SMCC/NBVJ/JSM/2022-23/45

DESIGN BASIS REPORT

MARCH 10, 2023

FOR

MAJOR UPGRADATION OF NEW BHUJ RAILWAY STATION OF WESTERN RAILWAY

AT

BHUJ

STRUCTURAL DESIGN CONSULTANT:

DUCON CONSULTANTS PRIVATE LIMITED

DUCON CONSULTANT PVT. LTD.
A3/A4 SAFAL PROFITAIRE,
CORPORATE ROAD,
PRAHLADNAGAR AUDA GARDEN,
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PREPARED BY:

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KAMLESH PANKH
ARCHITECTS,
AHMEDABAD

M/s. SHRI MOHANGARH KRISHNA JV

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Director (Ducon Consultants Pvt. Ltd.)

SHAHID ALAM
(LEAD DESIGNER)
Intercontinental Consultants
and Technocrats Pvt. Ltd.

M/s. SHRI MOHANGARH KRISHNA JV
Authorised Signatory

KAMLESH PAREKH ARCHITECT
RAJKOT
ARCHITECT

PROJECT NO : 3322

PROJECT NAME : MAJOR UPGRADATION OF NEW BHUJ RAILWAY STATION OF WESTERN RAILWAY

STRUCTURAL DESIGN BASIS REPORT FOR PROPOSED "MAJOR UPGRADATION OF NEW BHUJ RAILWAY STATION OF WESTERN RAILWAY" AT BHUJ, GUJARAT.

Date: 10TH MARCH 2023
Rev. No. R1

SHAHID ALAM
(LEAD DESIGNER)
Intercontinental Consultants and Technocrats Pvt. Ltd.

M/S. SHRI MOHANGARH KRISHNA JV

KAMLESH PAREKH ARCHITECTS RAJKOT ARCHITECT

STRUCTURAL DESIGN BASIS REPORT FOR PROPOSED "MAJOR UPGRADATION OF NEW BHUJ RAILWAY STATION OF WESTERN RAILWAY"

AT BHUJ, GUJARAT.

Project No : 3322

Project Name : MAJOR UPGRADATION OF NEW BHUJ RAILWAY STATION OF WESTERN RAILWAY

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SHAHID ALAM (LEAD DESIGNER) Intercontinental Consultants and Technocrats Pvt. Ltd.

M/s. SHRI MOHANGARH KRISHNA JV

KAMLESH PAREKH ARCHITECTS RAJKOT ARCHITECT

1.INTRODUCTION

"KAMLESH PAREKH ARCHITECTS" has appointed **DUCON CONSULTANTS PRIVATE LIMITED** to develop structural schemes and design for proposed construction of **MAJOR UPGRADATION OF NEW BHUJ RAILWAY STATION OF WESTERN RAILWAY AT BHUJ, GUJARAT.**

This DBR focuses on the proposed various buildings like,

1. Building no. 1 A - Main building (concourse area) with departure FOB and entrance canopy
2. Building no. 1 B- (Part 1 and Part 2)
3. Building no. 1 C
4. Building no. 1 D (Through Canopy)
5. Building no. 1 E (Through Canopy)
6. Building no. 1 F (Through Canopy)
7. Building no. 1 G (Through Canopy)
8. Building no. 2 - Second Entry Building
9. Building no. 3
10. Building no. 4
11. Building no. 5- FOB 1
12. Building no. 6- FOB 2

SHAHID ALAM
(LEAD DESIGNER)
Intercontinental Consultants
and Tech... Pvt. Ltd.

- Identify and record all input requirements, Analysis and design criteria.
- Develop safe and stable structural scheme pertaining to Indian Standards compatible with Architectural vision, services requirements and client's needs.
- Prepare structural design that will aim to actual structural durability and integrity.
- Desirable structural performance under characteristic services load.

M/S SHRI MOHANGARH KRISHNA JV

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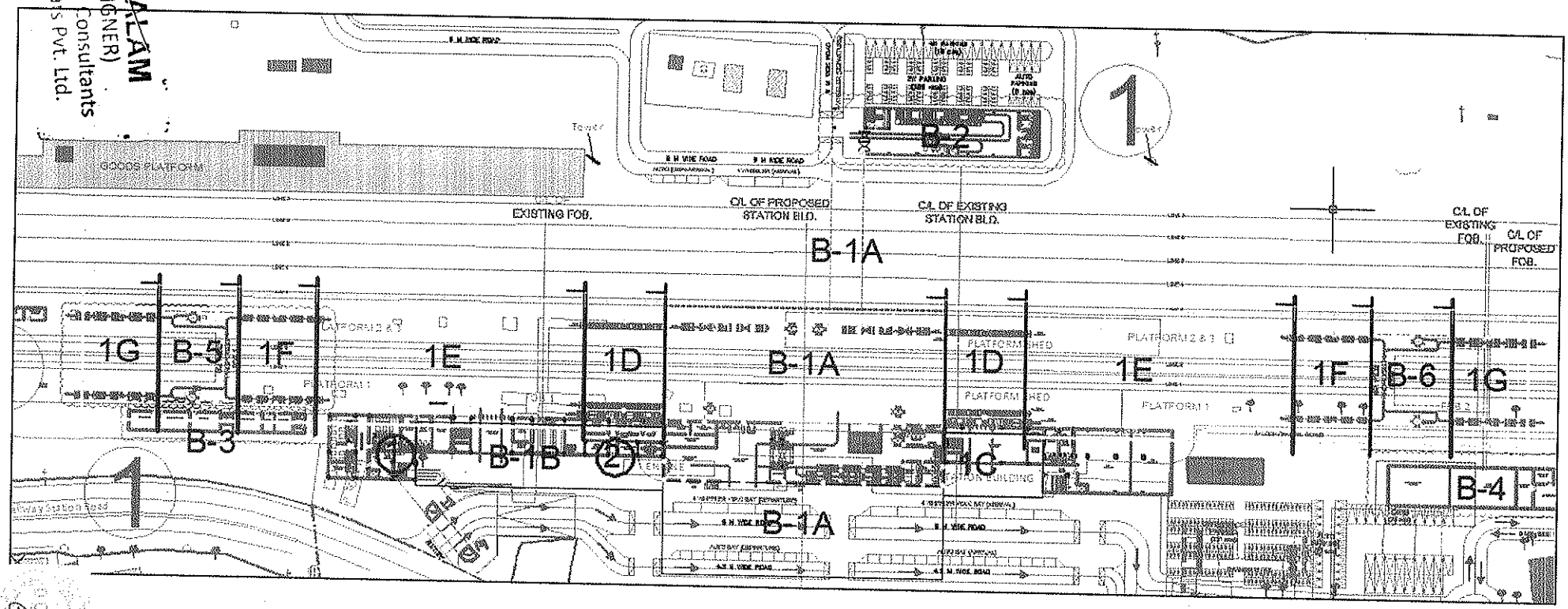
Pvt. Technocrats Pvt. Ltd.



BUILDINGS NOMENCLATURE

KAMLESH PAREKH ARCHITECTS
RAJKOT
ARCHITECT

M/s. SHRI MOHANGARH KRISHNA JV

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2. PROJECT DESCRIPTION

Project	:	**MAJOR UPGRADATION OF NEW BHUJ RAILWAY STATION OF WESTERN RAILWAY**
Location	:	BHUJ (Zone - V), GUJARAT.

2.1 AGENCIES

Client	:	M/S SHRI MOHANGARH KRISHNA JV
Design Architects	:	KAMLESH PAREKH ARCHITECTS
Structural Consultants	:	M/S. DUCON Consultants Private Limited A3-A4, 3rd floor, Safal Profitaire,Corporate Road,Near Prahladnagar Garden,S.G Road Ahmedabad-51 E-mail: **utsav@duconconsultants.in** **contact@duconconsultants.in** P\h: 40073196, (079)29705245, (079)29705246

2.2 PROJECT

The project consists of various structures on railway station as captioned. Structural form should contribute to the building character and identity, while being efficient, cost effective and simple to construct.

Provisions are incorporated in to the design in such a way that services can be laid without any major obstructions and maximum head room is achieved along with the basic criteria of cost-effectiveness.

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2.3 BUILDING DIMENSION

2.3.1 Plan dimension :

Name of building	X direction dimension	Y direction dimension
Building no. 1 A -		
Main building (concourse area)	72.00 mt	45.00 mt
Departure FOB	8.00 mt	43.68 mt
Entrance canopy	72.00 mt	AS PER PROFILE
Building no. 1 B		
Part 1	31.92 mt	16.50 mt
Part 2	53.98 mt.	9.35 mt.
Building no. 1 C	58.54 mt	16.50 mt
Building no. 1 D	20.42 mt	32.96 mt
Building no. 1 E	68.73 mt	32.96 mt.
Building no. 1 F	19.74 mt	32.96 mt.
Building no. 1 G	19.67 mt	32.96 mt.
Building no. 2 -		
Second Entry Building	53.00 mt.	12.00 mt.
Building no. 3	49.10 mt	5.2mt
Building no. 4	47.96 mt	10.23 mt
Building no. 5- FOB 1	20.49 mt.	22.02 mt. c/c (FOB) 32.96mt (Thru. Roof above FOB)
Building no. 6- FOB 2	20.49 mt.	22.02 mt. c/c (FOB) 32.96mt (Thru. Roof above FOB)

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2.3.2 Floor Levels in mt. From railway track

Name of building	Mezzanine slab	First slab	Second slab	Terrace slab
Building no. 1 A - Main building (concourse area)	6.0	10.0	---	16.6
Departure FOB	---	10.0	---	13.75
Entrance canopy	15.0 mt approx at ridge			
Building no. 1 B				
Part 1	6.0	10.0	13.3	16.6
Part 2	6.0	10.0	---	---
Building no. 1 C	6.0	10.0	13.3	16.6
Building no. 1 D	17.0 mt approx at ridge			
Building no. 1 E	15.0 mt approx at ridge			
Building no. 1 F	15.0 mt approx at ridge			
Building no. 1 G	15.0 mt approx at ridge			
Building no. 2 - Second Entry Building	---	10.0	---	16.6
Building no. 3	4.55	8.15		
Building no. 4	4.2	---	---	---
Building no. 5- FOB 1	---	10.0 + 5.0 mt at ridge for through roof		
Building no. 6- FOB 2	---	10.0 + 5.0 mt at ridge for through roof		

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3. STRUCTURAL DESIGN STANDARDS AND CODES

Following Indian codes shall here to be used for detailed design.

