement Board: Shall be 100% asbestos free and of Type A, Category 3 minimum. as stipulated in IS 14862:2000.(ii) Pre-painted Galvanized Iron (PPGI) sheet: Shall be 0.5mm thick and as conform to IS 14246:2013 (iii) Square Hollow Section (SHS)/C Channel: Shall be manufactured from pre-galvanized high tensile steel conforming to IS 277:2003. (iv) Fibre glass mesh: Shall be as per manufacturer specifications. (v) Acrylic based glue: Shall be as per manufacturer specifications. (vi) Galvanized MS screws: Shall be as per manufacturer specifications. (vii) Anchor fasteners: Shall be of 10mm to 12mm dia., 50mm to 75mm length and as per manufacturer specifications. (viii) Premix Putty: Shall conform to IS 419:1967.

PIR wall being non-loadbearing wall panels shall be supported with Steel Structural frame members as per approved structural design & conforming to IS 800 (Code of practice for general construction in steel).

2. Erection & Installation of Components

Erection & Installation of Steel sections in correct & final position with proper line level and plumb at site making all arrangements (i.e cranes, push-pull jacks & all another T & P for lifting Placing & Alignment of elements, as per approved shop drawings and all complete as per the direction of Engineer-in-Charge including all accessories, jointing, grouting complete. The structure shall be complete in all respect with all internal and external finishing as per approved drawings.

3. Floor/Roof

In-situ RCC slab or RCC slab over deck sheet as per design & relevant code shall be provided as per approved drawing.

D-4) Load Bearing Insulated Sandwich Panel System for Walling & Flooring
(1. M/s Project Etopia Group)

Brief of Housing System

It is proprietary 4Wall panelised construction system comprising of light weight load bearing insulated panels. The System is sustainable since the panels can be deconstructed & recycled. The system is energy positive (uses solar grids) with no carbon produced from running/operation of the building & it creates more energy than used, feeding back to main building. The system introduces daylight mimicry, creates perfect lighting environment irrespective of rain & shine condition. It has air purification system & smart control.

Specifications of the panel;

S. No.	Key Aspects of the system/panel	Values/details
1.	Strength	Structural loading strength of 825 KN/80 tonne
2.	Thermal Value	0.13 U value with light weight panel structure
3.	Structural Fire Resistance	66 minutes (40KN)
4.	Air Tightness	0.07 l/s/m2
5.	Panel Lightness	Heaviest panel weighs 97 Kg, meaning it can easily be lifted and transported
6.	Hurricane Resistance	Can handle/withstand winds exceeding 400 Mph

Structural Requirement

The structural design calculations should clearly demonstrate structural integrity and stability including connection details. In addition, any other requirements including safety against earthquake need to be ensured by the designer as per prevailing codal requirements. All relevant Indian Standards/ requirement of NBC shall be conformed.

E. MONOLITHIC CONCRETE CONSTRUCTION SYSTEM

(1. M/s Maini Scaffold Systems Pvt. Ltd., 2. M/ KumkangKind India Pvt. Ltd, 3. M/s S-form India Pvt. Ltd., 4. M/s ATS Infrastructure Ltd., 5. M/s Innovative housing & Infrastructure Pvt. Ltd 6. M/s MFS formwork Systems Pvt. Ltd. 7. M/s Knest Manufacturers LLP. 8. M/s Outinord Formworks Pvt. Ltd. 9. M/s Brilliant Etoile)

Aluminium Formwork System

The customized Aluminium formwork using grade 5052 aluminium with panel sheets of minimum 4 mm thick shall be used for monolithic construction of RCC members & for extruded sections grade 6061 (Type-6) aluminium shall be used. The panel sheets shall have repetitive usage of 100 times. The form work includes of beam components i.e. beam side panel, prop head for soffit beam, beams soffit panel, beam soffit bulk head and deck components i.e. deck panel, deck prop, prop length, deck mid, soffit length, deck beam bar and wall components i.e. wall panel, rocker, kiker and internal soffit corner, external soffit corner, external corner, internal corner etc., The panels are to be held in position by pin and wedge system that passes through holes in the out side rib of each panel. The tolerance of finished panels to be (-1 mm), and shall conform to IS 14687-1999 (Falsework for concrete structures – Guidelines). Pins and wedges to be made of high grade mild steel.

Modular Tunnel Form Work System

The Modular Tunnelform System shall consist of inverted L- shaped half tunnels (one vertical panel and one horizontal panel) joined together to create a tunnel. These forms are to be made up of factory cut, 80mm x 80 mm angle sections in accordance with the line of building forms. The panels shall be designed based on loading requirements with minimum 3 mm hot dip galvanized steel sheet, stiffened by folded sheet metal sections. All components shall meet relevant Indian Standards.

Structural Design

The structural design of plain & RCC shall be as per IS 456:2000 while IS 13920:2016 (Ductile detailing of reinforced concrete structures subjected to seismic forces -Code of practice) is referred for ductile detailing of reinforced concrete structure. Thickness of wall below plinth level should be minimum 200 mm with double layers reinforcement. The minimum thickness of RCC wall member shall be 120 mm. All relevant Indian Standards/ requirement of NBC shall be conformed.

F STAY IN PLACE FORMWORK SYSTEM

F-1) Expanded-Steel Panel reinforced with all Galvanized Steel Wire-Struts (M/s JK Structures)

Expanded-Steel Panel reinforced with all-galvanised Steel Wire-Struts serving both as the load-bearing steel structure and as the stay-in-place steel formwork filled with EPS-alleviated concrete.

Construction of monolithic structure completely “on site”, without formwork with 3D galvanized structural steel (as per manufacturer specification) panels assembled and reinforced with interlocked 3D steel studs and then injected with pumped-in and hand-finished EPS (expanded polystyrene) -alleviated concrete (as per approved mix design and manufacturer’s specification) combining in one single process a stay in place formwork with embedded columns and beams and bracing system. The EPS alleviated concrete is concrete produced with EPS beads. Erection & installation of the structure in correct & final position with proper line level and plumb at site making all necessary accessories & arrangements. per approved drawings and all complete as per the direction of Engineer-in-Charge including all accessories, jointing, grouting complete. The structure shall be complete in all respect with all internal and external finishing as per approved drawings. All relevant Indian Standards/ requirement of NBC shall be conformed

F-2) GFRG Panel Building System
(M/s FACT RCF Building Products Limited)

1. Providing & Erecting GFRG Panels

   Standard quality GFRG panel of 124 mm thickness with modular cavities procured from GFRG panel manufacturing plant in the country, cut to required wall sizes and floor/ roof slab sizes in correct length and height, including cutting of door, window and ventilator opening as per the cutting drawing prepared by architects /design engineers for the construction of GFRG building and loaded in stillages for transportation to the construction site. Panels to be unloading at site using suitable fork lift/ crane.
   Erection of GFRG Panels in walls in all floors using suitable crane as per instructions of Engineer-in-Charge, as per cutting drawings and structural drawings, in perfect line and plumb, above RCC plinth beam/GFRG panel below and provide necessary lateral/ slanting support to keep the wall panel in safe position, providing & tieing of Reinforcement as per structural drawings and applying a coat of water repellant coating Zycosil/equivalent or equivalent product (1 Zycosil/equivalent compound: 10 water) to saturation level over RCC plinth beam to provide water proofing treatment to joint between wall panel & plinth beam to make it sealed completely.

