भूमि से सम्पदा

सत्यमेव जयते

Rail Land Developement Authority
रेल मंत्रालय,भारत सरकार का सांविधिक प्राधिकरण
(A statutory Authority under Ministry of Railways, Government of India)

No. RLDA/2023/Design Unit/DBR Correspondence/2863 **Dated 15.05.2023**
17

CEO/SITCO
Surat
Rail Land Development Authority

Sub.: Approval of Structural DBR for Surat MMTH Project.

Ref.: 1. CEO/SITCO letter no. SITCO/SITE/SURATMMTH/EPC Contract/Corroesp/2023 dated 28.04.2023.
2. Comments on Structural DBR conveyed vide Note#2 of file no. SITCO/HQ/Surat MMTH/DBR (2023).
3. CEO/SITCO letter no. SITCO/SITE/SURATMMTH/EPC Contract/Corroesp/2023 dated 11.05.2023.

1. Structural DBR related to project mentioned in subject was received vide ref. 1. was submitted for approval. The same was scrutinized and observations were communicated vide ref. 2. Revised structural DBR no. DBR/SMMTH/STR/R9 was submitted vide ref. 3 along with the reply on comments communicated vide ref. 2.

2. The submitted structural DBR no. DBR/SMMTH/STR/R9 has been scrutinized in light of reply of comments communicated vide ref. 2. Submitted structural DBR is approved for the structures mentioned in this DBR subject to incorporation of points given as Annexure A. Separate DBR should be submitted for structures which are crossing over tracks or in vicinity of tracks such as concourse, FOB, through roof and cover over platforms, etc.

3. Above mentioned DBR has been examined by Design Unit from codal point of view, based on data provided in the DBRs. Correctness of site-specific details included in DBR and compliance of DBR with contractual/ RLDA requirements have not been examined. Compliance of all requirements as per contract agreement, site conditions and railway requirements may be ensured at your end. Notwithstanding the above approval, the designer shall remain responsible for compliance of design from statutory codal requirements, standards, norms, guidelines, regulations at all times.

This is for your kind information and further necessary action.

DA: As above

15.05.23
(Atul Kumar Verma)
GM/Design/RLDA

Points to be incorporated in DBR No. DBR/CMMTH/STR/R0.

SN	Para / Page No. of Design Basis Report	Points to be incorporated
1	Page No.-2 / Cl. 1.2 .	Design life of all the buildings may be taken as 70 years and to be designed accordingly in view of reply given vide ref. 2.
2	Page No.-3 / Cl. 1.3 C Internal Loads	• Properties of reinforcement steel should be in accordance with IS 1786. • Properties of structural steel should be as per IS 2062. Hollow section properties to be as IS 4923 or IS 1161 as the case may be. These codes should be mentioned in this clause.
3	Other points to be incorporated/added in DBR at suitable place	• Structural design and detailing aspects such as joint detailing, accessibility of critical components which affects maintainability of structures should be addressed at the design stage. Accordingly, the structure should be designed keeping in view the maintenance aspects of structure also.
4		• Design of structure during various construction stages considering sequence of construction/ erection and launching along with applicable construction loads need to be done apart from design of final structure considering serviceability and ultimate limit states.
5		• Effect of vibrations and noise due to trains on various structures should be included in the design of various structures. Structures should be designed such that effects of vibrations, noise, etc. on structure should not make it unserviceable.
6		• The stiffness modifiers for cracked section as per IS 1893-2016 may be considered in seismic analysis. • Beam-column joint strength of moment resisting frames may be verified as per clause 9 of IS 13920-2016

DEVELOPMENT
OF
MULTI MODAL TRANSPORTATION HUB
IN
SURAT, GUJARAT

DESIGN BASIS REPORT
(STRUCTURE)

SITCO

Client

Design Point Consult Pvt. Ltd.
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Ar. Surjit Singh Bhambra
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Jatly Associates New Delhi Consulting Engineers

GLC ACCURACY. QUALITY. COMMITMENT

EPC Contractor

DPC PVT. LTD.

