

SCADDS/RC-Column Designer 2007 [Release: 3.01.1001]

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**Limit State Design of Braced/Unbraced Short/Long
Rectangular/Circular Cracked/Uncracked Column Sections
Subjected to Axial Load/Uni-axial & Bi-axial Bending
in accordance with IS:456-2000.**

Introduction:-

This Report contains the detailed solution for the given Reinforced Concrete Column Design problem.

The given Column Section is considered for Compression & Bending Design and the output contains the following portions:

1. Global Input Data
2. Development Length Output
3. Slenderness & Eccentricity Output
4. Flexural Design Output
5. Tie Design Output

While detailed design will be carried out for Compression & Bending, design for Axial Tension and Shear is not incorporated in this Release.

Global Material Data

Concrete Clear Cover	=	40	mm.
Char. Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Strength of Main Steel	=	415	N/sq.mm.
Main Rod Size-1	=	16	mm.
Main Rod Size-2	=	20	mm.
Yield Strength of Tie Steel	=	415	N/sq.mm.
Tie Rod Size-1	=	8	mm.
Tie Rod Size-2	=	10	mm.
Factor of Safety for Load	=	1	
Partial Safety Factor for Concrete	=	1.5	
Partial Safety Factor for Steel	=	1.15	
Max. Strain in Concrete	=	0.0035	mm./mm.
Max. Strain in Steel	=	0.0055	mm./mm.
Young's Modulus of Concrete	=	22360.68	N/sq.mm.
Young's Modulus of Steel	=	200000	N/sq.mm.

Bond / Development Length Output

Char. Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Main Steel	=	415	N/sq.mm.

As Per IS:456-2000, Clause 26.2.1.1,

Design Bond Stress for Main Rods	=	2.4	N/sq.mm.
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Rods in Compression:-

Main Rod Diameter-1	=	16	mm.
Corresponding Development Length	=	601.75	mm.

Main Rod Diameter-2	=	20	mm.
Corresponding Development Length	=	752.187	mm.

C11 : Global Input Data (LC No. : 1)

Column Section	=	Rectangular	
Width of Column	=	230	mm.
Depth of Column	=	450	mm.
The Effective Lengths about ZZ and YY axes were calculated based on actual framing conditions from the 3D Model.			
Effective Length Coeff. about ZZ axis	=	0.802	
Effective Length Coeff. about YY axis	=	0.686	
Unsupported Length-ZZ of Column	=	1.5	m.
Unsupported Length-YY of Column	=	1.2	m.
Effective Length-ZZ of Column	=	1.203	m.
Effective Length-YY of Column	=	0.823	m.
Working Axial Load on Column	=	98.908	KN.
Working Moment about ZZ-axis at Top	=	-2.167	KN m.
Working Moment about YY-axis at Top	=	-0.05	KN m.
Working Moment about ZZ-axis at Bottom	=	-3.634	KN m.
Working Moment about YY-axis at Bottom	=	-0.096	KN m.

C11 : Slenderness & Eccentricity Output (LC No. : 1)

Effective Length-ZZ of Column	=	1.203	m.
Effective Length-YY of Column	=	0.823	m.
Slenderness Ratio about ZZ-axis	=	3.577	
The Column is Short about the ZZ-axis.			
Slenderness Ratio about YY-axis	=	2.672	
The Column is Short about the YY-axis.			
As Per IS:456-2000, 25.4,			
Minimum Eccentricity	=	20	mm.
$L_0/500 + b/30$	=	10.067	mm.
$L_0/500 + D/30$	=	18	mm.
Actual Minimum Eccentricity about ZZ	=	20	mm.
Actual Minimum Eccentricity about YY	=	20	mm.
As Per IS:456-2000, 39.3,			
0.05 times D (Limiting Value about ZZ)	=	22.5	mm.
0.05 times b (Limiting Value about YY)	=	11.5	mm.
Actual Eccentricity about ZZ due to Moment-ZZ	=	36.742	mm.
Actual Eccentricity about YY due to Moment-YY	=	0.967	mm.
Design Eccentricity about ZZ due to Moment-ZZ	=	36.742	mm.
Design Eccentricity about YY due to Moment-YY	=	20	mm.

As Per IS:456-2000, 39.3,

Design Eccentricity about ZZ is more than the Limiting Value.
Hence, the Column has Axial Load & Bending about ZZ.

Revised Design Bending Moment about ZZ = 3.634 KN m.

*Design Eccentricity about YY is more than the Limiting Value.
Hence, the Column has Axial Load & Bending about YY.*

Revised Design Bending Moment about YY = 1.978 KN m.

C11 : Flexural Design Output (LC No. : 1)

Axial Load on Column = 98.908 KN.
Factored Axial Load = 98.908 KN.

Revised Design Moment about ZZ axis = 3.634 KN m.
Revised Design Moment about YY axis = 1.978 KN m.

The Column is subjected to Axial Load & Bi-axial Bending.

Main Reinforcement is provided along all the FOUR Sides.

Characteristic Comp. Strength of Concrete = 20 N/sq.mm.
Yield Stress of Main Steel = 415 N/sq.mm.

Min. Percentage of Reinforcement Required = 0.8 %
Max. Percentage of Reinforcement Allowed = 6 %

Percentage of Reinforcement Required = 0.001 %

As Per IS:456-2000, 26.5.3.1,

the required percentage of Reinforcement is less than the Minimum value to be provided. Therefore, Minimum Reinforcement will be provided.

Depth of Neutral Axis about ZZ-axis = 59.85 mm.
Depth of Neutral Axis about YY-axis = 59.85 mm.

Ultimate Axial Load, Puz = 931.813 KN.
Ratio of Pu/Puz = 0.106

Value of Coefficient, Alpha-n = 1

Ultimate Moment Capacity about ZZ-axis = 19.859 KN m.
Ultimate Moment Capacity about YY-axis = 10.144 KN m.

Ratio of Actual to Ultimate Moment, Mux/Mux1 = 0.183
Ratio of Actual to Ultimate Moment, Muy/Muy1 = 0.195

Sum of above Ratios, applied with Alpha-n = 0.378

Width of Column = 230 mm.
Depth of Column = 450 mm.