3.1 INDIAN CODES

3.1.1 LOADS

IS 875(Part 1):1987 - Dead Loads - Unit Weight of Building and Stored Material

IS 875(Part 2):1987 - Imposed Loads

IS 875(Part 3):2015 - Wind Loads

IS 875(Part 5):1987 - Special loads and load combinations

IS 1893(Part 1):2016 - Criteria for earthquake resistance design of structure

3.1.2 CONCRETE DESIGN

IS 456: 2000 - Plain and Reinforced Concrete - Code of practice

SP16 - Structural use of concrete. Design charts for singly reinforced beams, doubly reinforced beams and columns

SP 34 - Handbook on Concrete Reinforcement & Detailing

IS 1904 - Indian Standard Code of practice for design & construction of foundations in Soil:General Requirements

IS 13920:2016- Ductile design and detailing of Reinforced Concrete Structures subjected to Seismic Forces

3.1.3 STEEL DESIGN

IS 800 - 2007 - General Construction in Steel - Code of Practice

3.1.4 INDIAN RAILWAY STANDARDS (IRS) CODES AND MANUAL

IRS Manuals for Standards and Specifications for Railway Stations 2009 issued by Ministry of Railways, Railway Board

IRS Indian Railway Works Manual 2000 issued by Ministry of Railways, Railway Board

IRS Indian Railways Permanent Way Manual

IRS Indian Railways Telecom Manual 2007

IRS Indian Railways Coaching Maintenance Manual

IRS Indian Railways Medical Maintenance

IRS Indian Railways Manual of AC Traction Maintenance and Operation, Volume – I

IRS Indian Railways Manual of AC Traction Maintenance and Operation, Volume – II (Part 1)

IRS Indian Railways Manual of AC Traction Maintenance and Operation, Volume – II (Part II)

IRS Indian Railways Manual of AC Traction Maintenance and Operation, Volume – III

IRS Signal Engineering Manual, Part I

IRS Signal Engineering Manual, Part II

IRS Indian Railways Schedule of Dimensions 1676mm Gauge (BG), Revised 2004

IRS All Pertinent IRS Specifications issued by the various Directorates of the Ministry of Railways

(e.g., Signal Directorate, Bridges and Structures Directorate, track Directorate, Telecom Directorate,

Traction Installation Directorate, Electrical Directorate, etc.)

IRS IRS Bridge Rules for Loading

IRS IRS Codes of Practice for Stell Bridges

IRS IRS Code of Practice for Plain, Reinforced and Pre-stressed Concrete for general Bridge Construction

IRS IRS Code of Practice for Design of Substructures and Foundation of Bridges

CT-38 RDSO Guidelines for Noise and Vibrations

Indian Road Congress Standards (IRC)

IRC 5 Standards Specifications and Code of Practice for Road Bridges,

Section I - General Features of Design

IRC 6 Standards Specifications and Code of Practice for Road Bridges,

Section II – Load and Stresses

IRC 11 Recommended Practice for the Design of Layout of Cycle Tracks

IRC 19 Standards Specifications and Code of Practice for Water Bound Macadam

IRC 112 Standards Specifications and Code of Practice for Road Bridges,

Section III – Cement Concrete (Plain and Reinforced)

IRC 22 Standards Specifications and Code of Practice for Road Bridges,

Section IV – Composite Construction

IRC 24 Standards Specifications and Code of Practice for Road Bridges,

Section IV – Steel Road Bridges

IRC 37 Guidelines for the Design of Flexible Pavement

IRC 45 Recommendations for Estimating the Resistance of soil below the maximum Scour Level

in the design of Well Foundations of Bridges

IRC 48 Tentative Specifications for Bituminous Surface Dressing Using Pre-Coated Aggregates

IRC 78 Standards Specifications and Code of Practice for Road Bridges,

Section VII Parts 1 and 2, Foundations and Substructure

IRC 87 Guidelines for the Design and Erection of False Work for Road Bridges

IRC 89 Guidelines for the Design and Erection of River Training and Control Works for Road Bridges

3.2 OTHER IMP. CODES

AISC 360-16 - Specification for structural steel buildings

NATIONAL BUILDING CODE 2016

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KAMLESH PAREKH ARCHITECTS RAJKOT ARCHITECT

M/s. SHRI MOHANGARH KRISHNA JV

DESIGN PARAMETERS

4.1 Material of Construction

4.1.1 RCC WORKS

Density of reinforced concrete shall be : **25 kN/m^3**

Structural Elements	**Design Grade of concrete**	**Recommend Grade of concrete**
Concrete mix in columns	**M30**	**M35**
Concrete mix for beams and slabs	**M30**	**M30**
Foundation	**M30**	**M30**
Retaining wall	**M30**	**M30**
Ramp & Staircase	**M30**	**M30**
Grade slab,Sill,Lintel,Mullions,RCC Non-Structural Pardi	**M30**	**M30**
PCC(All)	**M15**	**M15**

4.1.2 STRUCTURAL STEEL WORKS

Structural Elements	**Design Grade of steel**
Rolled sections	**Fe250**
Hollw section (RHS/SHS) readily available from Approved Ven	**Fe310**
Built up sections, Hollow sections made from plates	**Fe355**

- Grade of Concrete **M 15** will be used in filling, plum concrete, leveling courses and other non-structural items. Density of reinforced concrete is assumed as **25 kN/m^3**.

- Minimum cement content, water cement ratio etc. will conform to **IS 456:2000** provisions for durability and strength criteria. (As per approved mix design from concrete supplier and contractor)

- Ordinary Portland cement of **grade 43** or higher confirming **to IS 8112** and **IS 12269** are specified for concrete grades ranging up-to **M 25**

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- The sizes of aggregates conform to **IS 383**. Nominal maximum size of coarse aggregate is 20 mm, suitably graded as per the requirement of mix design.
- Mixing Water will conform to **IS 456: 2000**.
- High yield strength deformed bars conforming to **IS 1786 : 2008** with **Fe500D** $\mathbf{F_y}$ **= 500 N/mm²** TMT bars will be used as Reinforcing-bars in concrete elements.
- Elongation of reinforcement should not be less than 16% as per **IS 1786 : 2008**
- All mix design of concrete should be done from authorised NABL agency & got approved prior to execution of work.
- We will take out 6 cubes from every batch of concrete and report of the same of 7 days and 28 days.
- We will carry out reinforcement report at every 30 ton for each category and elongation test will also be performed.
- We will submit Tensile Test report to agency as per IS 800 Table-1
- We will submit Chemical composition,temperature and ductility test report as per IS 2062.
- We will submit Sieve Analysis and resources to authority.
- We will submit deformed bar tensile test ,composition test ,bend and re-bend test to authority.

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4.2 LOADING PARAMETERS

4.2.1 SELF WEIGHTS

Self-weight of the structural members shall here to be considered on the basis of the following properties.

- Density of Reinforced Concrete : 25.0 kN/m^3.
- Density of Plain Concrete : 24.0 kN/m^3.
- Density of Steel : 78.5 kN/m^3.
- Density of Floor Finishes / Plasters : 20.0 kN/m^3.
- Density of Soil (Unsaturated) : 18.0 kN/m^3.
- Density of Soil (Saturated) : 21.0 kN/m^3.
- Density of Light Weight Concrete : 20.0 kN/m^3.
- Density of Block Masonry : 8.00 kN/m3
- Density of brick Masonry : 20.00 kN/m3

4.2.2 IMPOSED GRAVITY LOADS

The following imposed gravity loads shall be adopted in addition to the self-weight of the structure. (Self-weight of slab / beam / columns and wall will be as per the dimensions adopted in the respective drawings.)

4.2.2.1 LIVE LOAD (As per IS:875-part II-1987)

Name of buildings;

1. Building no. 1 A -

Main building (concourse area);

- Mezzanine floor slab

  Miscellaneousness railway office : 5.0 kN/m2

  BMS/SCADA/CCTV monitoring room : 5.0 kN/m2
- Ground floor roof slab

  Unreserved waiting area : 5.0 kN/m2

  Commercial area : 5.0 kN/m2

  Executive waiting area : 5.0 kN/m2

  Reserved waiting area : 5.0 kN/m2

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Passage area : 5.0 kN/m2

Retail room (1 to 6) : 5.0 kN/m2

Baby care room : 5.0 kN/m2

Electric room : 5.0 kN/m2

ATM room : 5.0 kN/m2

Toilet block area : 5.0 kN/m2

Staircase : 5.0 kN/m2

- First floor roof slab Terrace area : 2.0 kN/m2 (Services Loads needs to be taken care additionally as per MEPF vendor)

Departure FOB;

Ground floor roof slab : 5.0 kN/m2

Roofing sheet : 0.75 kN/m2

Entrance canopy :

Roofing sheet : 0.75 kN/m2

Building no. 1 B -

Part 1

- Ground floor roof slab :

  Retiring room : 3.0 kN/m2

  Electric room : 5.0 kN/m2

  Passage : 4.0 kN/m2

  Foyer : 5.0 kN/m2

  Staircase : 5.0 kN/m2

- Mezzanine floor roof slab :

  Holiday room : 3.0 kN/m2

  Electric room : 5.0 kN/m2

  Passage : 4.0 kN/m2

  Foyer : 5.0 kN/m2

  Staircase : 5.0 kN/m2

- First floor roof slab :

  Office rest room : 3.0 kN/m2

  Electric room : 5.0 kN/m2

  Passage : 4.0 kN/m2

  Foyer : 5.0 kN/m2

  Staircase : 5.0 kN/m2

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- Second floor roof slab : Terrace area : 2.0 kN/m2 (**Services Loads needs to be taken care additionally as per MEPF vendor)**

Part 2

- Ground floor roof slab :

  Commercial area : 5.0 kN/m2

  Store and library room : 5.0 kN/m2

  Water room : 3.0 kN/m2

  Toilet block area : 2.0 kN/m2

  Staircase : 5.0 kN/m2

  Passage : 4.0 kN/m2

- Mezzanine floor roof slab:

  Open terrace area : 2.0 kN/m2

Building no. 1 C -

- Ground floor roof slab:

  RPF room : 3.0 kN/m2

  Passage : 4.0 kN/m2

  Foyer : 5.0 kN/m2

  Service room : 3.0 kN/m2

  Toilet block area : 2.0 kN/m2

  Staircase : 5.0 kN/m2

- Mezzanine floor roof slab:

  TTE rest room : 3.0 kN/m2

  Passage : 4.0 kN/m2

  Foyer : 5.0 kN/m2

  Service room : 3.0 kN/m2 Toilet

  block area : 2.0 kN/m2

  Staircase : 5.0 kN/m2

  Open terrace area : 2.0 kN/m2

- First floor roof slab:

  Running room : 3.0 kN/m2

  Passage : 4.0 kN/m2

  Foyer : 5.0 kN/m2

  Service room : 3.0 kN/m2

  Toilet block area : 2.0 kN/m2

  Staircase : 5.0 kN/m2

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- Second floor roof slab: Terrace area : 2.0 kN/m2(Services Loads needs to be taken care additionally as per MEPF vendor)

Building no. 1 D, 1 E, 1 F and 1 G:

Roofing sheet : 0.75 kN/m2

2. Building no. 2 - Second Entry Building

- Ground floor roof slab : 5.0 kN/m2
- First floor roof slab : 2.0 kN/m2

3. Building no. 3 :

- Ground floor roof slab :

  Duty room : 3.0 kN/m2

  Office area : 3.0 kN/m2

  Record room : 5.0 kN/m2

  Health inspector with Store : 5.0 kN/m2

  Passage : 4.0 kN/m2
- Mezzanine floor roof slab

  Open terrace area : 2.0 kN/m2 (Services Loads as per MEPF vendor)

4. Building no. 4:

- Ground floor roof slab:

Ope terrace area : 2.0 kN/m2 (Services Loads as per MEPF vendor)

5. Building no. 5 : FOB 1

Ground floor roof slab : 5.0 kN/m2

Roofing sheet : 0.75 kN/m2

6. Building no. 6 : FOB 2

Ground floor roof slab : 5.0 kN/m2

Roofing sheet : 0.75 kN/m2

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4.2.2.2 FLOOR FINISHES

Name of buildings;

1.Building no. 1 A -

Main building (concourse area);

- Mezzanine floor slab : 1.5 kN/m2
- Ground floor roof slab : 1.5 kN/m2
- First floor roof slab : 2.5 kN/m2

Departure FOB;

- Ground floor roof slab : 1.5 kN/m2

Building no. 1 B -

- Ground floor roof slab : 1.5 kN/m2
- Mezzanine floor roof slab : 1.5 kN/m2
- First floor roof slab : 1.5 kN/m2
- Second floor roof slab : 2.5 kN/m2

Building no. 1 C -

- Ground floor roof slab: 1.5 kN/m2
- Mezzanine floor roof slab: 1.5 kN/m2
- First floor roof slab: 1.5 kN/m2

  Part terrace area : 2.5 kN/m2
- Second floor roof slab:

  Terrace area : 2.5 kN/m2

2. Building no. 2 - Second Entry Building

- Ground floor roof slab : 1.5 kN/m2
- First floor roof slab : 1.5 kN/m2

3. Building no. 3 :

- Ground floor roof slab : 1.5 kN/m2
- Mezzanine floor roof slab : 1.5 kN/m2

4. Building no. 4:

- Ground floor roof slab: 1.5 kN/m2

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5. Building no. 5 : FOB 1

Ground floor roof slab : 1.5 kN/m2

Roofing sheet : 0.5 kN/m2

6. Building no. 6 : FOB 2

Ground floor roof slab : 1.5 kN/m2

Roofing sheet : 0.5 kN/m2

Floor finish load on Stair = 4.6 kN/m^2

Self weight of steps = 1.875 kN/m^2

Floor finish of steps = 1.8 x 1.5 = 2.7 kN/m^2

Total floor finish load on stair = 2.7 + 1.875 = 4.57 kN/m^2

*Specific loads given by vendors will be adopted wherever applicable.

- Service load on Typical floor roof Slab = 0.5 kN/m2/ AS PER MEPF
- Collateral loads for Roof = AS PER MEPF
- Water tank load = Height x density

4.2.2.4 SELF - WEIGHT OF WALLS

Name of buildings;

1. Building no. 1 A -

- Main building (concourse area);

Ground floor slab

Floor height 6.0 mt- external wall

= [{(0.23x 20)+(0.032 x 20)} x (6.0-0.55)] = 28.56 kN/m

Floor height 6.0 mt- internal wall

= [{(0.23x 20)+(0.024 x 20)} x (6.0-0.55)] = 27.69 kN/m

Mezzanine floor slab :

Floor height 4.0 mt- external wall

= [{(0.23x 20)+(0.032 x 20)} x (4.0-0.55)] = 18.08 kN/m

Floor height 4.0 mt- internal wall

= [{(0.23x 20)+(0.024 x 20)} x (4.0-0.55)] = 17.53 kN/m

Floor height 4.0 mt- external wall

= [{(0.23x 20)+(0.032 x 20)} x (4.0-0.3)] = 19.39 kN/m

Floor height 4.0 mt- internal wall

= [{(0.23x 20)+(0.024 x 20)} x (4.0-0.3)] = 18.80 kN/m

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Ground floor roof slab:

Floor height 6.6 mt- external wall

= [{(0.23x 20)+(0.032 x 20)} x (6.6-0.55)] = 31.70 kN/m

Floor height 6.6 mt- internal wall

= [{(0.23x 20)+(0.024 x 20)} x (6.6-0.55)] = 30.73 kN/m

Floor height 6.6 mt- cxternal wall

= [{(0.23x 20)+(0.032 x 20)} x (6.6-1.5)] = 26.72 kN/m

Floor height 6.6 mt- internal wall

= [{(0.23x 20)+(0.024 x 20)} x (6.6-1.5)] = 25.90 kN/m

First floor roof slab :

parapet wall;

= [{(0.230x 20)+(0.036x 20)} x 1.3] = 6.92 kN/m

- Departure FOB;

M.S. Grill load : 0.005 x 78.5 x 3.75 = 1.47 kN/mt

Building no. 1 B -

Part 1

Ground floor slab;

Floor height 6.0 mt- external wall

= [{(0.23x 20)+(0.032 x 20)} x (6.0-0.6)] = 28.30 kN/m

Floor height 6.0 mt- internal wall

= [{(0.23x 20)+(0.024 x 20)} x (6.0-0.6)] = 27.43 kN/m

Ground floor roof slab :

Floor height 4.0 mt- external wall

= [{(0.23x 20)+(0.032 x 20)} x (4.0-0.6)] = 17.82 kN/m

Floor height 4.0 mt- internal wall

= [{(0.23x 20)+(0.024 x 20)} x (4.0-0.6)] = 17.27 kN/m

First floor roof slab :

Floor height 3.3 mt- external wall

= [{(0.23x 20)+(0.032 x 20)} x (3.3-0.6)] = 14.15 kN/m

Floor height 4.0 mt- internal wall

= [{(0.23x 20)+(0.024 x 20)} x (3.3-0.6)] = 13.72 kN/m

Second floor roof slab :

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Floor height 3.3 mt- external wall

= [{(0.23x 20)+(0.032 x 20)} x (3.3-0.6)] = 14.15 kN/m

Floor height 4.0 mt- internal wall

= [{(0.23x 20)+(0.024 x 20)} x (3.3-0.6)] = 13.72 kN/m

Terrace floor slab;

parapet wall;

= [{(0.230x 20)+(0.036x 20)} x 1.3] = 6.92 kN/m

Part 2

Ground floor slab;

Floor height 6.0 mt- external wall

= [{(0.23x 20)+(0.032 x 20)} x (6.0-0.6)] = 28.30 kN/m

Floor height 6.0 mt- internal wall

= [{(0.23x 20)+(0.024 x 20)} x (6.0-0.6)] = 27.43 kN/m

Ground floor roof slab :

Floor height 4.0 mt- external wall

= [{(0.23x 20)+(0.032 x 20)} x (4.0-0.6)] = 17.82 kN/m

Floor height 4.0 mt- internal wall

= [{(0.23x 20)+(0.024 x 20)} x (4.0-0.6)] = 17.27 kN/m

Terrace floor slab;

parapet wall;

= [{(0.230x 20)+(0.036x 20)} x 1.3] = 6.92 kN/m

Building no. 1 C -

Ground floor slab;

Floor height 6.0 mt- external wall

= [{(0.23x 20)+(0.032 x 20)} x (6.0-0.6)] = 28.30 kN/m

Floor height 6.0 mt- internal wall

= [{(0.23x 20)+(0.024 x 20)} x (6.0-0.6)] = 27.43 kN/m

Ground floor roof slab :

Floor height 4.0 mt- external wall

= [{(0.23x 20)+(0.032 x 20)} x (4.0-0.6)] = 17.82 kN/m

Floor height 4.0 mt- internal wall

= [{(0.23x 20)+(0.024 x 20)} x (4.0-0.6)] = 17.27 kN/m

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First floor roof slab :

Floor height 3.3 mt- external wall

= [{(0.23x 20)+(0.032 x 20)} x (3.3-0.6)] = 14.15 kN/m

Floor height 3.3 mt- internal wall

= [{(0.23x 20)+(0.024 x 20)} x (3.3-0.6)] = 13.72 kN/m

parapet wall;

= [{(0.230x 20)+(0.036x 20)} x 1.3] = 6.92 kN/m

Second floor roof slab :

Floor height 3.3 mt- external wall

= [{(0.23x 20)+(0.032 x 20)} x (3.3-0.6)] = 14.15 kN/m

Floor height 3.3 mt- internal wall

= [{(0.23x 20)+(0.024 x 20)} x (3.3-0.6)] = 13.72 kN/m

Terrace floor slab;

parapet wall;

= [{(0.230x 20)+(0.036x 20)} x 1.3] = 6.92 kN/m

Building no. 1 D, 1 E, 1 F and 1 G - No wall load

2. Building no. 2 - Second Entry Building

Ground floor slab;

Floor height 6.0 mt- external wall

= [{(0.23x 20)+(0.032 x 20)} x (6.0-0.6)] = 28.30 kN/m

Floor height 6.0 mt- internal wall

= [{(0.23x 20)+(0.024 x 20)} x (6.0-0.6)] = 27.43 kN/m

Tie level :

Floor height 4.0 mt- external wall

= [{(0.23x 20)+(0.032 x 20)} x (4.0-0.6)] = 17.82 kN/m

Floor height 4.0 mt- internal wall

= [{(0.23x 20)+(0.024 x 20)} x (4.0-0.6)] = 17.27 kN/m

Ground floor roof slab:

Floor height 6.6 mt- external wall

= [{(0.23x 20)+(0.036 x 20)} x (6.0-0.55)] = 32.2 kN/m

Floor height 6.6 mt- internal wall

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= [{(0.23x 20)+(0.024 x 20)} x (6.6-0.55)] = 30.73 kN/m