Lead Designer

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Document No. - DBR/SMMTH/STR/R8

Table of Contents

1. STRUCTURAL AND CIVIL WORKS

1.1 GENERAL

This report generally covers the basis on which structural analysis, design and details will be done. The report covers: -

- Structural systems
- Material
- Loading
- Design limit state combinations
- Applicable codes and standards and reference documents.

1.2 TYPE OF STRUCTURE

- RCC and Steel structure to be used as per requirement. The life of the structure considered in the design will be 70 years.

1.3 MATERIAL USED

A. Material Properties

Unit Weight of Concrete	=25.0 kN/cu.m
Unit Weight of Steel	=78.5 kN/cu.m
Unit Weight of Soil (Dry)	= As per Geotechnical report
Unit Weight of Water	= 10.0 kN/cu.m
Unit Weight of AAC Block	= 8.0 kN/cu.m
Unit Weight of floor finish	= 20.0 kN/cu.m
Unit Weight of Brick	= 20.0 kN/cu.m
Unit Weight of Toe Wall	=25.0 kN/cu.m
Unit Weight of 12 mm glazing	=33.0 Kg/sqm

B. Following are the Grades of Concrete used in design.

Elements	minimum concrete grade
COLUMNS	M30,M40,M70
BEAM AND SLAB	M30
FOUNDATION	M30,M40,M50

C. Reinforcement Specification

Grade of Reinforcement Steel = Fe-550D

Structural steel grades Fe 250 for rolled steel sections, 310 & 350 for SHS, RHS, etc. will be used as per the requirements of the structure. Structural Steel will be used only in specific areas on terrace e.g., raised platforms, for OHWT, services, etc.

1.4 STRUCTURAL SYSTEM

The structural system adopted is the Special Moment Resisting Frame (SMRF) System.
The main considerations followed for the design of structural are:

- Structural safety and stability
- To meet the demands of aesthetics conceived by the architect
- Availability of material, equipment and expertise.
- Constructability and ease of maintenance.
- Durability
- Economy

1.4.1 Superstructure —Gravity Load Resisting System

The structural system comprises of RCC columns & Beams with solid slab to transfer all gravity load to the foundation level. Columns are placed at locations such that the stability and utility are fulfilled.

1.4.2 Superstructure — Lateral Load Resisting System

The stability of building against lateral forces is entirely provided by the SMRF system.

1.4.3 Substructure

1) For GSRTC Building - Discussion with Geo-technical Engineer on allowable bearing pressure under the raft has not yet been concluded. Hence type of foundation may change on conclusion on the allowable bearing pressure.
2) For temporary structures the SBC has been interpolated from the soil report & the values adopted are 20 T/sqm for temporary buildings. Isolated footings have been provided.

3) For East Side Building – Taking the reference of the geo-technical report, SBC of 25 T/sqm is considered. Isolated/combined footings shall be provided.

4) For West Side Building - The geotechnical report is still awaited.

1.4.4 Water Retaining Structures

Water retaining structures shall be designed as per IS: 456 -2000 and IS: 3370 - 2009 (Part-2). Since water retaining structures are subjected to cyclic loading (full or empty conditions). thus, as structural concept all water retaining structures shall be designed based on working stress method, and stress limitations in concrete and steel shall be as per IS :3370 - 2009 (Part-2).

1.4.5 Retaining Walls

Retaining walls are used to retain earth at location where there is level difference in ground level. At rest Earth Pressure condition has been considered. Retaining walls are designed for stability (overturning and sliding) and checked for bending and shear.

At Rest earth pressure coefficient, $k_0 = 1-\sin\Phi$

1.4.6 Expansion joint

If the length of Building is more than 45m, then expansion joint will be provided to control the thermal stresses. Temperature loads will be considered as per IS 875 Part 5. Maximum temperature = 45 ^{0}C. Minimum temperature = 7.5^{0}C. Ambient temperature of concrete = 27^{o}C. Difference in temperature in Summer = 18^{0}C. Difference in temperature during winters = 19.5^{0}C. Temperature loads considered shall be +18^{0}C and -19.5^{0}C.