Gross Sectional Area = 103500 sq.mm.

Percentage of Reinforcement to be Provided	=	0.8	%
Area of Longitudinal Reinforcement Required	=	828	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	4.118	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	804.248	sq.mm.
Main Rod Size-2	=	20	mm.
No. of Rods Required	=	2.636	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	1256.637	sq.mm.

Note:- Please note that the minimum number of Rods to be provided will be always FOUR for Rectangular Columns and SIX for Circular Columns, as per IS:456-2000 Clause 26.5.3.1.(c)

C11 : Tie Pitch Output (LC No. : 1)

Tie Rod Size-1	=	8	mm.
Tie Rod Size-2	=	10	mm.
Main Rod Size-1	=	16	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	256	mm.
Maximum allowable value as per Code	=	300	mm.
Minimum of the above values for 16# Rods	=	225	mm.
Main Rod Size-2	=	20	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	320	mm.
Maximum allowable value as per Code	=	300	mm.
Minimum of the above values for 20# Rods	=	225	mm.

Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

C11 : Global Input Data (LC No. : 2)

Column Section	=	Rectangular
Width of Column	=	230 mm.
Depth of Column	=	450 mm.
The Effective Lengths about ZZ and YY axes were calculated based on actual framing conditions from the 3D Model.		
Effective Length Coeff. about ZZ axis	=	0.802
Effective Length Coeff. about YY axis	=	0.686

Unsupported Length-ZZ of Column	=	1.5	m.
Unsupported Length-YY of Column	=	1.2	m.
Effective Length-ZZ of Column	=	1.203	m.
Effective Length-YY of Column	=	0.823	m.
Working Axial Load on Column	=	352.405	KN.
Working Moment about ZZ-axis at Top	=	-8.754	KN m.
Working Moment about YY-axis at Top	=	-0.378	KN m.
Working Moment about ZZ-axis at Bottom	=	-13.821	KN m.
Working Moment about YY-axis at Bottom	=	-0.728	KN m.

C11 : Slenderness & Eccentricity Output (LC No. : 2)

Effective Length-ZZ of Column	=	1.203	m.
Effective Length-YY of Column	=	0.823	m.
Slenderness Ratio about ZZ-axis	=	3.577	
The Column is Short about the ZZ-axis.			
Slenderness Ratio about YY-axis	=	2.672	
The Column is Short about the YY-axis.			
As Per IS:456-2000, 25.4,			
Minimum Eccentricity	=	20	mm.
Lo/500 + b/30	=	10.067	mm.
Lo/500 + D/30	=	18	mm.
Actual Minimum Eccentricity about ZZ	=	20	mm.
Actual Minimum Eccentricity about YY	=	20	mm.
As Per IS:456-2000, 39.3,			
0.05 times D (Limiting Value about ZZ)	=	22.5	mm.
0.05 times b (Limiting Value about YY)	=	11.5	mm.
Actual Eccentricity about ZZ due to Moment-ZZ	=	39.22	mm.
Actual Eccentricity about YY due to Moment-YY	=	2.067	mm.
Design Eccentricity about ZZ due to Moment-ZZ	=	39.22	mm.
Design Eccentricity about YY due to Moment-YY	=	20	mm.
As Per IS:456-2000, 39.3,			
Design Eccentricity about ZZ is more than the Limiting Value.			
Hence, the Column has Axial Load & Bending about ZZ.			
Revised Design Bending Moment about ZZ	=	13.821	KN m.
<i>Design Eccentricity about YY is more than the Limiting Value.</i>			
<i>Hence, the Column has Axial Load & Bending about YY.</i>			
Revised Design Bending Moment about YY	=	7.048	KN m.

C11 : Flexural Design Output (LC No. : 2)

Axial Load on Column	=	352.405	KN.
Factored Axial Load	=	352.405	KN.

Revised Design Moment about ZZ axis	=	13.821	KN m.
Revised Design Moment about YY axis	=	7.048	KN m.

The Column is subjected to Axial Load & Bi-axial Bending.

Main Reinforcement is provided along all the FOUR Sides.

Characteristic Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Main Steel	=	415	N/sq.mm.
Min. Percentage of Reinforcement Required	=	0.8	%
Max. Percentage of Reinforcement Allowed	=	6	%
Percentage of Reinforcement Required	=	0.001	%

As Per IS:456-2000, 26.5.3.1,

the required percentage of Reinforcement is less than the Minimum value to be provided. Therefore, Minimum Reinforcement will be provided.

Depth of Neutral Axis about ZZ-axis	=	212.4	mm.
Depth of Neutral Axis about YY-axis	=	212.4	mm.
Ultimate Axial Load, Puz	=	931.813	KN.
Ratio of Pu/Puz	=	0.378	
Value of Coefficient, Alpha-n	=	1.297	
Ultimate Moment Capacity about ZZ-axis	=	48.107	KN m.
Ultimate Moment Capacity about YY-axis	=	24.582	KN m.
Ratio of Actual to Ultimate Moment, Mux/Mux1	=	0.287	
Ratio of Actual to Ultimate Moment, Muy/Muy1	=	0.287	
Sum of above Ratios, applied with Alpha-n	=	0.396	
Width of Column	=	230	mm.
Depth of Column	=	450	mm.
Gross Sectional Area	=	103500	sq.mm.
Percentage of Reinforcement to be Provided	=	0.8	%
Area of Longitudinal Reinforcement Required	=	828	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	4.118	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	804.248	sq.mm.
Main Rod Size-2	=	20	mm.
No. of Rods Required	=	2.636	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	1256.637	sq.mm.

Note:- Please note that the minimum number of Rods to be provided will be always FOUR for Rectangular Columns and SIX for Circular

Columns, as per IS:456-2000 Clause 26.5.3.1.(c)

C11 : Tie Pitch Output (LC No. : 2)

Tie Rod Size-1	=	8	mm.
Tie Rod Size-2	=	10	mm.
Main Rod Size-1	=	16	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	256	mm.
Maximum allowable value as per Code	=	300	mm.
Minimum of the above values for 16# Rods	=	225	mm.
Main Rod Size-2	=	20	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	320	mm.
Maximum allowable value as per Code	=	300	mm.
Minimum of the above values for 20# Rods	=	225	mm.

Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

C11 : Global Input Data (LC No. : 3)

Column Section	=	Rectangular	
Width of Column	=	230	mm.
Depth of Column	=	450	mm.
The Effective Lengths about ZZ and YY axes were calculated based on actual framing conditions from the 3D Model.			
Effective Length Coeff. about ZZ axis	=	0.802	
Effective Length Coeff. about YY axis	=	0.686	
Unsupported Length-ZZ of Column	=	1.5	m.
Unsupported Length-YY of Column	=	1.2	m.
Effective Length-ZZ of Column	=	1.203	m.
Effective Length-YY of Column	=	0.823	m.
Working Axial Load on Column	=	208.56	KN.
Working Moment about ZZ-axis at Top	=	1.26	KN m.
Working Moment about YY-axis at Top	=	0.174	KN m.
Working Moment about ZZ-axis at Bottom	=	2.699	KN m.
Working Moment about YY-axis at Bottom	=	0.299	KN m.

C11 : Slenderness & Eccentricity Output (LC No. : 3)

Effective Length-ZZ of Column	=	1.203	m.
Effective Length-YY of Column	=	0.823	m.

Slenderness Ratio about ZZ-axis The Column is Short about the ZZ-axis.	=	3.577	
Slenderness Ratio about YY-axis The Column is Short about the YY-axis.	=	2.672	
As Per IS:456-2000, 25.4,			
Minimum Eccentricity	=	20	mm.
Lo/500 + b/30	=	10.067	mm.
Lo/500 + D/30	=	18	mm.
Actual Minimum Eccentricity about ZZ	=	20	mm.
Actual Minimum Eccentricity about YY	=	20	mm.
As Per IS:456-2000, 39.3,			
0.05 times D (Limiting Value about ZZ)	=	22.5	mm.
0.05 times b (Limiting Value about YY)	=	11.5	mm.
Actual Eccentricity about ZZ due to Moment-ZZ	=	12.942	mm.
Actual Eccentricity about YY due to Moment-YY	=	1.431	mm.
Design Eccentricity about ZZ due to Moment-ZZ	=	20	mm.
Design Eccentricity about YY due to Moment-YY	=	20	mm.

As Per IS:456-2000, 39.3,

Design Eccentricity about ZZ is not more than the Limiting Value.
Hence, the Column carries only Axial Load about ZZ.

*Design Eccentricity about YY is more than the Limiting Value.
Hence, the Column has Axial Load & Bending about YY.*

Revised Design Bending Moment about YY	=	4.171	KN m.
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C11 : Flexural Design Output (LC No. : 3)

Axial Load on Column	=	208.56	KN.
Factored Axial Load	=	208.56	KN.
Revised Design Moment about YY axis	=	4.171	KN m.
The Column is subjected to Axial Load & Uni-axial Bending.			
Main Reinforcement is provided along all the FOUR Sides.			
Characteristic Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Main Steel	=	415	N/sq.mm.
Min. Percentage of Reinforcement Required	=	0.8	%
Max. Percentage of Reinforcement Allowed	=	6	%
Depth of Neutral Axis	=	4.5	mm.
Width of Column	=	230	mm.
Depth of Column	=	450	mm.
Gross Sectional Area	=	103500	sq.mm.

Percentage of Reinforcement to be Provided	=	0.8	%
Area of Longitudinal Reinforcement Required	=	828	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	4.118	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	804.248	sq.mm.
Main Rod Size-2	=	20	mm.
No. of Rods Required	=	2.636	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	1256.637	sq.mm.

Note:- Please note that the minimum number of Rods to be provided will be always FOUR for Rectangular Columns and SIX for Circular Columns, as per IS:456-2000 Clause 26.5.3.1.(c)

C11 : Tie Pitch Output (LC No. : 3)

Tie Rod Size-1	=	8	mm.
Tie Rod Size-2	=	10	mm.
Main Rod Size-1	=	16	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	256	mm.
Maximum allowable value as per Code	=	300	mm.
Minimum of the above values for 16# Rods	=	225	mm.
Main Rod Size-2	=	20	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	320	mm.
Maximum allowable value as per Code	=	300	mm.
Minimum of the above values for 20# Rods	=	225	mm.

Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

C11 : Global Input Data (LC No. : 4)

Column Section	=	Rectangular
Width of Column	=	230 mm.
Depth of Column	=	450 mm.
The Effective Lengths about ZZ and YY axes were calculated based on actual framing conditions from the 3D Model.		
Effective Length Coeff. about ZZ axis	=	0.802
Effective Length Coeff. about YY axis	=	0.686

Unsupported Length-ZZ of Column	=	1.5	m.
Unsupported Length-YY of Column	=	1.2	m.
Effective Length-ZZ of Column	=	1.203	m.
Effective Length-YY of Column	=	0.823	m.
Working Axial Load on Column	=	205.246	KN.
Working Moment about ZZ-axis at Top	=	1.24	KN m.
Working Moment about YY-axis at Top	=	0.172	KN m.
Working Moment about ZZ-axis at Bottom	=	2.656	KN m.
Working Moment about YY-axis at Bottom	=	0.294	KN m.