   Note:

   i. When cutting panel, “A” side is to be for outside or external surface of respective external wall and B side is to be for internal surface of wall
   ii. Erection of panel is to be with reference to both building plan & cutting drawing by following notational mark indicated in the cutting drawing as well as notional mark written on each panel cut as per cutting drawing

2. Filling of empty cavities

   Filling of empty cavities (as shown in the structural design drawing) with quarry dust mixed with 5% cement (by volume). After initial infill of 50 mm thick with M25 concrete at base/bottom of cavities to seal off, infill wall panel cavities in 3 stages as detailed below,

   i. 1st pour / infill to be limited to 0.3 to 0.50 m height from bottom of the panel.

ii. 2nd Pour/ infill: infilling shall be done only after 90 minutes interval between successive pours. The maximum height of infill shall be restricted to 1.5m height or up to the top level of door / window.

iii. 3rd pour/infill: After an interval of 90 minutes of second pour, infill or pour the balance height up to the bottom of embedded RCC tie beam. Pour enough water just required to dampen the dry mix enough to form cake form after each stage. (If any rain falls in between any stages of concrete pour, make sure to cover the panel top to prevent ingress of water or water falling into the cavities. In case of water collection over the concrete inside the panel, drill 10mm hole in GFRG panel immediately above concrete filled level to drain out water before pour/in-fill of balance concreting)

3. Laying of GFRG panel as roof / floor slab panel and staircase panel

Laying of GFRG panel as roof / floor slab panel and staircase panel using suitable crane as per instructions of Engineer-in-Charge, including providing support system with 25mm x 300mm-400 mm wide plywood, as runner with proper prop below proposed micro beams including

a. Cutting of top flange of panel to 180 mm wide (leaving 25mm projection on either side) to provide RCC embedded micro beam as per cutting drawings and structural drawings.

b. Reinforcement for micro beams and tie beams to be provided in position with proper anchorage as per structural drawings.

c. Provision for Electrical cabling, fan hooks and laying of pipes for plumbing work.

d. Concreting of Tie beam, micro beam and top of GFRG panels (50 mm thick) with M-25 cement concrete mix using coarse aggregate of size less than 20 mm including laying of 10 gauge 100mmx100mm size weld mesh with 25 mm effective cover from the panel top.

Supplying and fixing 10 Gauge weld mesh of size 100mm x100 mm for floor/roof slab concrete screed over the micro beams as reinforcement. The weld mesh shall be fixed as per drawing.

4. Waterproofing Applications & Sealing of Joints

i. Application of ZMB 60/equivalent solution (100 Kg ZMB 60/equivalent, 1 litre ZMB Nano Thinner, 20 litre water & 1 Litre Zycoprime/equivalent = 122 litre/kg) over already applied coat of Zycosil/equivalent & Zycoprime/ equivalent solution on the top of all the RCC plinth beams by brush/spray coat before erection of GFRG over RCC plinth beams in GF. In the case of upper floors 150 mm wide on floor slab for all the external walls, bath/toilet/ wet areas (3 hrs drying time) before erection of wall panel on upper floors including erection of parapet wall.

ii. After erection of GFRG wall panels, seal all GFRG wall joints with paper tape temporarily. Water proofing treatment of vertical joints with Zycosil/equivalent water proofing Solution (1 litre of Zycosil/equivalent & 20 litres of water stirred first & 2 litres of Zycoprime/equivalent added and stirred (total 23 litres)) with 50 ml syringe till the gap and in filled concrete is completely saturated. After removing the paper seal, seal off the vertical joints with water proofing material “Grout RW/equivalent”.

iii. Filling of joints between RCC plinth beam / floor slab and wall panel of external walls, toilet / bath room / wet areas walls on all floor and parapet wall over roof slab, stair case

head room at the time of erection of GFRG panels with Grout RW/equivalent sealant compound after the erection of panel before the infill of concrete in panel cavities and fine finish. This applies for all horizontal and vertical joints between GFRG wall and slab panels.

iv. Water proofing treatment of Vertical joints (of external side and internal side) between door frame, window & ventilator frames (on all four sides) of outer wall over the Zycosil/equivalent & Zycoprime/equivalent solution already applied (before the installation of door / window / ventilator frames in position) and fine finish with Grout RW/equivalent.

v. Water proofing treatment of RCC sunshade with Zycosil/ equivalent water proofing Solution (1 litre of Zycosil/ equivalent & 20 litres of water stirred first & 2 litres of Zycoprime/equivalent added and stirred (total 23 litres)) till it meets the saturation level and testing as per RILEM or by water drops test in which water drops do not absorb but drops remain or rolls.

vi. In-filling / sealing of joint between RCC lintel cum sunshade and wall (on external side) in all floors by pushing in Grout RW/equivalent in paste form and coving 20 mm x 20 mm after applying a coat of Zycosil/equivalent & zycoprime/equivalent solution before cement plastering of top, bottom and sides of RCC sunshade.

All relevant Indian Standards/ requirement of NBC shall be conformed.

F-3) Structural Stay In Place Galvanized Steel formwork system
(M/s Coffor Construction Technology Pvt. Ltd)

Brief Discription

The formwork system comprises of two filtering grids made of rib mesh reinforced by ‘C’ channel vertical stiffeners. The grids are connected by rebar which act as horizontal stiffeners and connector which act as a shear link. The grids on both faces act as sacrificial formwork in which concrete is poured in-situ. The vertical steel channels and horizontal steel bars act as steel reinforcement for load bearing wall. The connectors help to fold the formwork for easy transportation.

After the erection of formwork panels in alignment, corners, edges of doors and windows frame

are closed with rebar positioning & concrete of required grade is poured in the panels. The concreting may be done with a pump, bucket or with a shovel loader. The inside and outside walls are finished with cement plaster of suitable grade. The panels are prefabricated according to a structural plan (based on client's architectural plans) designed by structural engineers.

Product assembly Components in Structural Stay-in-Place Formwork Panel**:**

The various parts of Structural Stay-in-Place Formwork panel are explained briefly below:

C-Chanel

These are vertical stiffeners, work as vertical steel in Reinforced Concrete wall

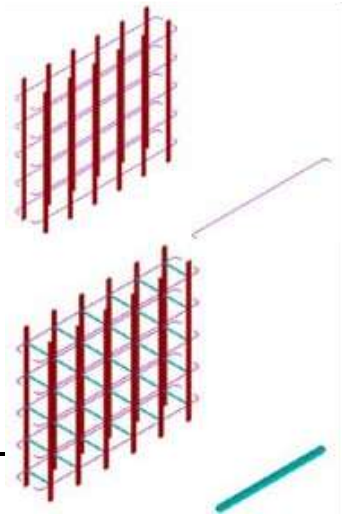
It is made up of 0.6 mm thick galvanized sheet. The 180 GSM to 275GSM zinc coating is used based on geological location to prevent rusting of steel.

Area of profile is 60.6 mm^2 (i.e > 8 mm dia bar)

Placed at every 200 mm distance along the width

Rebar

Rebar's are horizontal stiffeners at every 200 mm or 100 mm centre to centre



It is 5 mm dia MS bars and work as distribution bar.

Made up of Fe 415 Grade steel

Connector

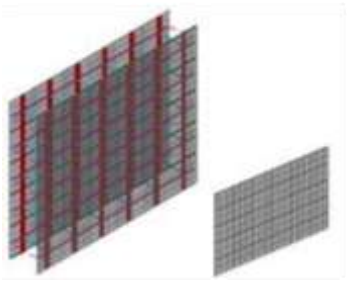
Connects C profile & Rebar.