1.4.7 Nominal Cover

Clear covers to main reinforcement for different structural elements based on 2 hours fire rating are as follows (latest IS-456 should be followed in case of any ambiguity): IS 456:2000, TABLE 16, CLAUSE 21.4 and 26.4.3 and FIG 1. For super structure mild exposure condition and for sub-structure severe exposure condition has been considered.

Beam	= 30mm,40mm
Slab	= 25mm,35mm
Column	= 40mm
RCC wall	= 40mm
Foundation	= 50mm
PILE	= 75 mm
PILE CAP	= 75 mm

1.4.8 Excavation

Excavation shall be done as per structural drawing for excavation.

1.4.9 Crack width

Cracking of concrete will occur whenever the tensile strength of concrete is exceeded. As concrete has relatively low tensile strength as well as low failure strain in tension, cracking is usually inevitable in normal reinforced concrete members. However, the degree of cracking (in terms of width and spacing of cracks) can be controlled through proper design. In order to avoid excessive cracking in the flexural members, maximum diameter and spacing of the reinforcements is restricted as per the building rules indicated in IS:456:2000.

1) 0.3 mm where cracking is not harmful (Super Structure, Structural Fitments)
2) 0.2 mm where cracking is harmful (structures below Ground)
3) 0.1mm for water retaining structure

Note: - To control cracking maximum spacing of bars in all structural elements shall not be more than 250 mm center to center.

1.5 DESIGN PHILOSPHY

Limit state design approach will be considered including limit state of serviceability and collapse so that the structure should sustain all loads and deformations liable to occur during its construction, perform adequately in normal use, and have adequate durability.

1.6 LOAD AND LOAD COMBINATION

The structure is analyzed and designed for all possible Load Combinations of gravity loads (dead and live load), lateral loads (Earthquake loads/Wind) & temperature loads.

1.6.1 LOADING PARAMETERS

1. Material Properties

Unit Weight of Concrete	= 25.0 kN/cu.m
Unit Weight of Steel	= 78.5 kN/cu.m
Unit Weight of Soil (Dry)	= As per Geotech report
Unit Weight of Water	= 10.0 kN/cu.m
Unit Weight of AAC Block	= 8.0 kN/cu.m Unit

Weight of floor finish = 20.0 kN/cu.m Unit

Weight of Brick = 20.0 kN/cu.m

2. Dead Loads

Self-Weight- shall be calculated based on material properties, unit in kN/cum.

Self- weight of RCC column and beams are automatically considered by software.

Self-weight factor for RCC = 1.0

RCC Slab Load

Slab 150mm thick = 3.75 KN /Sq-m

Slab 175mm thick = 4.375 KN /Sq-m

Floor Finishes (50 mm) = 1. 2 KN/Sq-m

Floor Finishes (75 mm) = 1. 50 KN/Sq-m

3. Imposed Load/ Live Load

Balconies-4kN/m^2, Bath&Toilets-2kN/m^2, Staircase-4kN/m^2, Fire Tender 20kN/m^2, Offices-4kN/m^2, Corridors-4kN/m^2, Car parking-5kN/m^2, Bus parking 10kN/m^2 as per IS 875 (Part-2) for calculation of Live Load for Building.
Earthquake Loads

The structure is designed for the minimum state seismic base shear set out by latest IS- 1893- 2016 (Part-I), using the parameters given below:

Design Earthquake = 10% chance of being exceeded within 50 years Seismic Zone = Zone III

Seismic Zone Factor, = 0.16

Soil Profile Type = type II

Seismic Importance Factor (I) = 1.5

Response Reduction Factor (R) = 5.0

Damping Ratio = 5 %

4. Wind Loads

The structure is designed for the wind load as for basic wind speed of 44 m/s as per IS 875-2015 (Part 3)