C11 : Slenderness & Eccentricity Output (LC No. : 4)

Effective Length-ZZ of Column	=	1.203	m.
Effective Length-YY of Column	=	0.823	m.
Slenderness Ratio about ZZ-axis	=	3.577	
The Column is Short about the ZZ-axis.			
Slenderness Ratio about YY-axis	=	2.672	
The Column is Short about the YY-axis.			
As Per IS:456-2000, 25.4,			
Minimum Eccentricity	=	20	mm.
Lo/500 + b/30	=	10.067	mm.
Lo/500 + D/30	=	18	mm.
Actual Minimum Eccentricity about ZZ	=	20	mm.
Actual Minimum Eccentricity about YY	=	20	mm.
As Per IS:456-2000, 39.3,			
0.05 times D (Limiting Value about ZZ)	=	22.5	mm.
0.05 times b (Limiting Value about YY)	=	11.5	mm.
Actual Eccentricity about ZZ due to Moment-ZZ	=	12.942	mm.
Actual Eccentricity about YY due to Moment-YY	=	1.431	mm.
Design Eccentricity about ZZ due to Moment-ZZ	=	20	mm.
Design Eccentricity about YY due to Moment-YY	=	20	mm.
As Per IS:456-2000, 39.3,			
Design Eccentricity about ZZ is not more than the Limiting Value.			
Hence, the Column carries only Axial Load about ZZ.			
<i>Design Eccentricity about YY is more than the Limiting Value.</i>			
<i>Hence, the Column has Axial Load & Bending about YY.</i>			
Revised Design Bending Moment about YY	=	4.105	KN m.

C11 : Flexural Design Output (LC No. : 4)

Axial Load on Column	=	205.246	KN.
Factored Axial Load	=	205.246	KN.
Revised Design Moment about YY axis	=	4.105	KN m.

The Column is subjected to Axial Load & Uni-axial Bending.

Main Reinforcement is provided along all the FOUR Sides.

Characteristic Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Main Steel	=	415	N/sq.mm.
Min. Percentage of Reinforcement Required	=	0.8	%
Max. Percentage of Reinforcement Allowed	=	6	%
Depth of Neutral Axis	=	4.5	mm.
Width of Column	=	230	mm.
Depth of Column	=	450	mm.
Gross Sectional Area	=	103500	sq.mm.
Percentage of Reinforcement to be Provided	=	0.8	%
Area of Longitudinal Reinforcement Required	=	828	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	4.118	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	804.248	sq.mm.
Main Rod Size-2	=	20	mm.
No. of Rods Required	=	2.636	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	1256.637	sq.mm.

Note:- Please note that the minimum number of Rods to be provided will be always FOUR for Rectangular Columns and SIX for Circular Columns, as per IS:456-2000 Clause 26.5.3.1.(c)

C11 : Tie Pitch Output (LC No. : 4)

Tie Rod Size-1	=	8	mm.
Tie Rod Size-2	=	10	mm.
Main Rod Size-1	=	16	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	256	mm.
Maximum allowable value as per Code	=	300	mm.
Minimum of the above values for 16# Rods	=	225	mm.
Main Rod Size-2	=	20	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	320	mm.
Maximum allowable value as per Code	=	300	mm.

Minimum of the above values for 20# Rods = 225 mm.

Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

C11 : Global Input Data (LC No. : 5)

Column Section = Rectangular

Width of Column = 230 mm.

Depth of Column = 450 mm.

The Effective Lengths about ZZ and YY axes were calculated based on actual framing conditions from the 3D Model.

Effective Length Coeff. about ZZ axis = 0.802

Effective Length Coeff. about YY axis = 0.686

Unsupported Length-ZZ of Column = 1.5 m.

Unsupported Length-YY of Column = 1.2 m.

Effective Length-ZZ of Column = 1.203 m.

Effective Length-YY of Column = 0.823 m.

Working Axial Load on Column = 989.81 KN.

Working Moment about ZZ-axis at Top = -14.492 KN m.

Working Moment about YY-axis at Top = -0.38 KN m.

Working Moment about ZZ-axis at Bottom = -22.134 KN m.

Working Moment about YY-axis at Bottom = -0.788 KN m.

C11 : Slenderness & Eccentricity Output (LC No. : 5)

Effective Length-ZZ of Column = 1.203 m.

Effective Length-YY of Column = 0.823 m.

Slenderness Ratio about ZZ-axis = 3.577

The Column is Short about the ZZ-axis.

Slenderness Ratio about YY-axis = 2.672

The Column is Short about the YY-axis.

As Per IS:456-2000, 25.4,

Minimum Eccentricity = 20 mm.

$L_0/500 + b/30$ = 10.067 mm.

$L_0/500 + D/30$ = 18 mm.

Actual Minimum Eccentricity about ZZ = 20 mm.

Actual Minimum Eccentricity about YY = 20 mm.

As Per IS:456-2000, 39.3,

0.05 times D (Limiting Value about ZZ) = 22.5 mm.

0.05 times b (Limiting Value about YY) = 11.5 mm.

Actual Eccentricity about ZZ due to Moment-ZZ = 22.362 mm.

Actual Eccentricity about YY due to Moment-YY = 0.796 mm.

Design Eccentricity about ZZ due to Moment-ZZ = 22.362 mm.

Design Eccentricity about YY due to Moment-YY = 20 mm.

As Per IS:456-2000, 39.3,

Design Eccentricity about ZZ is not more than the Limiting Value.
Hence, the Column carries only Axial Load about ZZ.

*Design Eccentricity about YY is more than the Limiting Value.
Hence, the Column has Axial Load & Bending about YY.*

Revised Design Bending Moment about YY = 19.796 KN m.

C11 : Flexural Design Output (LC No. : 5)

Axial Load on Column = 989.81 KN.

Factored Axial Load = 989.81 KN.

Revised Design Moment about YY axis = 19.796 KN m.

The Column is subjected to Axial Load & Uni-axial Bending.

Main Reinforcement is provided along all the FOUR Sides.

Characteristic Comp. Strength of Concrete = 20 N/sq.mm.

Yield Stress of Main Steel = 415 N/sq.mm.

Min. Percentage of Reinforcement Required = 0.8 %

Max. Percentage of Reinforcement Allowed = 6 %

Depth of Neutral Axis = 440.55 mm.

Width of Column = 230 mm.

Depth of Column = 450 mm.

Gross Sectional Area = 103500 sq.mm.

Percentage of Reinforcement to be Provided = 0.948 %

Area of Longitudinal Reinforcement Required = 980.724 sq.mm.

Main Rod Size-1 = 16 mm.

No. of Rods Required = 4.878 Nos.