It is made up of 1.6 thick Cold Rolled Cold Annealed (CRCA) plates of120 gm/m^2 zinc coated sheet to prevent rusting

Works as shear link to connect steel on both face of form work.

Also helps to avoid bulging of formwork during concrete pouring.

Part – 4: Rib Mesh



Rib meshes are filtering grids.

They are made up of 0.42 mm thick high galvanized sheet with 180

GSM to 275 GSM zinc coating used as per geological location to prevent rusting of steel

It works as reinforcement to plaster to prevent crack generated due to contraction and expansion.

Also provide good bonding to plaster

Size and Types of Panels

Panels are normally produced in sizes as given below (See Fig. 2): Width (W): 300mm, 500mm, 700mm, 900mm & 1100mm Height (H): 500mm to 5000mm in multiples of 100 mm. Thickness (T): 100mm, 140mm, 160mm, 200mm & 250mm. However, customized sizes also be made available on demand.

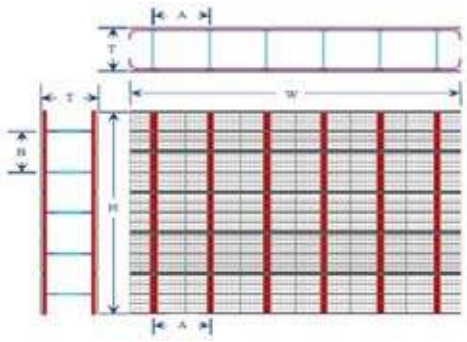


Fig.2

Panel Type	T mm	A mm	B mm	W mm	H mm
C10	100	200	100, 200	300,	Min.
C14	140	200	100, 200	500,	500
C16	160	200	100, 200	700,	then
C20	200	200	100, 200	900,	in multiples
C25	250	200	100, 200	1100	of 100

Types of panels are given below:

i. Standard single panels – These panels shall be used for slab shuttering but may also be used as shuttering option for RCC wall having thickness of more than 350mm. (Fig. 3)

ii. Double panels – Double panels shall have inbuilt steel and not require extra reinforcement. In double panels, the grids shall be connected by articulated rebar loops and connectors that fold.

These panels are of two types:

a. Standard double panels shall be of fixed size and need to be cut on site for openings etc.
b. Customized double panels from the factory shall have required cutting for openings as per drawing and there is no need for cutting on site.
c. These panels create a monolithic structure as it allows pouring of walls and slab together. These panels shall be used for load bearing walls, retaining walls and shear walls. (Fig. 4)

iii. Insulated Double panel – These panels shall have an integrated insulation on the exterior side. The insulated material shall be of polystyrene or polyurethane of required thickness as per design.(Fig. 5)

iv. Fiber Cement Double panel – These panels shall have its interior face as fibre cement board which has smooth surface and avoid plastering of walls. (Fig.6). These panels may be used for water retaining structures.

Fig.3 Standard Single Panel

Fig.4 Standard Double Pane

Fig.5 Insulated Panel

Fig.6 Fiber Cement Panel

Foundation

Strip Footing or normal column and beam structure up to Plinth level based on soil condition.

In case of Strip footing, Coffor panels will start from foundation and on the top of strip concrete raft which increase speed to come out from the ground.

Installation of Panel:

Layout and Blocking

The alignment shall be traced with chalk on the two sides. Boards/batten shall be nailed on the ground to indicate the positioning of one face of the panels.

Positioning the Panel

- The Structural formwork panels shall be fitted over projecting vertical reinforcing rods. Each panel shall be held vertically with wood pieces (boards/battens) or metal pieces (L-sections/tubes). The minimum length of these bracing elements shall not be less than 1.80m. The panels shall preferably be positioned beginning from the angles and from the doors. Whenever length of the wall does not correspond to a multiple of width of the panels, the last panel shall be cut with a rotary saw to adjust to length of the wall. The horizontal battens shall be installed on a single side. The verticality shall be checked using a plumb line or level.

- Shuttering of Slab: after completion of Coffor panel installation of the wall, slab shuttering will start either with use of Coffor single panels or normal conventional shuttering for RCC or any other slab.

- Plumbing and Electrification: After installation of slab shuttering, electrical and plumbing conduits can be placed in between panels. For installing the electrical box, panels can be cut with small grinder machine.

- Panel alignment & slab steel needs to be checked & ensured prior to concreting.

- Concrete Pouring: The placing of concrete of specified grade is done in wall and slab in one go with either with Boom placer, stationary pump or manually. As all concreting is done in one go, a monolithic reinforced concrete structure is created.

Structural Requirements of the Construction

Design analysis of the Structural formwork walls, panels, floor slabs etc. shall be done using Staad Pro Software or equivalent. The Optimal result is obtained when walls shall be designed as braced construction elements whose horizontal loads are supported by other bracing elements belonging to the same construction e.g. shear walls. The panels with concrete shall act as “lightly reinforced RCC walls” as per clause 32 of IS 456:2000 and as “prefabricated concrete load bearing walls” as per IS 15916:2010 & IS 15917:2010 & amp; IS 15971:2010.

Structural design and analysis of the formwork shall be based on relevant Indian and International standards. The panel construction assembly shall be used for free standing walls when designed and anchored as cantilever walls. Panels shall be reinforced and tied at vertical joints to maintain alignment. Additional reinforcement and cement plaster shall be provided as per the design requirement. Foundation shall be specifically designed in accordance with provisions given in IS 1904:2005. All relevant Indian Standards/ requirement of NBC shall be conformed.

F-4) Stay-in-Place Formwork System PVC Form for Shear Walls
(M/s Joseph Jebastin (Novel Assembler Private Limited)

Brief Description

Stay in place PVC form wall System consists of rigid poly-vinyl chloride (PVC) based polymer components that serve as a permanent stay-in-place durable finished form-work for concrete walls. The extruded components slide and interlock together to create continuous formwork with the two faces of the wall connected together by continuous web members forming hollow rectangular components. The web members are punched with oval-shaped cores to allow easy flow of the poured concrete between the components. The hollow Wall components are erected and filled with concrete, in situ, to provide a monolithic concrete wall with enhanced curing capacity due to water entrapment, as the polymer encasement does not allow the concrete to dry prematurely with only the top surface of the wall being exposed to potential drying. The polymer encasement provides crack control vertically and horizontally for the concrete, and provides vertical tension reinforcement thus increasing the structural strength of the wall. Steel dowels are necessary to anchor the wall to the concrete foundation.