Basic Wind Speed	Vb	=	44	m/sec	For Surat
Probability Factor	K_1	=	1.07	015 TABLE 1, CLAUSE6.3.1	
Terrain, Height and Structure Size Factor	K_2	=	VARIES	As per CATEGORY-2 at various storey heights as per IS-875(part-3):2015 TABLE 2, CLAUSE 6.3.2.2	
Topography Factor	K_3	=	1	IS-875(part-3):2015, CLAUSE 6.3.3	
Cyclonic Region	K_4	=	1.3	IS-875(part-3):2015, CLAUSE 6.3.4	
Design Wind Speed	Vz	=	$K_1*K_2*K_3*K_4*V_b$	69.160	m/sec
Design Wind Pressure	Pz	=	$0.6*(Vz)^2$	2869.90	N/m^2
				2.87	kN/m^2
Internal Pressure Coefficients			±0.5		
External Pressure Coefficients			As per table 5 of IS 875 Part III: 2015		

1.6.2. LOAD COMBINATIONS

For reinforced concrete design, the individual loads will be combined in accordance with the loading combinations specified in latest IS 1893 (part -1):2016, IS:456 :2000 & IS 875-1987(Part-5) to achieve the applicable limit state.

ULS Load Combinations

401-(1.5DL+1.5TL+1.5WX)
402-(1.5DL+1.5TL +1.5WY)
403-(1.5DL+1.5TL -1.5WX)
404-(1.5DL+1.5TL -1.5WY)
405-(0.9DL+0.9TL +1.5WX)
406-(0.9DL+0.9TL +1.5WY)
407-(0.9DL+0.9TL -1.5WX)
408-(0.9DL+0.9TL -1.5WY)
409-(1.2DL+1.2TL+1.2LL+1.2WX)
410-(1.2DL+1.2TL +1.2LL+1.2WY)
411-(1.2DL+1.2TL +1.2LL-1.2WX)
412-(1.2DL+1.2TL +1.2LL-1.2WY)
701-(1.5 DL+1.5LL+FTL)
801-(DL+50%LL)
801-A(DL+LL)
201-A(1.5DL+1.5TL+1.5SPECX+0.45SPECZ)
201-B(1.5DL+1.5TL +1.5SPECX-0.45SPECZ)
201-C(1.5DL+1.5TL -1.5SPECX+0.45SPECZ)
201-D(1.5DL+1.5TL -1.5SPEC-0.45SPECZ)
202-A(1.5DL+1.5TL +1.5SPECY+0.45SPECZ)
202-B(1.5DL+1.5TL +1.5SPECY-0.45SPECZ)
202-C(1.5DL+1.5TL -1.5SPECY+0.45SPECZ)
202-D(1.5DL+1.5TL -1.5SPECY-0.45SPECZ)
203-A(1.5DL+1.5TL +1.5SPECZ+0.45SPECX)