No. of Rods Provided = 5 Nos.

Corresponding Steel Area = 1005.31 sq.mm.

Main Rod Size-2 = 20 mm.

No. of Rods Required = 3.122 Nos.

No. of Rods Provided = 4 Nos.

Corresponding Steel Area = 1256.637 sq.mm.

Note:- Please note that the minimum number of Rods to be provided will be always FOUR for Rectangular Columns and SIX for Circular Columns, as per IS:456-2000 Clause 26.5.3.1.(c)

C11 : Tie Pitch Output (LC No. : 5)

Tie Rod Size-1 = 8 mm.

Tie Rod Size-2 = 10 mm.

Main Rod Size-1	=	16	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	256	mm.
Maximum allowable value as per Code	=	300	mm.
Minimum of the above values for 16# Rods	=	225	mm.
Main Rod Size-2	=	20	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	320	mm.
Maximum allowable value as per Code	=	300	mm.
Minimum of the above values for 20# Rods	=	225	mm.

Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

C11 : Global Input Data (LC No. : 6)

Column Section	=	Rectangular	
Width of Column	=	230	mm.
Depth of Column	=	450	mm.
The Effective Lengths about ZZ and YY axes were calculated based on actual framing conditions from the 3D Model.			
Effective Length Coeff. about ZZ axis	=	0.802	
Effective Length Coeff. about YY axis	=	0.686	
Unsupported Length-ZZ of Column	=	1.5	m.
Unsupported Length-YY of Column	=	1.2	m.
Effective Length-ZZ of Column	=	1.203	m.
Effective Length-YY of Column	=	0.823	m.
Working Axial Load on Column	=	1297.68	KN.
Working Moment about ZZ-axis at Top	=	-12.633	KN m.
Working Moment about YY-axis at Top	=	-0.123	KN m.
Working Moment about ZZ-axis at Bottom	=	-18.15	KN m.
Working Moment about YY-axis at Bottom	=	-0.348	KN m.

C11 : Slenderness & Eccentricity Output (LC No. : 6)

Effective Length-ZZ of Column	=	1.203	m.
Effective Length-YY of Column	=	0.823	m.
Slenderness Ratio about ZZ-axis	=	3.577	
The Column is Short about the ZZ-axis.			
Slenderness Ratio about YY-axis	=	2.672	
The Column is Short about the YY-axis.			

As Per IS:456-2000, 25.4,

Minimum Eccentricity	=	20	mm.
$L_0/500 + b/30$	=	10.067	mm.
$L_0/500 + D/30$	=	18	mm.

Actual Minimum Eccentricity about ZZ	=	20	mm.
Actual Minimum Eccentricity about YY	=	20	mm.

As Per IS:456-2000, 39.3,

0.05 times D (Limiting Value about ZZ)	=	22.5	mm.
0.05 times b (Limiting Value about YY)	=	11.5	mm.

Actual Eccentricity about ZZ due to Moment-ZZ	=	13.987	mm.
Actual Eccentricity about YY due to Moment-YY	=	0.268	mm.

Design Eccentricity about ZZ due to Moment-ZZ	=	20	mm.
Design Eccentricity about YY due to Moment-YY	=	20	mm.

As Per IS:456-2000, 39.3,

Design Eccentricity about ZZ is not more than the Limiting Value.
Hence, the Column carries only Axial Load about ZZ.

*Design Eccentricity about YY is more than the Limiting Value.
Hence, the Column has Axial Load & Bending about YY.*

Revised Design Bending Moment about YY	=	25.954	KN m.
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C11 : Flexural Design Output (LC No. : 6)

Axial Load on Column	=	1297.68	KN.
Factored Axial Load	=	1297.68	KN.
Revised Design Moment about YY axis	=	25.954	KN m.

The Column is subjected to Axial Load & Uni-axial Bending.

Main Reinforcement is provided along all the FOUR Sides.

Characteristic Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Main Steel	=	415	N/sq.mm.

Min. Percentage of Reinforcement Required	=	0.8	%
Max. Percentage of Reinforcement Allowed	=	6	%

Depth of Neutral Axis	=	436.5	mm.
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Width of Column	=	230	mm.
Depth of Column	=	450	mm.

Gross Sectional Area	=	103500	sq.mm.
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Percentage of Reinforcement to be Provided	=	2.123	%
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Area of Longitudinal Reinforcement Required	=	2197.192	sq.mm.
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Main Rod Size-1	=	16	mm.
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No. of Rods Required	=	10.928	Nos.
No. of Rods Provided	=	11	Nos.
Corresponding Steel Area	=	2211.681	sq.mm.
 Main Rod Size-2	=	 20	 mm.
No. of Rods Required	=	6.994	Nos.
No. of Rods Provided	=	7	Nos.
Corresponding Steel Area	=	2199.115	sq.mm.

Note:- Please note that the minimum number of Rods to be provided will be always FOUR for Rectangular Columns and SIX for Circular Columns, as per IS:456-2000 Clause 26.5.3.1.(c)

C11 : Tie Pitch Output (LC No. : 6)

Tie Rod Size-1	=	8	mm.
Tie Rod Size-2	=	10	mm.
 Main Rod Size-1	=	 16	 mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	256	mm.
Maximum allowable value as per Code	=	300	mm.
 Minimum of the above values for 16# Rods	=	 225	 mm.
 Main Rod Size-2	=	 20	 mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	320	mm.
Maximum allowable value as per Code	=	300	mm.
 Minimum of the above values for 20# Rods	=	 225	 mm.

Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

C51 : Global Input Data (LC No. : 1)

Column Section	=	Rectangular	
Width of Column	=	230	mm.
Depth of Column	=	450	mm.
The Effective Lengths about ZZ and YY axes were calculated based on actual framing conditions from the 3D Model.			
Effective Length Coeff. about ZZ axis	=	0.945	
Effective Length Coeff. about YY axis	=	0.657	
Unsupported Length-ZZ of Column	=	2.7	m.
Unsupported Length-YY of Column	=	2.4	m.
Effective Length-ZZ of Column	=	2.552	m.
Effective Length-YY of Column	=	1.577	m.
Working Axial Load on Column	=	68.213	KN.
Working Moment about ZZ-axis at Top	=	-3.447	KN m.
Working Moment about YY-axis at Top	=	-0.055	KN m.
Working Moment about ZZ-axis at Bottom	=	-3.185	KN m.
Working Moment about YY-axis at Bottom	=	-0.031	KN m.