First floor roof slab :

Floor height 6.6 mt- external wall

= [{(0.23x 20)+(0.032 x 20)} x (6.6-0.6)] = 31.44 kN/m

Floor height 6.6 mt- internal wall

= [{(0.23x 20)+(0.024 x 20)} x (6.6-0.6)] = 30.48 kN/m

Terrace floor slab;

parapet wall;

= [{(0.230x 20)+(0.036x 20)} x 1.3] = 6.92 kN/m

4. Building no. 3 :

Floor height 3.6 mt- external wall

= [{(0.23x 20)+(0.036 x 20)} x (3.6-0.6)] = 15.96 kN/m

Floor height 3.6 mt- internal wall

= [{(0.23x 20)+(0.024 x 20)} x (3.6-0.6)] = 15.24 kN/m

Terrace floor slab;

parapet wall;

= [{(0.230x 20)+(0.036x 20)} x 1.3] = 6.92 kN/m

5. Building no. 4:

Floor height 3.6 mt- external wall

= [{(0.23x 20)+(0.036 x 20)} x (3.6-0.6)] = 15.96 kN/m

Floor height 3.6 mt- internal wall

= [{(0.23x 20)+(0.024 x 20)} x (3.6-0.6)] = 15.24 kN/m

Terrace floor slab;

parapet wall;

= [{(0.230x 20)+(0.036x 20)} x 1.3] = 6.92 kN/m

6. Building no. 5 : FOB 1

Parapet wall

= [{(0.230x 20)+(0.036x 20)} x 1.3] = 6.92 kN/m

7. Building no. 6 : FOB 2

Parapet wall

= [{(0.230x 20)+(0.036x 20)} x 1.3] = 6.92 kN/m

*Wall loads are considered as per architectural plans at respective levels.

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4.2.3 SEISMIC LOADS

The seismic load calculations will be carried out in accordance with IS 1893 (Part 1): 2016. As per the code, BHUJ lies in **Zone V**, zone factor **Z = 0.36**, The Design Base Shear is given by V_b = **(Z/2) x (I/R) x (Sa/g) x W** where, Importance factor, I will be taken as 1.5 as per IS 1893 : 2016 and response reduction factor R will be taken as '4.5' for braced framed structures with special braced frame (SBF) having concentric braces and as '5" for RC buildings with special moment resisting frames (SMRF). S_a/g is the normalized Response Spectrum value for the structure which is the function of the fundamental time period of vibration of the structure and the type of the founding soil. W is the Seismic Weight of the building, which will be calculated in accordance with the relevant clause in, IS 1893(Part 1):2016. For all structures, an approximate damping value of 5% will be considered.

1) Time period calculation

Name of buildings;

1. Building no. 1 A -

without infill wall

Main building with departure FOB;

Time period in X direction = $0.085x\ h^{\wedge 0.75}$

where, h=16.6 + 2.5 (From Base to terrace)

= $0.085 \times 19.1^{\wedge 0.75}$

= 0.776sec

Time period in Y direction = $0.085x\ h^{\wedge 0.75}$

where, h=16.6 + 2.5 (From Base to terrace)

= $0.085 \times 19.1^{\wedge 0.75}$

= 0.776sec

Building no. 1 B -

With Infill Wall.

Part 1;

Time period in X direction = $0.09 \times h/(Dx)^{\wedge 0.5}$

where, h=16.6 + 2.5 (From Base to terrace)

= $0.09 \times 19.1/(31.92)^{\wedge 0.5}$

= 0.304 sec

Time period in Y direction = $0.09 \times h/(Dy)^{\wedge 0.5}$

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where, h=16.6 + 2.5 (From Base to terrace)

= 0.09 x 19.1/(16.5)^0.5

= 0.423 sec

Part 2;

Time period in X direction = 0.09 x h/(Dx)^0.5

where, h=10 + 2.5 (From Base to terrace)

= 0.09 x 12.5/(53.98)^0.5

= 0.153 sec

Time period in Y direction = 0.09 x h/(Dy)^0.5

where, h=10 + 2.5 (From Base to terrace)

= 0.09 x 12.5/(9.35)^0.5

= 0.368 sec

Building no. 1 C -

With Infill Wall.

Time period in X direction = 0.09 x h/(Dx)^0.5

where, h=16.6 + 2.5 (From Base to terrace)

= 0.09 x 19.1/(58.54)^0.5

= 0.225 sec

Time period in Y direction = 0.09 x h/(Dy)^0.5

where, h=16.6 + 2.5 (From Base to terrace)

= 0.09 x 19.1/(16.5)^0.5

= 0.423 sec

Building no. 1 D, 1 E, 1 F and 1 G-

without infill wall

Time period in X direction = 0.085x h^0.75

where, h=15+ 2.5 (From Base to top of ridge)

= 0.085 x 17.5^0.75

= 0.727sec

Time period in X direction = 0.085x h^0.75

where, h=15+ 2.5 (From Base to top of ridge)

= 0.085 x 17.5^0.75

= 0.727sec

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Building no. 2- Second entry building

With Infill Wall.

Time period in X direction = 0.09 x h/(Dx)^0.5

where, h=16.6+ 2.5 (From Base to terrace)

= 0.09 x 19.1/(53)^0.5

= 0.236 sec

Time period in Y direction = 0.09 x h/(Dy)^0.5

where, h=16.6+ 2.5 (From Base to terrace)

= 0.09 x 19.1/(12)^0.5

= 0.496sec

Building no. 3-

With Infill Wall.

Time period in X direction = 0.09 x h/(Dx)^0.5

where, h=7.2+ 2.5 (From Base to terrace)

= 0.09 x 9.7/(45.42)^0.5

= 0.129 sec

Time period in Y direction = 0.09 x h/(Dy)^0.5

where, h=7.2+ 2.5 (From Base to terrace)

= 0.09 x 9.7/(6.69)^0.5

= 0.337sec

Building no. 4-

With Infill Wall.

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Time period in X direction = 0.09 x h/(Dx)^0.5 (h=From Base to Terrace)

where, h=3.6+ 2.5 (From Base to terrace)

= 0.09 x 6.1/(47.96)^0.5

= 0.079 sec

Time period in Y direction = 0.09 x h/(Dy)^0.5 (h=From From Base to Terrace)

where, h=3.6+ 2.5 (From Base to terrace)

= 0.09 x 6.1/(10.23)^0.5

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= 0.172sec

Building no. 5- FOB 1

Time period in X direction = $0.085x\ h^{\wedge 0.75}$

where, h=15 + 2.5 (From Base to top of ridge)

= $0.085 \times 17.5^{\wedge 0.75}$

= 0.727sec

Time period in Y direction = $0.085x\ h^{\wedge 0.75}$

where, h=15 + 2.5 (From Base to top of ridge)

= $0.085 \times 17.5^{\wedge 0.75}$

= 0.727sec

Building no. 6- FOB 2

Time period in X direction = $0.085x\ h^{\wedge 0.75}$

where, h=15 + 2.5 (From Base to top of ridge)

= $0.085 \times 17.5^{\wedge 0.75}$

= 0.727sec

Time period in Y direction = $0.085x\ h^{\wedge 0.75}$

where, h=15 + 2.5 (From Base to top of ridge)

= $0.085 \times 17.5^{\wedge 0.75}$

= 0.727sec

Considering Type-2 Soil (N<30) as per Geo-tech. Report,

Design Vertical seismic co-efficient *Av* for Building:

For steel structures;

Z = 0.36, I = 1.5, R = 4.5

Av = (2/3 x Z/2)/(R/I) x 2.5 = (2/3 x 0.36/2) / (4.5/1.5) x 2.5 = 0.1

For RC structures;

Z = 0.36, I = 1.5, R = 5

Av = (2/3 x Z/2)/(R/I) x 2.5 = (2/3 x 0.36/2) / (5/1.5) x 2.5 = 0.09

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4.2.4 WIND LOADS

IS 875-Part.III-2015 is used to find wind force.

Basic wind speed (Vb) = 50m/s (Bhuj)

The Design Wind Speed is given by $V_z = k_1 \times k_2 \times k_3 \times k_4 \times V_b$

Where, k_1 = Probability factor = 1.08;

k_2 = Terrain, height and structure size factor

k_3 = Topography factor,

k_4 = Important factor for cyclonic region,

$k_3 = k_4 = 1$ for this case.

The structure falls under Category-3 (Terrain with numerous closely space obstructions having size of buildings up to 10m in height with or without a few isolated tall structures.)and for the building height between 50 to 100m criteria,

Hence, $k_2 = 0.97$

Hence, $V_z = V_b \times k_1 \times k_2 \times k_3 \times k_4 = 50 \times 1.08 \times 0.97 \times 1 \times 1 = 52.38 m/s^2$

$p_z = 0.6 \times (V_z)^2 = 0.6 \times (52.38)^2 = 1646.2 N/m^2$

The Design Wind Pressure is given by $P_d = k_a \times k_d \times k_c \times p_z$

Where, k_a = Area averaging factor = 1;

k_d = Wind directionality factor = 0.9;

k_c = Combination factor = 0.9;

The Design Wind Pressure is given by $P_d = k_a \times k_d \times k_c \times p_z = 1*0.9*0.9*1646.2$

$= 1333.4 N/m^2$

However, value of P_d shall not be taken less then $0.7*p_z = 1152.3 N/m^2$

The Design Wind Pressure, $P_d = 1333.4 N/m^2$

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- **Dynamic Analysis (EARTHQUAKE):**

The 3D Dynamic Analysis of the structure has been performed to include the effect of Higher Modes. It gives the results of various parameters to be checked for the stability & serviceability of the structure like storey drifts, torsion effects, etc.

SDD Method :

S : Static

D : Dynamic Analysis (With Basic scale factor)

D : Scaled Dynamic Analysis

Step 1 (S)

In this method ,first of all Static Analysis is carried out with considering with infill Time Period.

Step 2 (D)

Then, 1st Dynamic Analysis is carried out with Response spectrum functions and cases for Spectrum are taken as Spec X & Spec Y with basic scale factor. Basic Scale factor is taken as 9810 as Sa, I, R, Z are taken from response spectrum function in Etabs.

Step 3 (D)

Now, 2nd Dynamic Analysis is carried out by multiplying Basic Scale factor by ratio of Static base shear & 1st Dynamic base shear.

- **P-Delta Analysis**

P-Delta Analysis has been carried out for accurate results.