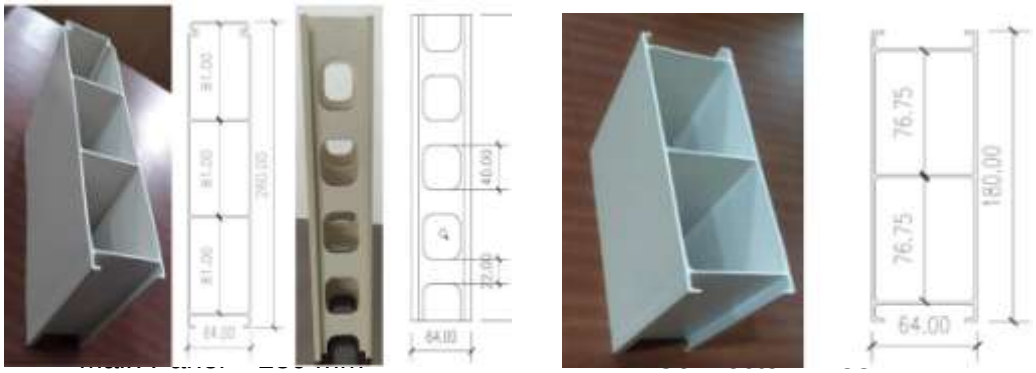
Size of Panels Size:

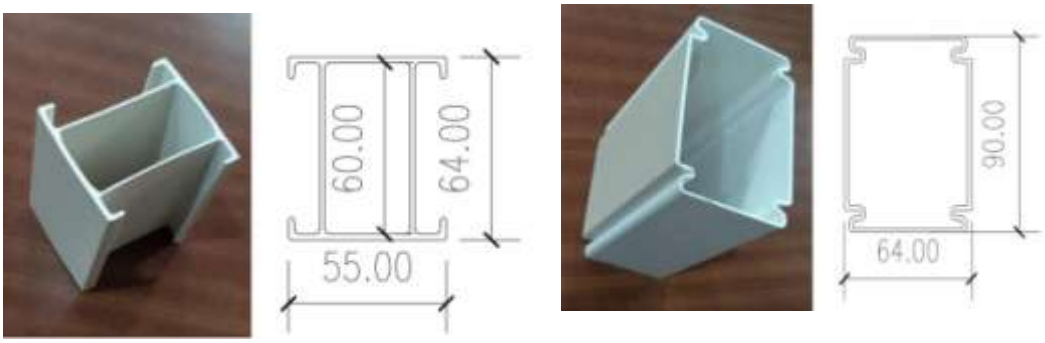
Wall Panels have been developed in various cross-sectional sizes as per project requirement. The common sizes are 64mm, 126mm, 166mm & 206mm. However available wall types are as follow:

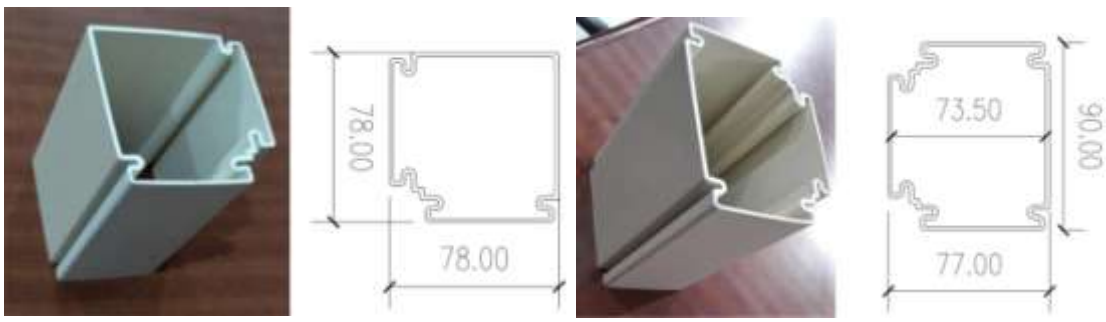
Wall components	Wall Thickness		
	Overall (Nominal)	Concrete Core	Insulation[1]
N64	64 mm	60 mm	0
N126	126 mm	120 mm	0

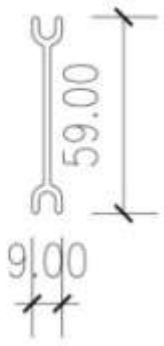
- N64 walls are erected individually and not preassembled, except for headers and sills.
- Pre-assembled walls sections are used for walls over 4300 mm (14') high
- The height of walls made with the Formwork vary according to the requirement.
- N126 walls less than 4300 mm (14') high are erected individually except for walls of unique projects and for headers and sills.

Panel Components



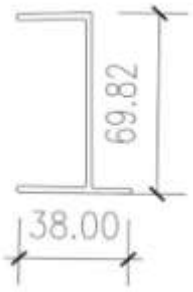




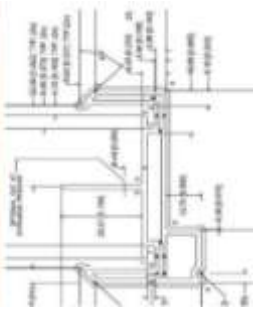


Jointer Connector

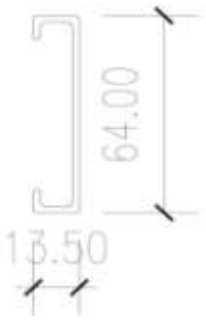
Basic Frame



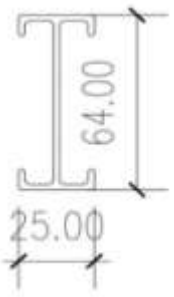
Window Frame



Azteca Frame



Starter



Jointer Panel

Design Consideration

General

The walls shall be designed to accommodate a wide range of axial, wind and seismic load conditions, using the equations developed for conventional and slender concrete walls. However, one of the unique properties of Novel walls is the ability of the permanent polymer formwork to provide concrete confinement and reinforce the concrete in tension. There are two main structural elements used in the wall, namely panel sections and box connectors. The panels come as three-cell sections 250 mm wide, while the box connectors are one-cell sections 64 mm wide. The webs of these elements have oval cores which allow lateral flow of the poured concrete between the adjacent cells and provide a mechanical transfer of forces between the concrete and the polymer thus creating a composite action.

Floor/Slab

In-situ RCC slab as per IS:456:2000 shall be provided.

Structural Aspects

The buildings constructed with the system walls shall be designed as reinforced concrete structure since the parameters required for their design are the same as needed for traditional reinforced concrete. The building shall be designed in accordance with IS 456:2000, as applicable.

The system shall be designed to provide the required performance against the loads to be taken into account in accordance with IS 875 (Parts 1-5):1987 and the data given by manufacturer for various panels. It shall also provide the required bearing resistance for earthquake and wind forces as per IS 875 (Part 3):2015 and IS 1893 (Part 1):216, wherever applicable.

Foundation shall be specifically designed in accordance with provision given in IS 1904:2005. Both single and double panels should have starter bars from either foundation or ground floor slab.

The structural design calculations should clearly demonstrate structural integrity and stability including connection details. In addition, any other requirement regarding safety against earthquake need to be ensured by the designer as per prevailing codal requirements. All relevant Indian Standards/ requirement of NBC shall be conformed.

F-5) Insulating Concrete Forms (ICF) System

(M/s Reliable Insupack Building Solutions)

Insulating concrete Forms (ICF) System comprises of a panel of two walls of *Expandable Polystyrene* (EPS) separated by a nominal distance of 150mm by hard plastic ties. These are assembled on site to hold reinforced concrete. The forms are open ended hollow polystyrene blocks which fit tightly together to form a shuttering system. Concrete poured into the hollow space to form a continuous wall. When cured, this wall supports the structural loads from floors and roofs, and the shuttering provides thermal insulation.

Reinforcing steel shall be as required as per the design parameters. Upper and lower surfaces of the polystyrene panels are castellated and the vertical mating surfaces are tongue-and-groove to form a tight fit when joined together. The rigid formwork does not require supporting falsework. Form locks are used for end stops. The outer surfaces are grooved vertically at 50 mm centres to aid cutting and trimming. Plan view of ICF is shown in Fig. 1.