203-B(1.5DL+1.5TL +1.5SPECZ-0.45SPECX)
203-C(1.5DL+1.5TL -1.5SPECZ+0.45SPECX)
203-D(1.5DL+1.5TL -1.5SPECZ-0.45SPECX)
204-A(1.5DL+1.5TL +1.5SPECZ+0.45SPECY)
204-B(1.5DL+1.5TL +1.5SPECZ-0.45SPECY)
204-C(1.5DL+1.5TL -1.5SPECZ+0.45SPECY)
204-D(1.5DL+1.5TL -1.5SPECZ-0.45SPECY)
205-A(0.9DL+0.9TL +1.5SPECX+0.45SPECZ)
205-B(0.9DL+0.9TL +1.5SPECX-0.45SPECZ)
205-C(0.9DL+0.9TL -1.5SPECX+0.45SPECZ)
205-D(0.9DL+0.9TL -1.5SPECX-0.45SPECZ)
206-A(0.9DL+0.9TL +1.5SPECY+0.45 SPECZ)
206-B(0.9DL+0.9TL +1.5SPECY-0.45SPECZ)
206-C(0.9DL+0.9TL -1.5SPECY+0.45SPECZ)
206-D(0.9DL+0.9TL -1.5SPECY -0.45SPECZ)
207-A (0.9DL+0.9TL +1.5SPECZ+0.45SPECX)
207-B (0.9DL+0.9TL +1.5SPECZ-0.45SPECX)
207-C (0.9DL+0.9TL -1.5SPECZ+0.45SPECX)
207-D (0.9DL+0.9TL -1.5SPECZ-0.45SPECX)
208-A(0.9DL+0.9TL +1.5SPECZ+0.45SPECY)
208-B(0.9DL+0.9TL +1.5SPECZ-0.45SPECY)
208-C(0.9DL+0.9TL +1.5SPECZ+0.45SPECY)
208-D(0.9DL+0.9TL -1.5SPECZ-0.45SPECY)
209-A(1.2DL+1.2TL +1.2RLL+1.2SPECX+0.36SPECZ)
209-B(1.2DL+1.2TL +1.2RLL+1.2SPECX-0.36SPECZ)
209-C (1.2DL+1.2TL+1.2RLL-1.2SPECX+0.36SPECZ)
209-D(1.2DL+1.2TL +1.2RLL-1.2SPECX-0.36SPECZ)
210-A(1.2DL+1.2TL+1.2RLL+1.2SPECY+0.36SPECZ)
210-B(1.2DL+1.2TL +1.2RLL+1.2SPECY-0.36SPECZ)
210C(1.2DL+1.2TL +1.2 RLL+1.2SPECY+0.36SPECZ)
210D(1.2DL+1.2TL +1.2RLL-1.2SPECY-0.36SPECZ)
211A(1.2DL+1.2TL +1.2RLL+1.2SPECZ+0.36SPECX)
211B(1.2DL+1.2TL +1.2RLL+1.2SPECZ-0.36SPECX)
211C(1.2DL+1.2TL +1.2RLL-1.2SPECZ+0.36SPECX)
211D(1.2DL+1.2TL -1.2RLL-1.2SPECZ-0.36SPECX)
212A(1.2DL+1.2TL +1.2RLL+1.2SPECZ+0.36SPECY)
212B(1.2DL+1.2TL +1.2RLL+1.2SPECZ-0.36SPECY)
212C(1.2DL+1.2TL +1.2RLL-1.2SPECZ+0.36SPECY)
212D(1.2DL+1.2TL +1.2RLL-1.2SPECZ-0.36SPECY)