Iterative -- Based on Load Cases: The load is computed from a specified combination of static load cases. This is called the P-Delta load combination. For example, the load may be the sum of a dead load case plus a fraction of a live load case. This approach requires an iterative solution to determine the P-Delta effect upon the structure. This method considers the P-Delta effect on an element-by-element basis.

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Hence, P-Delta Analysis of Type-II i.e . iterative type has been carried out for this Tower.

The Load factors considered for P-Delta analysis is (1.2 D.L + 1.2 L.L)

4.3 STIFFNESS MODIFIERS

According to **IS 1893-2016**, For structural analysis and design, the moment of inertia shall be taken as 35 percent of I_{gross} of beams and 70 percent of I_{gross} of columns. Displacement and Drift has to checked for Unscaled Response Spectrum load cases as per code.

> **6.4.3.1** For structural analysis, the moment of inertia shall be taken as:
>
> a) In RC and masonry structures: 70 percent of I_{gross} of columns, and 35 percent of I_{gross} of beams; and
>
> b) In steel structures: I_{gross} of both beams and columns.

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5. STRUCTURAL ANALYSIS

The structural form should contribute to the building character and identity while it is being efficient, cost effective and simple to construct.The structure is modeled for concrete frames and analyzed. Structure will be subjected for earthquake analysis by using minimum column section at floors. Structure will be analyzed using **ETABS 20.0.0** software.

6. LOAD COMBINATIONS

The results obtained from the computer analysis in the form of member forces and reactions will be used for designing the structural members. Following are the load combinations and the member forces will be considered for arriving at the design forces.

- **LIMIT STATE LOAD COMBINATIONS:**

1	1.5 D.L
4	1.5DL+1.5 LL
3	1.2DL+1.2LL+1.2EQX
4	1.2DL+1.2LL-1.2EQX
5	1.2DL+1.2LL+1.2EQY
6	1.2DL+1.2LL-1.2EQY
7	1.5DL+1.5EQX
8	1.5DL-1.5EQX
9	1.5DL+1.5EQY
10	1.5DL-1.5EQY
11	0.9D.L+1.5EQX
12	0.9D.L-1.5EQX
13	0.9D.L+1.5EQY
14	0.9D.L-1.5EQY
15	1.2DL+1.2LL+1.2SPEC X+0.36SPEC Z
16	1.2DL+1.2LL+1.2SPEC X-0.36SPEC Z
17	1.2DL+1.2LL-1.2SPEC X+0.36SPEC Z
18	1.2DL+1.2LL-1.2SPEC X-0.36SPEC Z

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19	1.2DL+1.2LL+1.2SPEC Y+0.36SPEC Z
20	1.2DL+1.2LL+1.2SPEC Y-0.36SPEC Z
21	1.2DL+1.2LL-1.2SPEC Y-+0.36SPEC Z
22	1.2DL+1.2LL-1.2SPEC Y-0.36SPEC Z
23	1.5DL+1.5SPEC X+0.45SPEC Z
24	1.5DL+1.5SPEC X-0.45SPEC Z
25	1.5DL-1.5SPEC X+0.45SPEC Z
26	1.5DL-1.5SPEC X-0.45SPEC Z
27	1.5DL+1.5SPEC Y+0.45SPEC Z
28	1.5DL+1.5SPEC Y-0.45SPEC Z
29	1.5DL-1.5SPEC Y+0.45SPEC Z
30	1.5DL-1.5SPEC Y-0.45SPEC Z
31	0.9DL+1.5SPEC X+0.45SPEC Z
32	0.9DL+1.5SPEC X-0.45SPEC Z
33	0.9DL-1.5SPEC X+0.45SPEC Z
34	0.9DL-1.5SPEC X-0.45SPEC Z
35	0.9DL+1.5SPEC Y+0.45SPEC Z
36	0.9DL+1.5SPEC Y-0.45SPEC Z
37	0.9DL-1.5SPEC Y+0.45SPEC Z
38	0.9DL-1.5SPEC Y-0.45SPEC Z
39	1.2DL+1.2LL+1.2WLX
40	1.2DL+1.2LL-1.2WLX
41	1.2DL+1.2LL+1.2WLY
42	1.2DL+1.2LL-1.2WLY
43	1.5DL+1.5WLX
44	1.5DL-1.5WLX
45	1.5DL+1.5WLY
46	1.5DL-1.5WLY

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47 0.9DL+1.5WLX

48 0.9DL-1.5WLX

49 0.9DL+1.5WLY

50 0.9DL-1.5WLY

- **SERVICEABILITY LOAD COMBINATION :**

1.DL+LL

2.DL+UN SPEC-X

3.DL+UN SPEC-Y

4.DL+0.8 LL+ 0.8 UNSPEC-X

5.DL+0.8 LL+ 0.8 UNSPEC-Y

6. DL±SPECX±0.3SPECZ

7. DL±SPECY±0.3SPECZ

8. DL + W.LX

9. DL - W.LX

10. D.L + W.LY

11. D.L - W.LY

12.D.L+0.8L.L+0.8W.LX

13.D.L+0.8L.L-0.8W.LX

13.D.L+0.8L.L+0.8W.LY

14.D.L+0.8L.L-0.8W.LY

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7. STRUCTURAL DESIGN

7.1 DESIGN METHOD

For the design of structural steel elements, limit state method will be used as per IS 800 : 2007.

For the design of R.C.C. elements, the Limit State Method will be used as per IS: 456:2000 Materials of construction will be predominantly concrete and steel with consideration for strength and durability. The Reinforcing bars to be used in concrete elements are conforming to IS:1786-2008 with Fy=500 N/mm^2 (Fe500D)

Covers to Reinforcement

Clear cover for all RCC members shall be in accordance with IS: 456:2000 corresponding to severe exposure conditions for the super-structure as well as the sub-structure and to satisfy a fire rating of 2 hrs.

Minimum clear cover is to be provided to main steel for

- For Footing : 50mm for Sides & Bottom
- For Column : 40mm
- For Beam (continuous) : 30mm for Sides & Bottom
- For Beam (simply supported) : 40mm for Bottom
- For Slab : 25 mm
- For RCC shear wall : 40 mm

All Sub structure is in Severe exposure condition and all super structure is in also Severe exposure condition.

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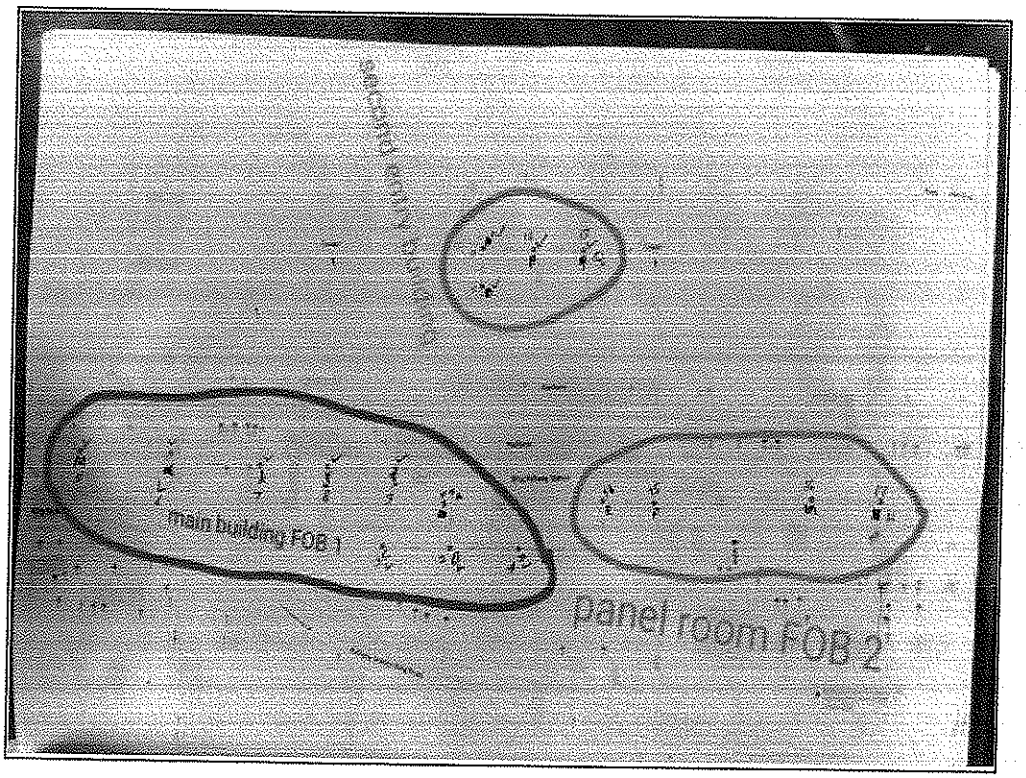
8. SOIL INVESTIGATION & BEARING CAPACITY

Soil investigation report is prepared by AMBAY TESTING LABORATORY, JAIPUR with Job No.32583 report no.ULR-TC637322000032583F.There are total 17 bores taken from the captioned site. The Net Safe Bearing capacity recommended for different bores is as under with their location as supplied by soil consultant;



Bore hole location

All SBC reports are submitted to Authority.We will consider SBC as per conclusion Table provided by Geotech. Consultant.Building and Location wise SBC recommendation is given in SBC reports. We will follow the same as per type of foundations in various Buildings mentioned in Reports.

Thickness of P.C.C. is considered 100mm. & Foundation is designed for fixed condition only. The water table was not met at a depth of about 15M below existing Ground Level. If the foundation pressure governs in earthquake/wind combinations, then SBC will be enhance upto 50% as per IS 1893_2016, Table-1.

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9. VALUE ENGINEERING

The parameters adopted in this report are going to be the basis of the structural design.Hence it is requested that all team members give their feedback and approval to the parameters, suggestions, recommendations mentioned in this report. Certain additional parametric changes may be adopted due to some conditional changes in plans or requirements. Structural consultant shall have full freedom to add value to any aspect of design parameters mentioned here in this DBR to maintain the sound integrity of the structure.

10. CONCLUSIONS & RECOMMENDATIONS

This brief concept has been formulated based on the architectural scheme provided by **KAMLESH PAREKH ARCHITECTS.** The report suggests a concept level structural design of **MAJOR UPGRADATION OF NEW BHUJ RAILWAY STATION OF WESTERN RAILWAY, BHUJ, Gujarat** and must be read keeping in mind these limitations.

It focuses only on the overall structural design and durability of the building and does not aim to address the details of the structural design of building. As the next logical step towards scheme design, following is recommended.