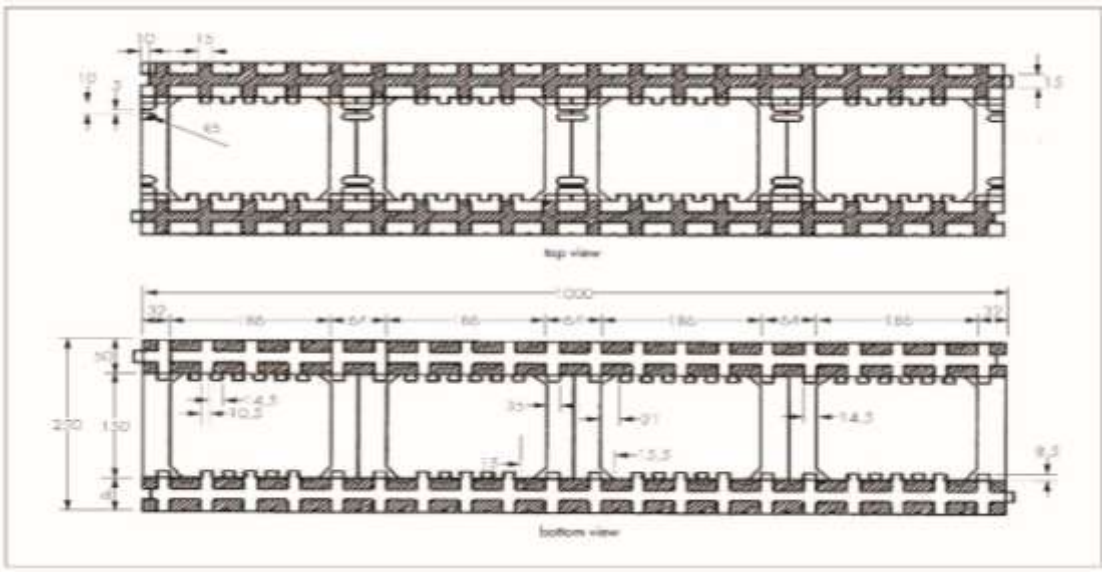


Fig. 1

Types of Forms

Standard Forms – These form bulk of the forms and have 50mm EPS panels on both sides with hard plastic ties holding the panels. Dimensions of these forms are 1000 x 250 x 250mm. (See Fig. 2)

Lintel Forms - In combination with Half Height forms, these form the top layer of all wall gaps and hold the concrete thus preventing thermal leaks. Dimensions of these forms are 1000 x 125 x 250mm. (See Fig. 3)

Half Height Forms **–**Together with the lintel, these form the top layer of all gaps in the wall and hold the required steel reinforcement. Dimensions of these forms are 1000 x 150 x 250mm. (See Fig. 4)

Floor Edge Forms – These form the top most layer, where the wall ends and floor begins. This envelopes the floor slab and thus prevents thermal bridging. Dimensions of these forms are 1000 x 375/125 x 250mm. (See Fig. 5)

Corner Forms – These constitute 90º corner of the building. The two sides are 50mm EPS panels held together with 8 hard ties. Dimensions of these forms are 750/500 x 250 x 250mm. (See Fig. 6)

End Forms – These create wall ending by fitting in inside the Standard or Corner form and provide a smooth and thermal bridge ending to the wall. Dimensions of these forms are 150 x 125 x 50mm. (See Fig. 7)

Fig. 2 Standard

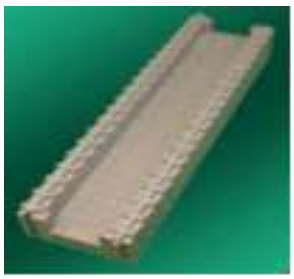


Fig. 3 Lintel

Fig. 4 Half Height

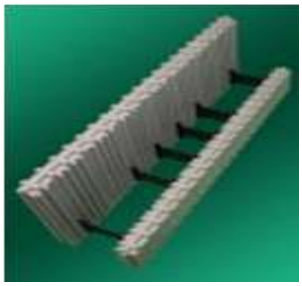


Fig. 5 Floor Edge

Fig. 6 Corner

Fig. 7 End

Typical construction

Construction process

The construction of most Insulating Concrete Forms (ICF) & Monolithic Insulated Concrete Systems (MICS) buildings is fundamentally a process of stacking lightweight blocks together in a similar manner to building bricks, laying reinforcement where necessary and pouring concrete into the voids of the block work.

Footings

The footings for Insulating Concrete Forms (ICF) & Monolithic Insulated Concrete Systems (MICS) buildings shall be reinforced concrete rafts or strips that are flat and even enough to enable stacking of the form blocks, with reinforcement starter bars set ready to connect with the concrete when poured into the formwork.

Load bearing walls

Any Insulated Concrete System/Forms wall can be designed to be load bearing.

Joints and connections

Joints and connections with other building elements shall be kept to a minimum, especially when the flooring or roofing elements are also made from Insulated Concrete System/Forms.

Fixings

The foam block work or formwork forms a poor basis for any fixings. Light loads are generally carried by the lining or facing materials, such as plasterboard, and heavier loads can be carried by supporting points drilled into the concrete that forms the inner material of the Insulated Concrete System/Forms.

Openings

Major openings for doors, windows, etc., shall be set out in the formwork as it is relatively difficult to make changes later, owing to the fundamentally monolithic nature of the structural elements. Once openings have been made, they can accommodate window and door frames of any type. A typical kind of fixing uses timber blocks set into the ends of the form blocks around the opening.Electrical conduit and plumbing is generally run in chasing in the depth of the form blocks.

Finishes

Finishes are dependent on the materials used to face the Insulated Concrete System/Forms units. Typically, the main finish is a render or render-equivalent covering or paint. Any additional cladding can be added to the Insulating Concrete Forms (ICF) & Monolithic Insulated Concrete Systems (MICS) walls subject to making appropriate sup- ports for it, although many sheet finishes, such as plasterboard, can be glued directly to the surface of the formwork. External renders require a base or skim coat embedded with fibreglass mesh, followed by a second coat and then a texture coating, finally finished with an 'armour coat'.

RAW MATERIALS

- Expanded Polystyrene (EPS): Self-extinguishing type EPS shall conform to IS 4671: 1984 having density not less than 25 kg/m3 and valid Restriction of Hazardous Substance (ROHS) test certification.
- Polyurethane (PU) Foam Adhesive: Shall have Skin Formation of 8 min, Density 25 kg/m³, Sound insulation 58 dB, Insulation factor 35 mW/mK, Shrinkage< 2%, Fire rating B3, Insulation factor 35 mW/m.K and Water absorption of 1 % volume
- Plasticizer: Slump retaining super plasticizer for self-compacting plastic concrete (CEMWET SP-3000) shall conform to IS 9103:1999
- Hard Plastic Tie: Shall be made with High density polyethylene ensuring stability
- Cast-in-place concrete: The ingredients, grade of concrete & slump for walls, floors and roofs shall be used as per IS 456:2000.

Structural Aspects

The Insulating Concrete Forms (ICF) & Monolithic Insulated Concrete Systems (MICS) may be designed using the appropriate design software. The buildings constructed with EPS shall be designed as reinforced concrete structure since the parameters required for their design are the same as needed for traditional reinforced concrete. In the calculation model, the building shall be

designed in accordance with IS 456:2000, as applicable, as structure composed of load bearing walls with a box-like structure.

The system shall be designed to provide the required performance against the loads to be taken into account in accordance with IS 875 (Parts 1,2,4&5):1987. It shall also provide the required bearing resistance for earthquake and wind forces as per IS 875 (Part 3):2015 and IS 1893(Part1):2016, wherever applicable. All relevant Indian Standards/ requirement of NBC shall be conformed.