SLS Load Combinations

900-SR-(DL+LL+TL+FTL)
900A(DL+TL±EQX)
900B(DL+TL±EQY)
901-SR-(DL+TL+0.6LL)
902A-SR-(DL+TL+SPECX+0.3SPECZ)
902B-SR-(DL+TL+SPECX-0.3SPECZ)
902C-SR-(DL+TL-SPECX+0.3SPECZ)
902D-SR-(DL+TL-SPECX-0.3SPECZ)
903A-SR-(DL+TL+SPECY+0.3SPECZ)
903B-SR-(DL+TL+SPECY-0.3SPECZ)
903C-SR-(DL+TL-SPECY+0.3SPECZ)
903D-SR-(DL+TL-SPECY-0.3SPECZ)
904A-SR-(DL+TL+SPECZ+0.3SPECX)
904B-SR-(DL+TL+SPECZ-0.3SPECX)
904C-SR-(DL+TL-SPECZ+0.3SPECX)
904D-SR-(DL+TL-SPECZ-0.3SPECX)
905A-SR-(DL+TL+SPECZ+0.3SPECY)
905B-SR-(DL+TL+SPECZ-0.3SPECY)
905C-SR-(DL+TL-SPECZ+0.3SPECY)
905D-SR-(DL+TL-SPECZ-0.3SPECY)
906-SR-(DL+TL+WX)
907-SR-(DL+TL -WX)
908-SR-(DL+TL +WY)
909-SR-(DL+TL -WY)
910-SR-(DL+TL+0.8LL+0.8WX)
911-SR-(DL+TL+0.8LL+0.8WY)
912-SR-(DL+TL+0.8LL-0.8WX)
913-SR-(DL+TL+0.8LL-0.8WY)
914A-SR-(DL+TL +0.8LL+0.8SPECX+0.24SPECZ)
914B-SR-(DL+TL +0.8LL+0.8SPECX-0.24SPECZ)
914C-SR-(DL+TL +0.8LL-0.8SPECX+0.24SPECZ)
914D-SR-(DL+TL +0.8LL-0.8SPECX-0.24SPECZ)
915A-SR-(DL+TL +0.8LL+0.8SPECY+0.24SPECZ)
915B-SR-(DL+TL +0.8LL+0.8SPECY-0.24SPECZ)
915C-SR-(DL+TL +0.8LL-0.8SPECY+0.24SPECZ)
915D-SR-(DL+TL +0.8LL-0.8SPECY-0.24SPECZ)
916A-SR-(DL+TL +0.8LL+0.8SPECZ+0.24SPECX)
916B-SR-(DL+TL +0.8LL+0.8SPECZ-0.24SPECX)
916C-SR-(DL+TL +0.8LL-0.8SPECZ+0.24SPECX)
916D-SR-(DL+TL +0.8LL-0.8SPECZ-0.24SPECX)
917A-SR-(DL+TL +0.8LL+0.8SPECZ+0.24SPECY)
917B-SR-(DL+TL +0.8LL+0.8SPECZ-0.24SPECY)
917C-SR-(DL+TL +0.8LL-0.8SPECZ+0.24SPECY)
917D-SR-(DL+TL +0.8LL-0.8SPECZ-0.24SPECY)

****

1.7 FOUNDATION TYPE

For Temporary Structures Isolated footings have been adopted. For GSRTC Building Raft Foundation along with column pedestals has been adopted based on the SBC obtained from the geotechnical report. For East Side Building isolated/combined footings shall be provided and for West Side building the geotechnical report is still awaited.

1.8 SOFTWARE/MANUAL SHEET USED FOR ANALYSIS

3-D Analysis of the building is carried out using C S I ETABs Software. Dynamic Analysis/design results are be used for designing/detailing of various structural elements. Manual, Excel sheets or other software will be used for foundation or other structural components as per requirement.

1.9 DETAILING OF STRUCTURES

Detailing of all structural members shall be done as per latest IS: 456 and IS: 13920, SP: 34 and SP-6. Detailing shall be done in such a way that it meets minimum & maximum R/F requirements, minimum and maximum spacing of bars.

A. For Beam

Longitudinal R/F - Minimum 0.25% & max 2.5% of total cross- s e c t io n a l area at tension face.

Shear R/F- Minimum as per IS: 456 & IS: 13920 using stress of Fe 500D steel for design.

B. For Slab

Minimum R/F - 0.12% of total cross-sectional area.

Max Spacing of bars - 3d or 300 mm whichever is less.

C. For Columns

Min 0.8% of area of column section required to resist direct stress and max 4% of column section. In extreme cases 6% of area of column section maybe provided.

D. RCC Wall

Min 0.8% of total cross-sectional area in both directions as per table 1 IS 13920:2016.

E. Retaining Wall

Min 0.12% of cross-sectional area as vertical R/F on each side Min 0.2% of cross-sectional area of horizontal R/F equally divided on each face.

1.10 CONTROL OF DEFLECTIONS

The deflections due to service loads should not exceed the following values:

A. Vertical Deflections

Concrete Structure

As per IS 456, clause no. 23.2, final long-term deflection due to all loads including the effects of temperature, creep and shrinkage and measured from the as-cast level of the supports, floors, roofs and all other horizontal members should not exceed span/250.The deflection including the effects of temperature, creep and shrinkage occurring after the erection of partitions and the application of finishes should not exceed span/350 or 20 mm, whichever is less.