1. Concept design of superstructure to be finalized by Client and Architects followed by final architectural drawings (Plans, Elevations & Sections) to be sent across for Structural Consultants to re-initiate the drawing process.
2. Approvals/Comments and sign-off of the structural system and structural framing plans.
3. Development of Construction Drawings.

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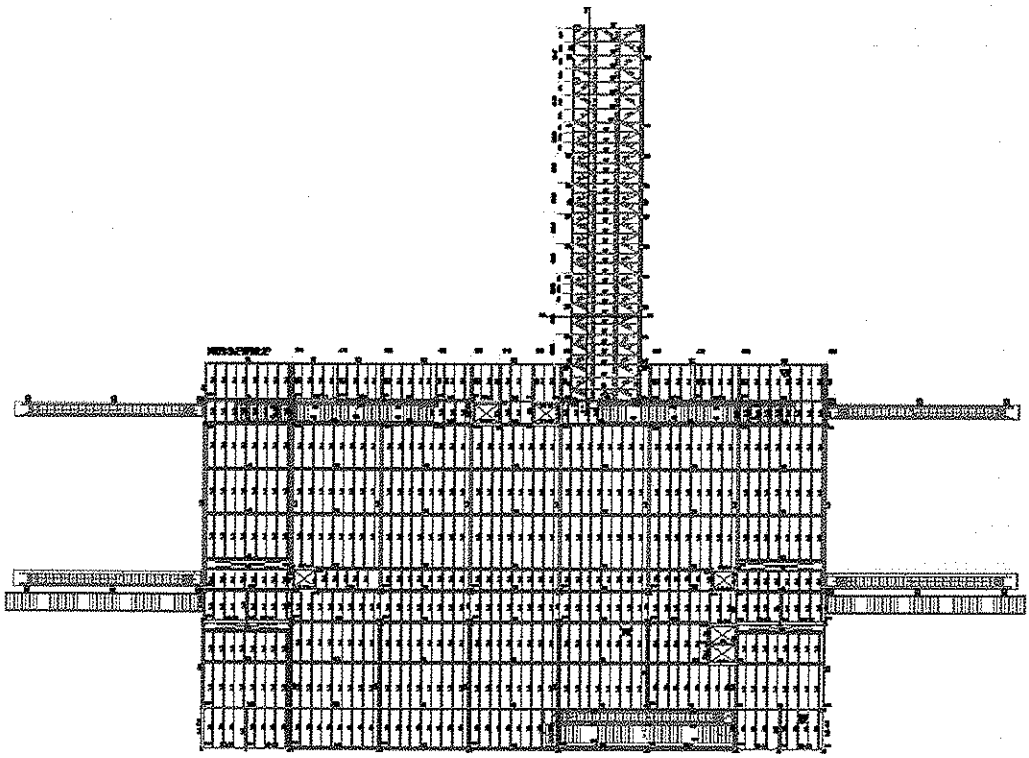
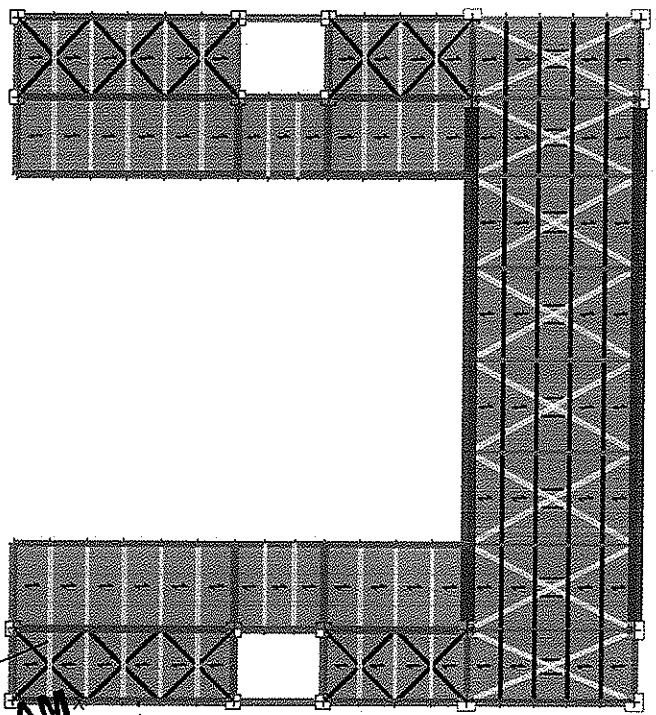
11. STRUCTURAL FLOOR PLAN





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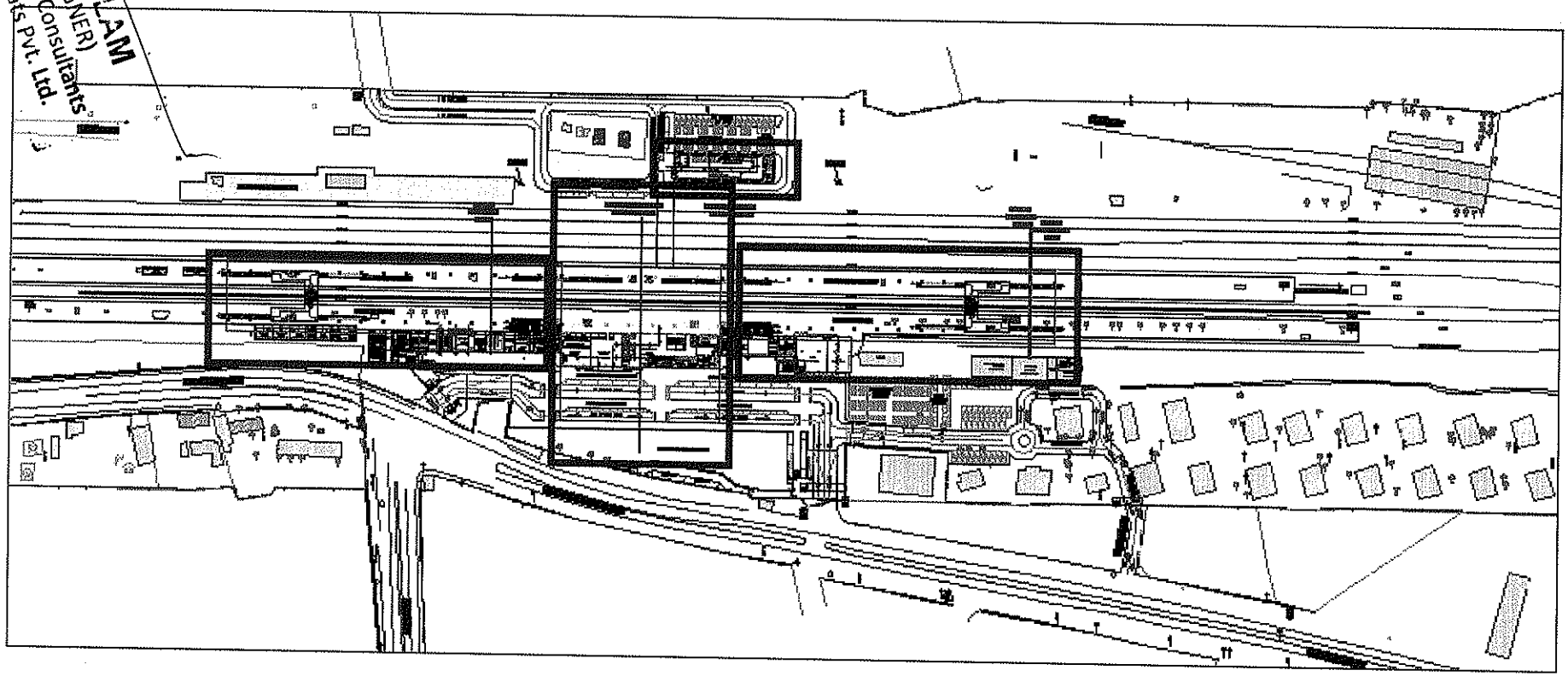
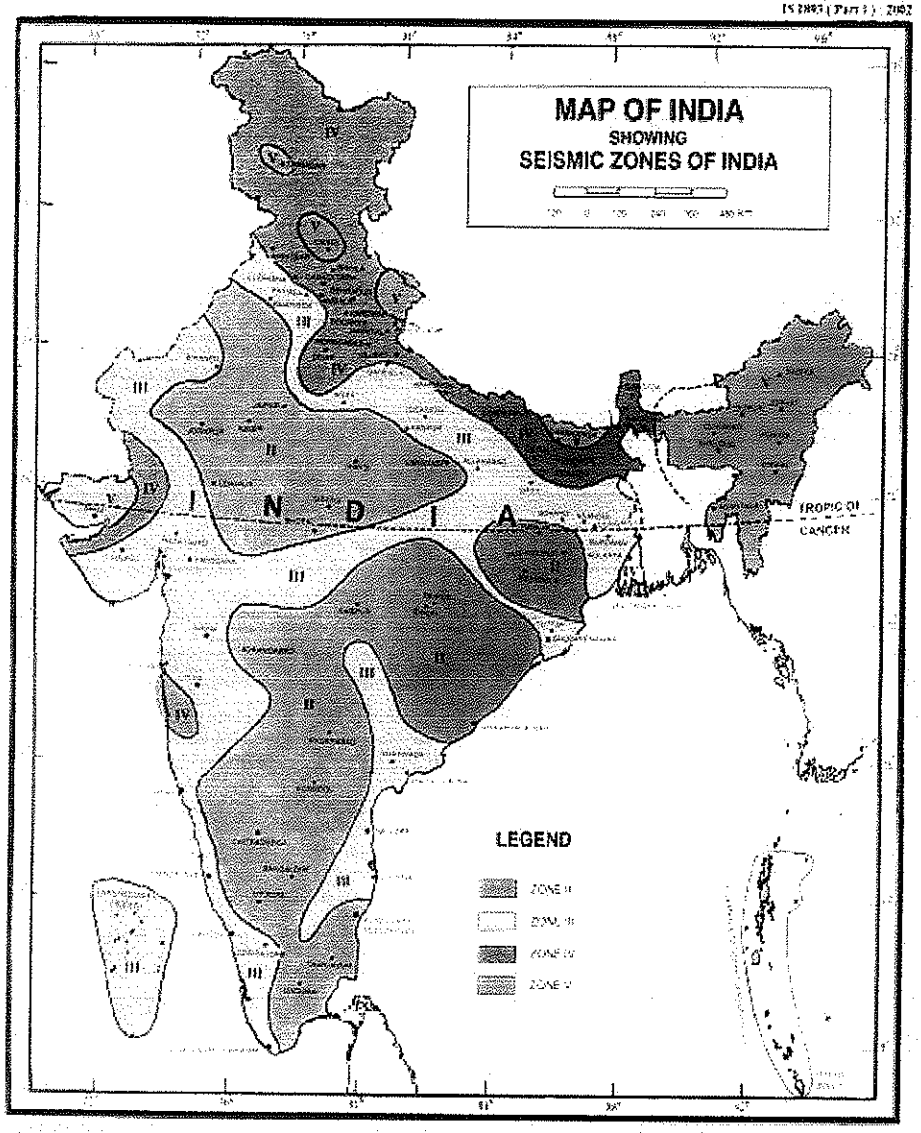


BUILDING LAYOUT PLAN

12. REFERENCE FOR SIESMIC ZONE



NOTE : Towns falling at the boundary of zones demarcation line between two zones shall be considered in High Zone.