F-6) Building PVC wall material

(M/s Kalzen Realty Pvt. Ltd)

Brief Description

Stay-in-place formwork consisting of hollow-type rib- reinforced Poly-vinyl chloride (PVC) material comprising of two PVC panel facings with internal PVC ribs, are used as permanent formwork for concrete walls. The web members are punched with cores to allow easy flow of the poured concrete between the components. After putting vertical & horizontal reinforcement as per the design, the hollow Wall components are filled with concrete, in situ, to provide a monolithic concrete wall.

Standard Panels

The standard size of available panels is as follows;

Height	Standard panels: 3 meters or 3.3 meters heights All panels can be ordered to custom height Minimum 0.5m; Maximum 6m
Panel width	Standard wall panels: 400mm Half wall panels: 200mm Quarter panels: 100mm
Thicknesses of Profile	110, 150 and 200 mm
PVC thickness	2.5 mm
PVC density	1,300 kg/m^3
Concrete volume	110mm profile: 0.10 cum per sqm 150mm profile: 0.14 cum per sqm 200mm profile: 0.18 cum per sqm

Weight	110mm profile: 18.1 kgs per sqm 150mm profile: 21.6 kgs per sqm 200mm profile: 23 kgs per sqm

The product shall not be affected by exposure to sunlight either in storage or as part of finished product.

Walling System

The wall shall be erected by placing the panels side by side or sliding the new panel down from top and held by using the clipping mechanism. The panel shall have double-hole system ensuring the position of the horizontal and vertical steel reinforcing bars.

The horizontal bars shall be placed along with the laying of panel and vertical bars shall be placed by dropping from top to improve the accuracy and structure of the wall, and minimize variations in the concrete thickness surrounding the reinforcing bars. Once the wall is erected, the plumbing and electrical conducting is done as per the design. After this, concrete of required Garde as per structural design shall be poured into the cavities. Once filled, the system acts as structural element. The external surface shall have specified finish.

Wall panel

Floor/Slab

In-situ RCC slab as per IS:456:2000 shall be provided.

Structural Aspects

The buildings constructed with the system shall be designed as reinforced concrete structure since the parameters required for their design are the same as needed for traditional reinforced concrete. The building shall be designed in accordance with IS 456:2000, as applicable.

The system shall be designed to provide the required performance against the loads to be taken into account in accordance with IS 875 (Parts 1-5):1987 and the data given by manufacturer for various panels. It shall also provide the required bearing resistance for wind forces & earthquake as per IS 875 (Part 3):2015 and IS 1893 (Part 1):2016, wherever applicable.

Foundation shall be specifically designed in accordance with provision given in IS 1904:2005. Both single and double panels shall have starter bars from either foundation or ground floor slab.

The structural design calculations should clearly demonstrate structural integrity and stability including connection details. In addition, any other requirements including safety against earthquake, cyclone shall be ensured by the designer as per prevailing codal requirements. All relevant Indian Standards/ requirement of NBC shall be conformed.

F-7) Fast Bloc Insulated Concrete Form (ICF)

(M/s Fast Bloc Building System)

Brief Description

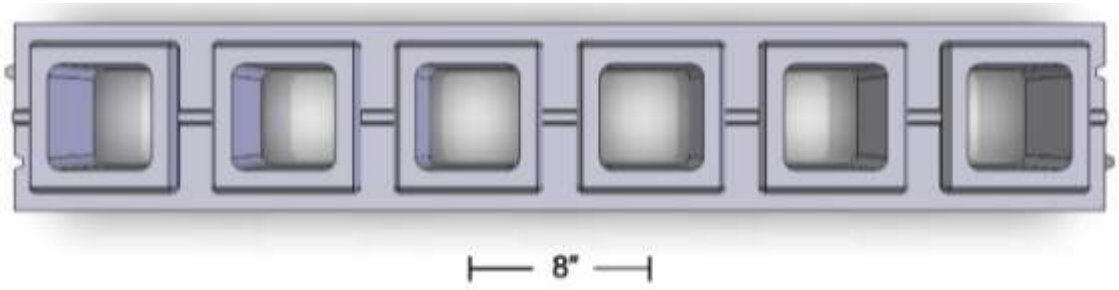
The FastBloc Building System (FastBloc) is stay-in-place, formwork for reinforced concrete, post and beam construction, thus creating skeleton with required strength within the wall. In the System, Expanded Polystyrene (EPS) blocks are stay in place forms which provide insulation and sound barrier. Concrete and rebar shall be installed along the wall as per design requirement.

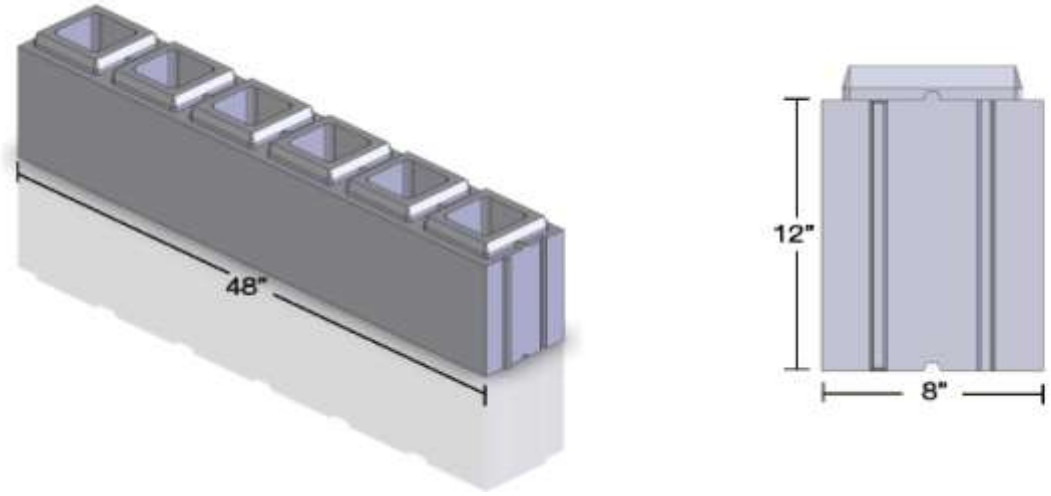
Standard Panels

Standard FastBloc has two different sizes as below;

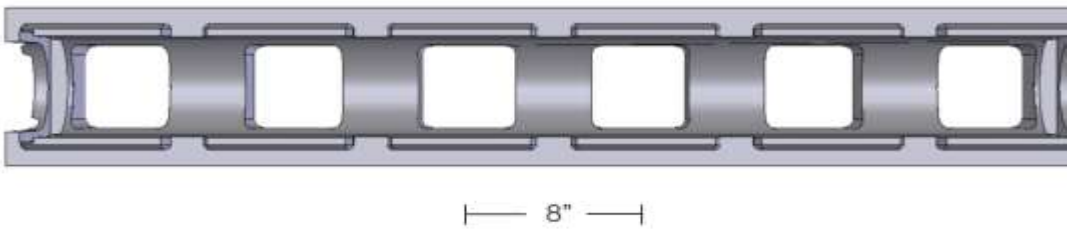
1. 15.10 cm (6 inches) x 30.50 cm (12 inches) x 121.00 cm (48 inches),
2. 20.32 cm (8 inches) x 30.50 cm (12 inches) x 121.00cm (48 inches)

These two sizes can be assembled to cater the needs of any project. The spacing of the cells allows for walls to be reinforced based on the needs of the project, location, number of stories, and other parameters based on structural design. As per the requirement, Lintel blocks shall be used.