B. Steel Structure

As per the clause 5.6.1 of IS 800, the deflection under serviceability loads of a building or a building component should not impair the strength of the structure or components or cause damage to the finishing. Deflections are to be checked for the most adverse but realistic combination of service loads and their arrangement, by elastic analysis, using a load factor of unity.

Table 6 gives recommended limits of deflections for certain structural members and systems.

Other Buildings	Vertical	Live load	Floor and Roof	Elements not susceptible to cracking	Span/300
				Elements susceptible to cracking	Span/360
		Live load	Cantilever	Elements not susceptible to cracking	Span/150
				Elements susceptible to cracking	Span/180

C. Horizontal Deflections

Concrete Structure

Drift due to EQ: The inter-storey drift should not exceed H/250 as per clause 5.4.1 of IS 16700:2017.

Drift due to WL: The overall drift of the structure under wind load should not exceed H/500. as per clause 5.4.1 of IS 16700:2017

The final deflection due to all loads including the effects of temperature, creep and shrinkage and measured from the as-cast level of the supports, floors, roofs and all other horizontal members should not exceed span/250 as per 23.2 (a)of IS456:2000.

The deflection including the effects of temperature, creep and shrinkage occurring after the erection of partitions and the application of finishes should not exceed span/350 or 20 mm, whichever is less as per 23.2 (b)of IS456:2000.

1.11 DESIGN STANDARDS

Specific applicable codes and standards will be identified and adopted in the design philosophies as appropriate to the structural elements. The latest editions of the Codes and standards will be used in designs. All design work shall be based on Indian Standards and Codes with latest revision, with amendments if any, as on date.

1.12 CODES USED FOR DESIGNING.

- IS:456-2000 Code of Practice for plain and reinforced concrete.
- IS:800-2007-Code of Practice for general construction in Steel.
- IS: 875(Part 1)-1987 Code of Practice for design loads (other than earthquake) for Buildings and structure (Dead loads).
- IS: 875(Part 2)-1987 Code of Practice for design loads (other than earthquake) for Buildings and structure (Imposed loads).
- IS: 875(Part 3)-2015 Code of Practice for design loads (other than earthquake) for Buildings and structure (Wind loads).
- IS: 875(Part 5)-1987 Code of Practice for design loads (other than earthquake) for Buildings and structure (Special loads and combinations).
- IS:1893 (Part-1)-2016 Criteria for earthquake resistant design of structures (General provisions and buildings).
- IS 13920-2016 Ductile Detailing of reinforced concrete structures subjected to seismic forces.
- IS: 1080-1985. Code of Practice for design and construction of shallow foundations on soils (Other than raft, ring and shell).
- IS: 1904-1986. Code of Practice for design and construction of foundations in soils general requirement.
- IS: 2950(Part 1)-1981 Code of Practice for design and construction of raft foundations.
- IS: 3370(Part 3&4)-2009 Code of Practice for concrete structures for the storage of liquids. IS:4326-1993 Code of Practice for earthquake resistant design and construction of buildings. IS: 5525-1969 Recommendation for detailing of reinforced concrete works.
- IS: 1786-2008 Specification for high strength deformed steel bars for concrete reinforcement. IS: 10262-1982. Recommended guidelines for concrete mix design.
- IS 3370 (Part 1): 2009 Indian Standard CONCRETE STRUCTURES FOR STORAGE OF LIQUIDS - CODE OF PRACTICE.
- IS 3370 (Part 2): Indian Standard Code of Practice CONCRETE STRUCTURES FOR STORAGE OF LIQUIDS, Part 2: Reinforced concrete structures.
- IS 16700: 2017 Criteria for Structural Safety of Tall Concrete Buildings.
- IS 2911 Indian Standard DESIGN AND CONSTRUCTION OF PILE FOUNDATIONS-CODE OF PRACTICE.