1) Based upon Survey of India map with the permission of the Surveyor General of India.

2) The responsibility for the correctness of internal details rests with the publisher.

3) The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.

4) The administrative headquarters of Chandigarh, Haryana and Punjab are at Chandigarh.

5) The interstate boundaries between Arunachal Pradesh, Assam and Meghalaya shown on this map are as interpreted from the North-Eastern Areas (Reorganization) Act, 1971 but have yet to be verified.

6) The external boundaries and coastlines of India agree with the Record/Master Copy certified by Survey of India.

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displacement of sand and mud; change of water level in wells; water from canals, lakes, rivers, etc, thrown on land. New lakes occur.

XI Destruction

i) —

ii) Severe damage even to well built buildings, bridges, water dams and railway lines. Highways become useless. Underground pipes destroyed.

iii) Ground considerably distorted by broad cracks and fissures, as well as movement in horizontal and vertical directions. Numerous landslips and falls of rocks. The intensity of the earthquake requires to be investigated specifically.

XII Landscape Changes

i) —

ii) Practically all structures above and below ground are greatly damaged or destroyed.

iii) The surface of the ground is radically changed. Considerable ground cracks with extensive vertical and horizontal movements are observed. Falling of rock and slumping of river banks over wide areas, lakes are dammed; waterfalls appear and rivers are deflected. The intensity of the earthquake requires to be investigated specially.

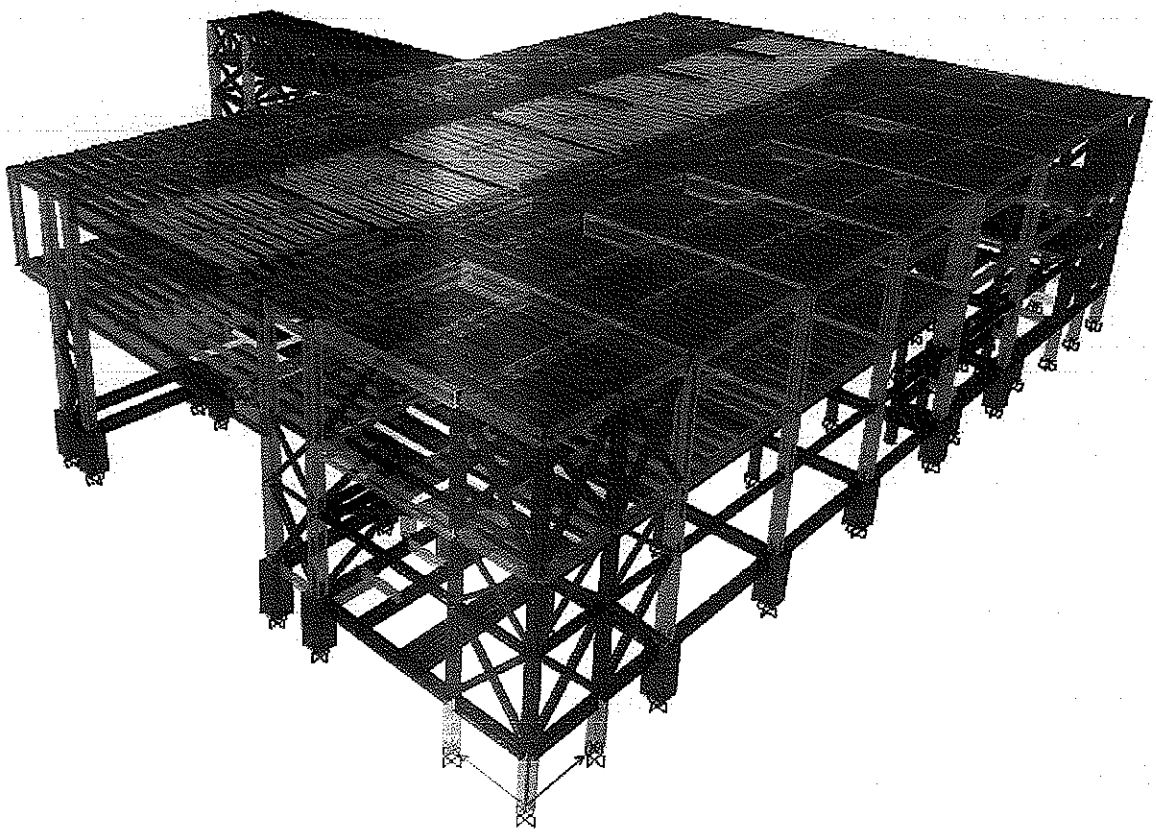
ANNEX E

(Foreword)

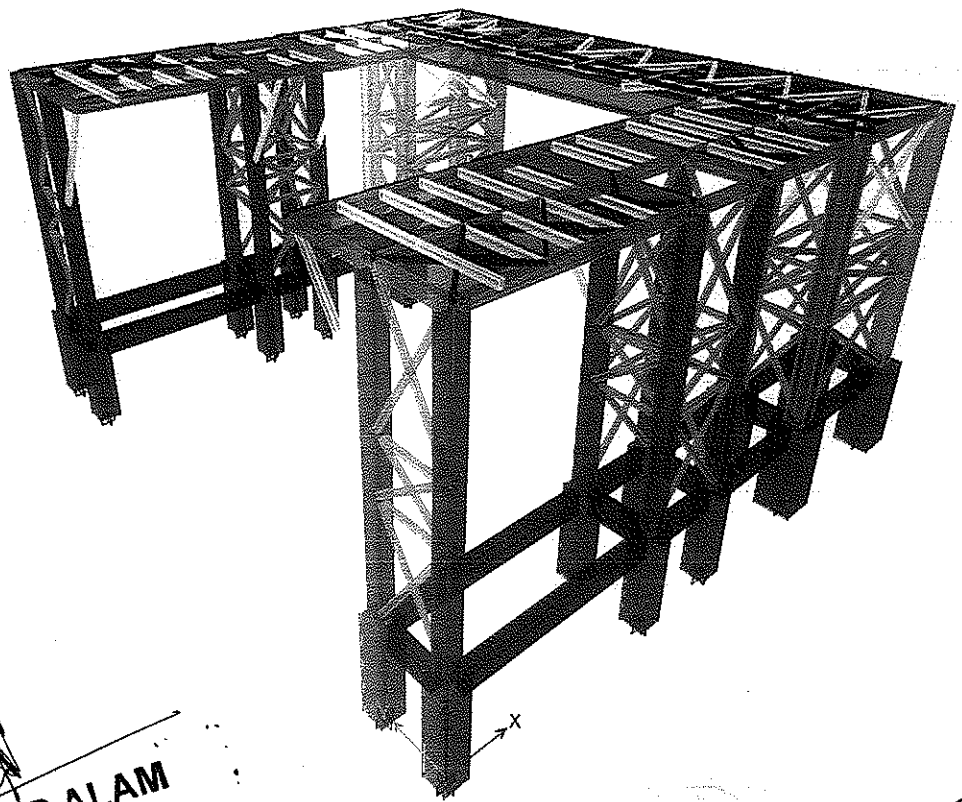
LIST OF SOME TOWNS WITH POPULATION MORE THAN 3 LAKHS (as per CENSUS 2011) AND THEIR SEISMIC ZONE FACTOR Z

Town	Zone	Z	Town	Zone	Z
Agra	III	0.16	Calicut (Kozhikode)	III	0.16
Ahmedabad	III	0.16	Chandigarh	IV	0.24
Ajmer	II	0.10	Chennai	III	0.16
Allahabad	II	0.10	Chitradurga	II	0.10
Almora	IV	0.24	Coimbatore	III	0.16
Ambala	IV	0.24	Cuddalore	II	0.10
Amritsar	IV	0.24	Cuttack	III	0.16
Asansol	III	0.16	Darbhanga	V	0.36
Aurangabad	II	0.10	Darjeeling	IV	0.24
Bahraich	IV	0.24	Dharwad	III	0.16
Bangalore (Bengaluru)	II	0.10	Dehra Dun	IV	0.24
Barauni	IV	0.24	Dharampuri	III	0.16
Bareilly	III	0.16	Delhi	IV	0.24
Belgaum	III	0.16	Durgapur	III	0.16
Bhatinda	III	0.16	Gangtok	IV	0.24
Bhilai	II	0.10	Guwahati	V	0.36
Bhopal	II	0.10	Gulbarga	II	0.10
Bhubaneswar	III	0.16	Gaya	III	0.16
Bhuj	V	0.36	Gorakhpur	IV	0.24
Bijapur	III	0.16	Hyderabad	II	0.10
Bikaner	III	0.16	Imphal	V	0.36
Bokaro	III	0.16	Jabalpur	III	0.16
Bulandshahr	IV	0.24	Jaipur	II	0.10
Burdwan	III	0.16	Jamshedpur	II	0.10