FastBloc®



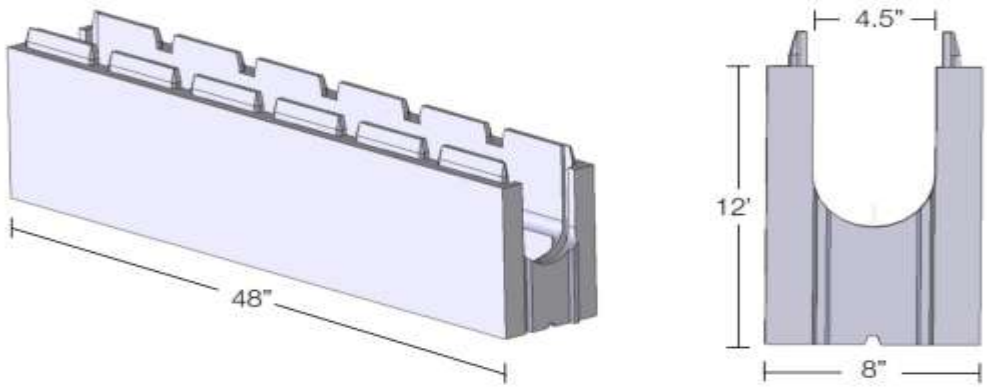


Fig. FastBloc® for Lintel

Walling System

To construct a FastBloc wall, parts shall be assembled similar to "Lego" blocks, by placing the pieces and form walls, known as "reinforced post and beam construction."

The plugs need to be placed in the cells that do not have vertical rebar reinforcement (per structural calculations), so they are not filled with concrete. The end caps provide an enclosure for the lintel at the end of walls. The vertical cells that are not filled with concrete can be used for electrical and / or plumbing.

Before pouring concrete, end plugs shall also be placed in the lintel beams at the end of walls to seal the blocks horizontally.

Utility Installation

The utilities shall be inserted before filling the walls with concrete. The utilities need to be properly placed in the foundation prior to installation of FastBloc in order to align with the center of the wall and an open FastBloc cell. It is important that the utilities do not interfere with the cells used for concrete and rebar, otherwise the utilities could cause a discontinuity in the concrete and steel and create a cold joint. The large-diameter pipes shall be put outside of the wall. The electrical boxes or load centers are to be placed prior to casting of the walls so they are drowned in concrete. Holes can be cut into FastBloc® walls where utility outlets are required.

Floor/Slab

In-situ RCC slab as per IS:456:2000 shall be provided. Speed floor as per design may also be provided.

Structural Aspects

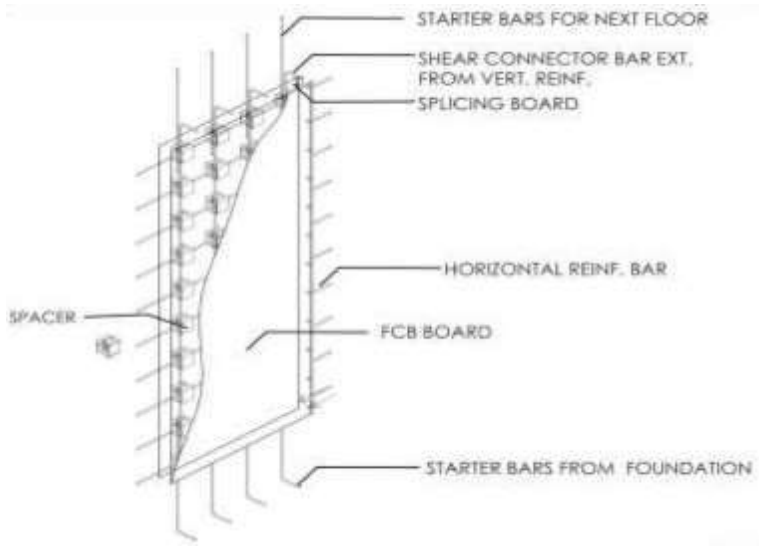
The buildings constructed with the system walls shall be designed as reinforced concrete structure since the parameters required for their design are the same as needed for traditional reinforced concrete. The building shall be designed in accordance with IS 456:2000, as applicable.

Foundation shall be specifically designed in accordance with provision given in IS 1904:2005. When performing the assembly of the foundation, depending on the type, vertical reinforcement rods (rebar) shall necessarily be inserted.
The structural design calculations should clearly demonstrate structural integrity and stability including connection details. In addition, any other requirement regarding safety against earthquake, cyclone shall be ensured by the designer as per prevailing codal requirements. All relevant Indian Standards/ requirement of NBC shall be conformed.

F-8) Plaswall Panel System

(M/s FTS Buildtech Pvt. Ltd)

Plaswall Panel System is a lost in place formwork, where two fiber cement boards (FCB) of 6mm thickness each and HIMI spacers (High Impact Molded Inserts) bonded between two sheets of FCB (in- situ) are erected to produce straight-to-finish panels. A monolithic structure is then created by filling the entire structure with M20 or higher grade of concrete as per the design. Additional load capacity can be obtained by providing extra reinforcing bars and/or by increasing grade of the concreteAn Isometric View of the Plaswall is shown in Fig. 1 below:


STARTER BARS FOR NEXT FLOOR
SHEAR CONNECTOR BAR EXT. FROM VERT. REINF.
SPLICING BOARD
HORIZONTAL REINF. BAR
SPACER
FCB BOARD
STARTER BARS FROM FOUNDATION

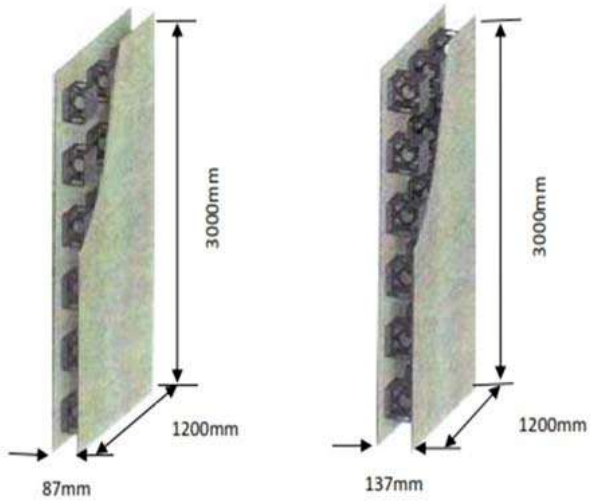
SIZE OF PANELS

Panels are normally produced in sizes and dimensions as below:

Length: 2400mm/3000 mm

Width: 1200 mm

Thickness: 87 mm, 112 mm, 137 mm, 162 mm & 230 mm including two fiber cement boards of 6mm thickness each and infill of concrete of 75mm, 100mm,125mm, 150mm and 218mm. The dimensional sketches are shown in



Raw Materials

- Fibre cement board shall be 100% asbestos free and conform to Type A, Category 3 min. as stipulated in IS14862:2000.

- Recycled plastic spacers made of High Impact Molded Inserts shall conform to the specifications of the Manufacturer.

- PU Adhesive Glue shall conform to the specifications of the manufacturer.

- Putty shall conform to IS 419:1967.

- Cement, sand, aggregate and reinforcement steel shall be as per the relevant Indian Standards.