C51 : Slenderness & Eccentricity Output (LC No. : 1)

Effective Length-ZZ of Column	=	2.552	m.
Effective Length-YY of Column	=	1.577	m.
Slenderness Ratio about ZZ-axis	=	6.858	
The Column is Short about the ZZ-axis.			
Slenderness Ratio about YY-axis	=	5.671	
The Column is Short about the YY-axis.			
As Per IS:456-2000, 25.4,			
Minimum Eccentricity	=	20	mm.
$L_0/500 + b/30$	=	12.467	mm.
$L_0/500 + D/30$	=	20.4	mm.
Actual Minimum Eccentricity about ZZ	=	20.4	mm.
Actual Minimum Eccentricity about YY	=	20	mm.
As Per IS:456-2000, 39.3,			
0.05 times D (Limiting Value about ZZ)	=	22.5	mm.
0.05 times b (Limiting Value about YY)	=	11.5	mm.
Actual Eccentricity about ZZ due to Moment-ZZ	=	50.533	mm.
Actual Eccentricity about YY due to Moment-YY	=	0.8	mm.
Design Eccentricity about ZZ due to Moment-ZZ	=	50.533	mm.
Design Eccentricity about YY due to Moment-YY	=	20	mm.

As Per IS:456-2000, 39.3,

Design Eccentricity about ZZ is more than the Limiting Value.
Hence, the Column has Axial Load & Bending about ZZ.

Revised Design Bending Moment about ZZ = 3.447 KN m.

*Design Eccentricity about YY is more than the Limiting Value.
Hence, the Column has Axial Load & Bending about YY.*

Revised Design Bending Moment about YY = 1.364 KN m.

C51 : Flexural Design Output (LC No. : 1)

Axial Load on Column = 68.213 KN.
Factored Axial Load = 68.213 KN.

Revised Design Moment about ZZ axis = 3.447 KN m.
Revised Design Moment about YY axis = 1.364 KN m.

The Column is subjected to Axial Load & Bi-axial Bending.

Main Reinforcement is provided along all the FOUR Sides.

Characteristic Comp. Strength of Concrete = 20 N/sq.mm.
Yield Stress of Main Steel = 415 N/sq.mm.

Min. Percentage of Reinforcement Required = 0.8 %
Max. Percentage of Reinforcement Allowed = 6 %

Percentage of Reinforcement Required = 0.001 %

As Per IS:456-2000, 26.5.3.1,

the required percentage of Reinforcement is less than
the Minimum value to be provided. Therefore, Minimum
Reinforcement will be provided.

Depth of Neutral Axis about ZZ-axis = 40.95 mm.
Depth of Neutral Axis about YY-axis = 40.95 mm.

Ultimate Axial Load, Puz = 931.813 KN.
Ratio of Pu/Puz = 0.073

Value of Coefficient, Alpha-n = 1

Ultimate Moment Capacity about ZZ-axis = 14.122 KN m.
Ultimate Moment Capacity about YY-axis = 7.215 KN m.

Ratio of Actual to Ultimate Moment, Mux/Mux1 = 0.244
Ratio of Actual to Ultimate Moment, Muy/Muy1 = 0.189

Sum of above Ratios, applied with Alpha-n = 0.433

Width of Column = 230 mm.
Depth of Column = 450 mm.

Gross Sectional Area = 103500 sq.mm.

Percentage of Reinforcement to be Provided	=	0.8	%
Area of Longitudinal Reinforcement Required	=	828	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	4.118	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	804.248	sq.mm.
Main Rod Size-2	=	20	mm.
No. of Rods Required	=	2.636	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	1256.637	sq.mm.

Note:- Please note that the minimum number of Rods to be provided will be always FOUR for Rectangular Columns and SIX for Circular Columns, as per IS:456-2000 Clause 26.5.3.1.(c)

C51 : Tie Pitch Output (LC No. : 1)

Tie Rod Size-1	=	8	mm.
Tie Rod Size-2	=	10	mm.
Main Rod Size-1	=	16	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	256	mm.
Maximum allowable value as per Code	=	300	mm.
Minimum of the above values for 16# Rods	=	225	mm.
Main Rod Size-2	=	20	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	320	mm.
Maximum allowable value as per Code	=	300	mm.
Minimum of the above values for 20# Rods	=	225	mm.

Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

C51 : Global Input Data (LC No. : 2)

Column Section	=	Rectangular
Width of Column	=	230 mm.
Depth of Column	=	450 mm.
The Effective Lengths about ZZ and YY axes were calculated based on actual framing conditions from the 3D Model.		
Effective Length Coeff. about ZZ axis	=	0.945
Effective Length Coeff. about YY axis	=	0.657

Unsupported Length-ZZ of Column	=	2.7	m.
Unsupported Length-YY of Column	=	2.4	m.
Effective Length-ZZ of Column	=	2.552	m.
Effective Length-YY of Column	=	1.577	m.
Working Axial Load on Column	=	176.199	KN.
Working Moment about ZZ-axis at Top	=	-15.725	KN m.
Working Moment about YY-axis at Top	=	-0.908	KN m.
Working Moment about ZZ-axis at Bottom	=	-17.184	KN m.
Working Moment about YY-axis at Bottom	=	-1.167	KN m.