13.ETABS MODEL - PRELIMINARY 3D IMAGES



BUILDING NO. 1A: MAIN BUILDING WITH DEPARTURE BRIDGE



BUILDING NO. 5- FOB 1

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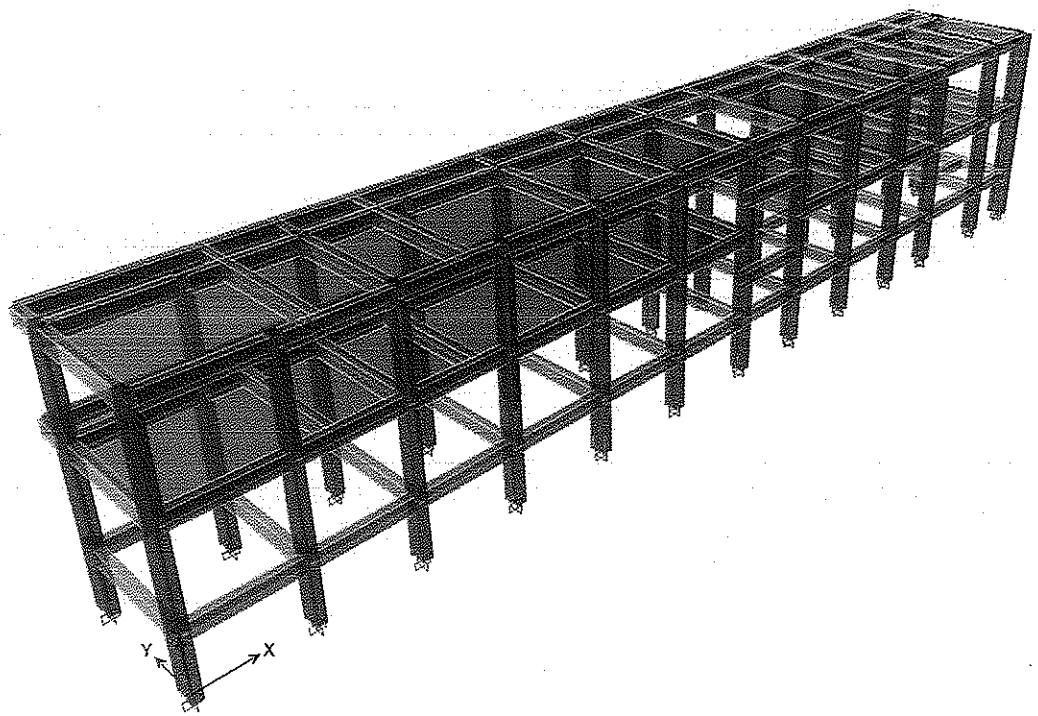
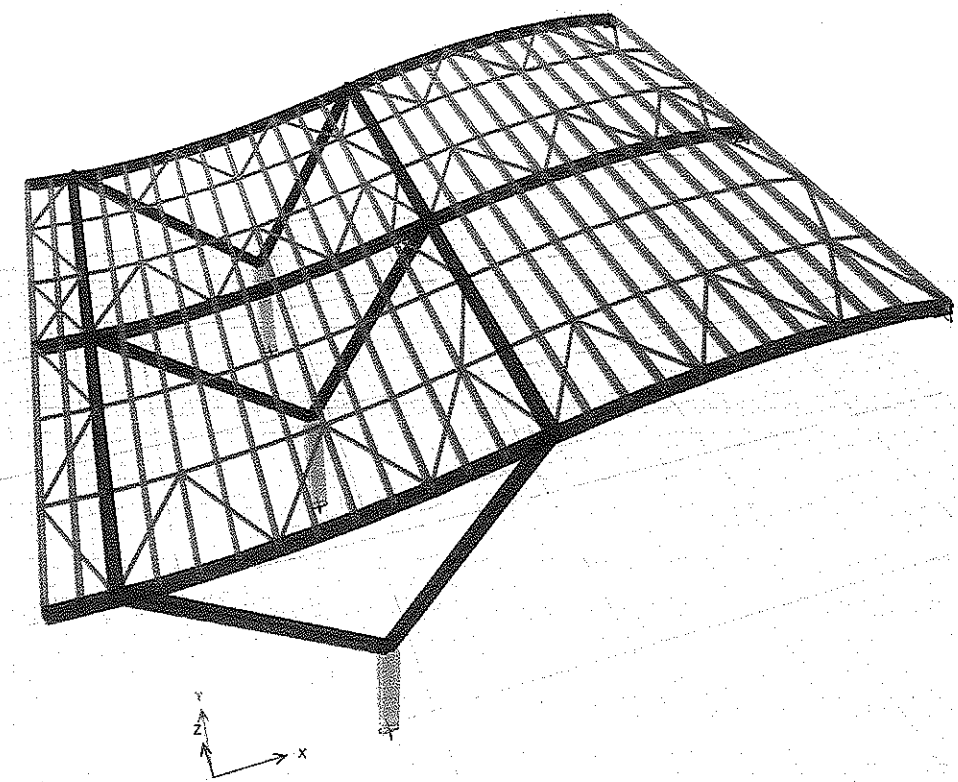


BUILDING NO. 3



Entrance canopy

* As per tender documents / contract agreements

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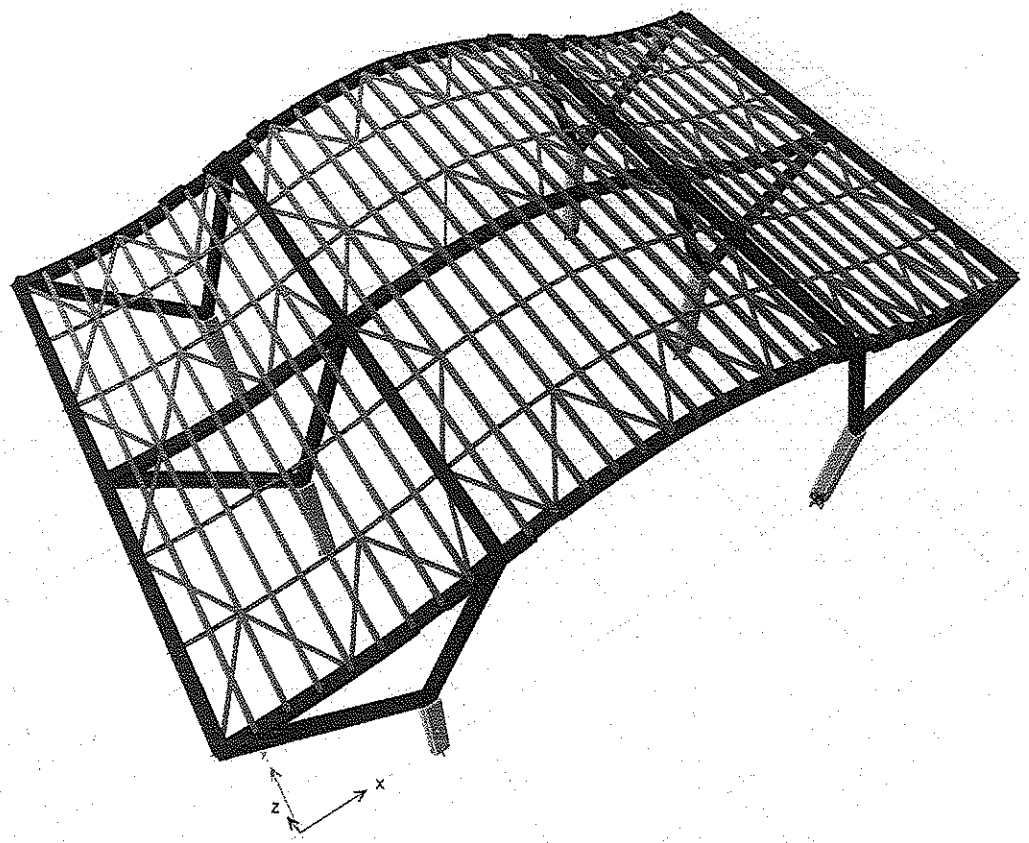
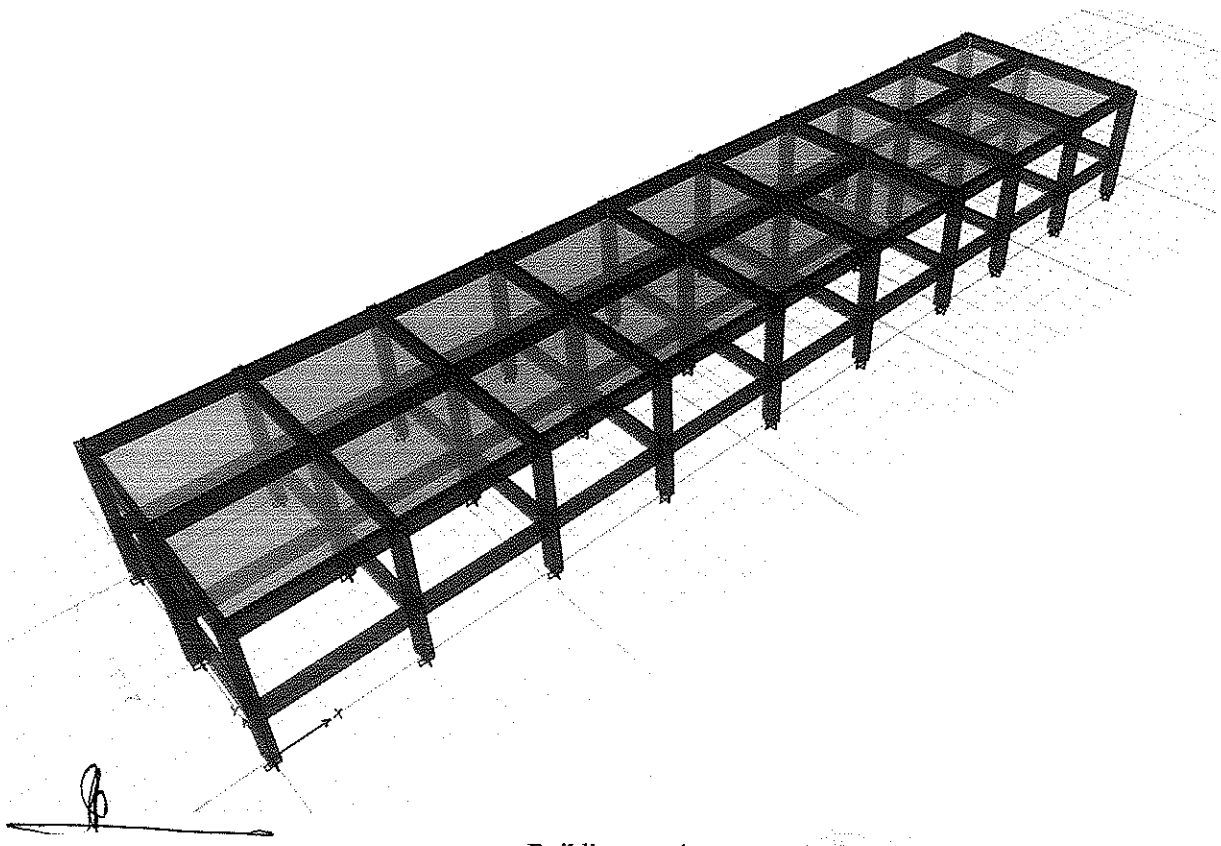


Building no. 1D, 1E, 1F and 1G (Through canopy)



Building no. 4

* As per tender/ Contract agreement

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