Construction, Installation and Jointing Procedure of Plaswall

Foundation

The foundation type as raft, strip, isolated footing shall be decided based on bearing capacity of the soil, site condition, etc. However, the provision for starter bars for walls shall be ensured in all foundation scenarios. Typical sketch for starter bars from foundation are given below (Fig.7).

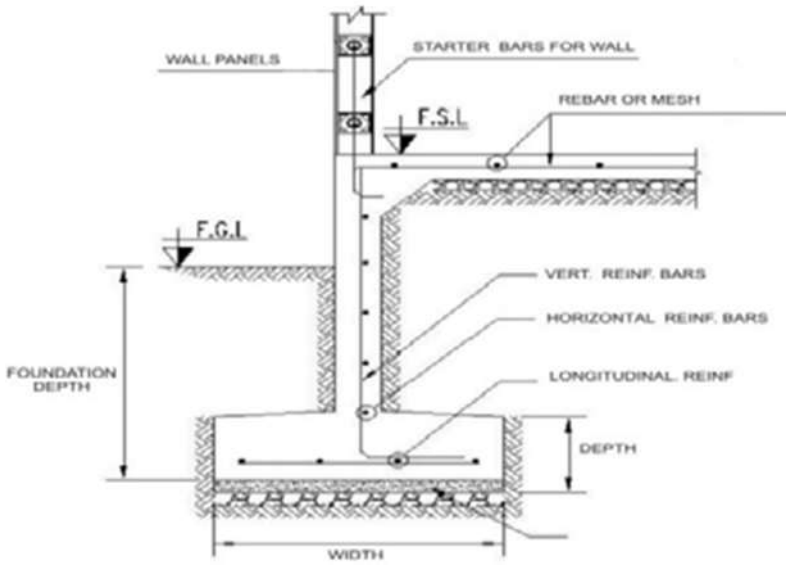


Fig. 7 Typical Strip footing

Panel Installation

Installation

The panel shall be lifted slightly and then placed along the bottom angles. The panel shall be plumbed at edge and face sides with provision of shims, if needed.

• The panel shall be screwed both sides at bottom at 250 mm center to center, while glue is applied & tacky.If glue is not available, spacing shall be kept at 200mm center to center.

• Support the temporarily angle installed on other side of panel to hold it in position for concreting (Fig. 8)

• Corner connection details shall be followed as shown in Fig. 9.

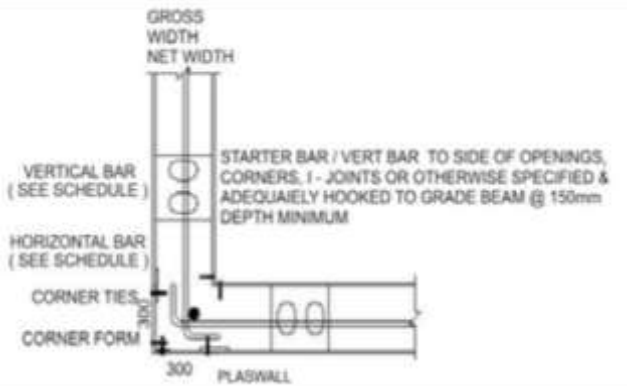


Fig. 8 Diagonal bracing ***Fig. 9 Corner connection***

T-Section

• After installing the primary walls, mark the place where corner will be constructed.

• The joiner stud shall be placed and marked by pencil to have a vertical line reference.

• The joiner stud shall be moved up by 60mm from slab to bottom of joiner stud. The stud hole shall be marked by pencil.

• The marked slots shall be cut by 100mm angle grinder with dry type diamond blade.

• Reinforced dowels shall be prepared, inserted & tied just after screwing the joiner stud corner connection.(Fig.9)

• In case, the holes intersect with panel stud of the primary wall, the portion of primary stud

shall be cut to accommodate the marked holes for T-connection. One 12mm vertical bar shall be provided as replacement.

- In case of cross-connection, horizontal bars shall be provided.

Nib End Wall Detail

- For nib, end cap shall be provided.
- Glue shall be applied on end cap stud which shall be inserted to correct position and screwed. (Fig. 10)

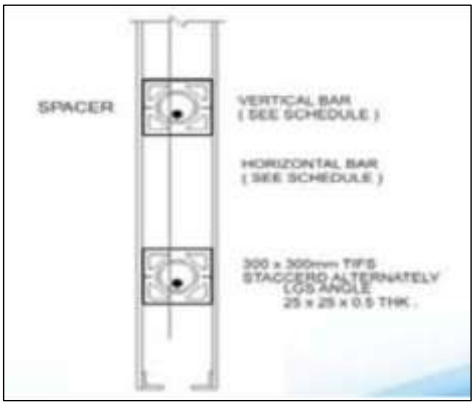


Fig. 10 Nib End Wall Detail

Fig. 11 Door & Window Jambs

Door & Window Jambs Installation

- Light gauge door & window jambs shall be provided for the panels Door jambs shall be installed along with the panel. (Fig. 11)
- Window jambs shall be installed (not fixed) to accommodate concrete at window sills. This will eliminate honey-comb and ease pouring of concrete.
- The window sill shall be overflowed by concrete and then push down window frame.
- The lintel panel shall be screwed to press down the window frame. Spacing of screws shall be the same.

Embedment of Services; After installation of the panels, electrical and plumbing pipes shall be inserted into the panel as per the drawings.

Placing of Reinforcement

Placing of reinforcement of required grade shall be as per the structural drawings and IS 456:2000 and IS 1139:1966.

Concreting

After placing of reinforcement and services in the panel, designed grade/mix of concrete shall be poured manually or by Pumping system. The concrete shall be poured from top of the wall or by cutting slit and attaching chute in the panel. Mix shall be prepared in accordance with section 9.2

of IS 456:2000. Agregate of max. size 6 to 10mm shall be used. Slump should be between 175mm to 200mm.

Pouring of concrete

- After proper mixing of concrete as per the mix, concrete shall be poured manually into the panel from top of the wall or by cutting slit and attaching chute in the panel. The first pour of concrete should be of 300mm height and after setting, concrete shall be poured up to 800mm as above.
- After setting time of each pour of concrete, keep pouring upto 800mm height and continue till height of the wall.
- Above process shall be followed horizontally for different walls. This will allow setting time of concrete for the previous wall while the next wall is being poured.
- Setting time of concrete shall be min. three hours but during that time other walls shall be poured. Since the project quantum will be big, there will be enough walls available to pour.
- Rubber mallet shall be used for tapping the wall while pouring the concrete to avoid honey comb/segregation.

Joint Treatment

After walls are completely filled and mix dried, joint treatment shall be done using fibre mesh tape and putty. (See Figs. 12 & 13)

Fig.12 Yellow Putty with Fibre mesh tape

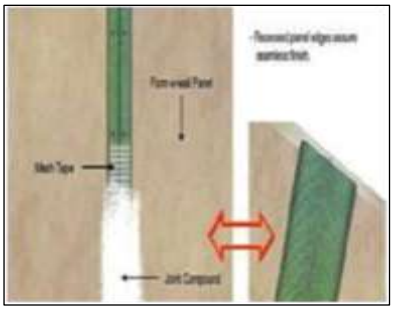


Fig.13 Joint Treatment

Construction of Slab**;** Once construction of panels is completed, slab construction shall be done as per the structural drawings with wall reinforcement and connection with slab reinforcement. ll relevant Indian Standard/ requirement of NBC shall be conformed.