C51 : Slenderness & Eccentricity Output (LC No. : 2)

Effective Length-ZZ of Column	=	2.552	m.
Effective Length-YY of Column	=	1.577	m.
Slenderness Ratio about ZZ-axis	=	6.858	
The Column is Short about the ZZ-axis.			
Slenderness Ratio about YY-axis	=	5.671	
The Column is Short about the YY-axis.			
As Per IS:456-2000, 25.4,			
Minimum Eccentricity	=	20	mm.
Lo/500 + b/30	=	12.467	mm.
Lo/500 + D/30	=	20.4	mm.
Actual Minimum Eccentricity about ZZ	=	20.4	mm.
Actual Minimum Eccentricity about YY	=	20	mm.
As Per IS:456-2000, 39.3,			
0.05 times D (Limiting Value about ZZ)	=	22.5	mm.
0.05 times b (Limiting Value about YY)	=	11.5	mm.
Actual Eccentricity about ZZ due to Moment-ZZ	=	97.526	mm.
Actual Eccentricity about YY due to Moment-YY	=	6.62	mm.
Design Eccentricity about ZZ due to Moment-ZZ	=	97.526	mm.
Design Eccentricity about YY due to Moment-YY	=	20	mm.
As Per IS:456-2000, 39.3,			
Design Eccentricity about ZZ is more than the Limiting Value.			
Hence, the Column has Axial Load & Bending about ZZ.			
Revised Design Bending Moment about ZZ	=	17.184	KN m.
<i>Design Eccentricity about YY is more than the Limiting Value.</i>			
<i>Hence, the Column has Axial Load & Bending about YY.</i>			
Revised Design Bending Moment about YY	=	3.524	KN m.

C51 : Flexural Design Output (LC No. : 2)

Axial Load on Column	=	176.199	KN.
Factored Axial Load	=	176.199	KN.

Revised Design Moment about ZZ axis	=	17.184	KN m.
Revised Design Moment about YY axis	=	3.524	KN m.

The Column is subjected to Axial Load & Bi-axial Bending.

Main Reinforcement is provided along all the FOUR Sides.

Characteristic Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Main Steel	=	415	N/sq.mm.
Min. Percentage of Reinforcement Required	=	0.8	%
Max. Percentage of Reinforcement Allowed	=	6	%
Percentage of Reinforcement Required	=	0.001	%

As Per IS:456-2000, 26.5.3.1,

the required percentage of Reinforcement is less than the Minimum value to be provided. Therefore, Minimum Reinforcement will be provided.

Depth of Neutral Axis about ZZ-axis	=	106.2	mm.
Depth of Neutral Axis about YY-axis	=	106.2	mm.
Ultimate Axial Load, Puz	=	931.813	KN.
Ratio of Pu/Puz	=	0.189	
Value of Coefficient, Alpha-n	=	1	
Ultimate Moment Capacity about ZZ-axis	=	31.84	KN m.
Ultimate Moment Capacity about YY-axis	=	16.262	KN m.
Ratio of Actual to Ultimate Moment, Mux/Mux1	=	0.54	
Ratio of Actual to Ultimate Moment, Muy/Muy1	=	0.217	
Sum of above Ratios, applied with Alpha-n	=	0.756	
Width of Column	=	230	mm.
Depth of Column	=	450	mm.
Gross Sectional Area	=	103500	sq.mm.
Percentage of Reinforcement to be Provided	=	0.8	%
Area of Longitudinal Reinforcement Required	=	828	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	4.118	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	804.248	sq.mm.
Main Rod Size-2	=	20	mm.
No. of Rods Required	=	2.636	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	1256.637	sq.mm.

Note:- Please note that the minimum number of Rods to be provided will be always FOUR for Rectangular Columns and SIX for Circular

Columns, as per IS:456-2000 Clause 26.5.3.1.(c)

C51 : Tie Pitch Output (LC No. : 2)

Tie Rod Size-1	=	8	mm.
Tie Rod Size-2	=	10	mm.
Main Rod Size-1	=	16	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	256	mm.
Maximum allowable value as per Code	=	300	mm.
Minimum of the above values for 16# Rods	=	225	mm.
Main Rod Size-2	=	20	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	320	mm.
Maximum allowable value as per Code	=	300	mm.
Minimum of the above values for 20# Rods	=	225	mm.

Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

C51 : Global Input Data (LC No. : 3)

Column Section	=	Rectangular	
Width of Column	=	230	mm.
Depth of Column	=	450	mm.
The Effective Lengths about ZZ and YY axes were calculated based on actual framing conditions from the 3D Model.			
Effective Length Coeff. about ZZ axis	=	0.945	
Effective Length Coeff. about YY axis	=	0.657	
Unsupported Length-ZZ of Column	=	2.7	m.
Unsupported Length-YY of Column	=	2.4	m.
Effective Length-ZZ of Column	=	2.552	m.
Effective Length-YY of Column	=	1.577	m.
Working Axial Load on Column	=	209.714	KN.
Working Moment about ZZ-axis at Top	=	-3.735	KN m.
Working Moment about YY-axis at Top	=	0.095	KN m.
Working Moment about ZZ-axis at Bottom	=	-7.789	KN m.
Working Moment about YY-axis at Bottom	=	-0.044	KN m.

C51 : Slenderness & Eccentricity Output (LC No. : 3)

Effective Length-ZZ of Column	=	2.552	m.
Effective Length-YY of Column	=	1.577	m.

Slenderness Ratio about ZZ-axis = 6.858
The Column is Short about the ZZ-axis.

Slenderness Ratio about YY-axis = 5.671
The Column is Short about the YY-axis.

As Per IS:456-2000, 25.4,

Minimum Eccentricity = 20 mm.
Lo/500 + b/30 = 12.467 mm.
Lo/500 + D/30 = 20.4 mm.

Actual Minimum Eccentricity about ZZ = 20.4 mm.
Actual Minimum Eccentricity about YY = 20 mm.

As Per IS:456-2000, 39.3,

0.05 times D (Limiting Value about ZZ) = 22.5 mm.
0.05 times b (Limiting Value about YY) = 11.5 mm.

Actual Eccentricity about ZZ due to Moment-ZZ = 37.142 mm.
Actual Eccentricity about YY due to Moment-YY = 0.451 mm.

Design Eccentricity about ZZ due to Moment-ZZ = 37.142 mm.
Design Eccentricity about YY due to Moment-YY = 20 mm.

As Per IS:456-2000, 39.3,

Design Eccentricity about ZZ is more than the Limiting Value.
Hence, the Column has Axial Load & Bending about ZZ.

Revised Design Bending Moment about ZZ = 7.789 KN m.

*Design Eccentricity about YY is more than the Limiting Value.
Hence, the Column has Axial Load & Bending about YY.*

Revised Design Bending Moment about YY = 4.194 KN m.

C51 : Flexural Design Output (LC No. : 3)

Axial Load on Column = 209.714 KN.
Factored Axial Load = 209.714 KN.

Revised Design Moment about ZZ axis = 7.789 KN m.
Revised Design Moment about YY axis = 4.194 KN m.

The Column is subjected to Axial Load & Bi-axial Bending.

Main Reinforcement is provided along all the FOUR Sides.

Characteristic Comp. Strength of Concrete = 20 N/sq.mm.
Yield Stress of Main Steel = 415 N/sq.mm.

Min. Percentage of Reinforcement Required = 0.8 %
Max. Percentage of Reinforcement Allowed = 6 %

Percentage of Reinforcement Required = 0.001 %

As Per IS:456-2000, 26.5.3.1,

the required percentage of Reinforcement is less than the Minimum value to be provided. Therefore, Minimum Reinforcement will be provided.

Depth of Neutral Axis about ZZ-axis	=	126.45	mm.
Depth of Neutral Axis about YY-axis	=	126.45	mm.
Ultimate Axial Load, Puz	=	931.813	KN.
Ratio of Pu/Puz	=	0.225	
Value of Coefficient, Alpha-n	=	1.042	
Ultimate Moment Capacity about ZZ-axis	=	36.142	KN m.
Ultimate Moment Capacity about YY-axis	=	18.463	KN m.
Ratio of Actual to Ultimate Moment, Mux/Mux1	=	0.216	
Ratio of Actual to Ultimate Moment, Muy/Muy1	=	0.227	
Sum of above Ratios, applied with Alpha-n	=	0.416	
Width of Column	=	230	mm.
Depth of Column	=	450	mm.
Gross Sectional Area	=	103500	sq.mm.
Percentage of Reinforcement to be Provided	=	0.8	%
Area of Longitudinal Reinforcement Required	=	828	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	4.118	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	804.248	sq.mm.
Main Rod Size-2	=	20	mm.
No. of Rods Required	=	2.636	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	1256.637	sq.mm.

Note:- Please note that the minimum number of Rods to be provided will be always FOUR for Rectangular Columns and SIX for Circular Columns, as per IS:456-2000 Clause 26.5.3.1.(c)

C51 : Tie Pitch Output (LC No. : 3)

Tie Rod Size-1	=	8	mm.
Tie Rod Size-2	=	10	mm.
Main Rod Size-1	=	16	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	256	mm.
Maximum allowable value as per Code	=	300	mm.
Minimum of the above values for 16# Rods	=	225	mm.

Main Rod Size-2 = 20 mm.

As Per IS:456-2000, 26.5.3.2,

Least Lateral Dimension = 230 mm.

16 times dia. of Main Rod = 320 mm.

Maximum allowable value as per Code = 300 mm.

Minimum of the above values for 20# Rods = 225 mm.

Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

C51 : Global Input Data (LC No. : 4)

Column Section = Rectangular

Width of Column = 230 mm.

Depth of Column = 450 mm.

The Effective Lengths about ZZ and YY axes were calculated based on actual framing conditions from the 3D Model.

Effective Length Coeff. about ZZ axis = 0.945

Effective Length Coeff. about YY axis = 0.657

Unsupported Length-ZZ of Column = 2.7 m.

Unsupported Length-YY of Column = 2.4 m.

Effective Length-ZZ of Column = 2.552 m.

Effective Length-YY of Column = 1.577 m.

Working Axial Load on Column = 206.382 KN.

Working Moment about ZZ-axis at Top = -3.676 KN m.

Working Moment about YY-axis at Top = 0.093 KN m.

Working Moment about ZZ-axis at Bottom = -7.665 KN m.

Working Moment about YY-axis at Bottom = -0.043 KN m.

C51 : Slenderness & Eccentricity Output (LC No. : 4)

Effective Length-ZZ of Column = 2.552 m.

Effective Length-YY of Column = 1.577 m.

Slenderness Ratio about ZZ-axis = 6.858
The Column is Short about the ZZ-axis.

Slenderness Ratio about YY-axis = 5.671
The Column is Short about the YY-axis.

As Per IS:456-2000, 25.4,

Minimum Eccentricity = 20 mm.

$L_0/500 + b/30$ = 12.467 mm.

$L_0/500 + D/30$ = 20.4 mm.

Actual Minimum Eccentricity about ZZ = 20.4 mm.

Actual Minimum Eccentricity about YY = 20 mm.

As Per IS:456-2000, 39.3,

0.05 times D (Limiting Value about ZZ)	=	22.5	mm.
0.05 times b (Limiting Value about YY)	=	11.5	mm.
Actual Eccentricity about ZZ due to Moment-ZZ	=	37.142	mm.
Actual Eccentricity about YY due to Moment-YY	=	0.451	mm.
Design Eccentricity about ZZ due to Moment-ZZ	=	37.142	mm.
Design Eccentricity about YY due to Moment-YY	=	20	mm.

As Per IS:456-2000, 39.3,

Design Eccentricity about ZZ is more than the Limiting Value.
Hence, the Column has Axial Load & Bending about ZZ.

Revised Design Bending Moment about ZZ	=	7.665	KN m.
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*Design Eccentricity about YY is more than the Limiting Value.
Hence, the Column has Axial Load & Bending about YY.*

Revised Design Bending Moment about YY	=	4.128	KN m.
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C51 : Flexural Design Output (LC No. : 4)

Axial Load on Column	=	206.382	KN.
Factored Axial Load	=	206.382	KN.
Revised Design Moment about ZZ axis	=	7.665	KN m.
Revised Design Moment about YY axis	=	4.128	KN m.

The Column is subjected to Axial Load & Bi-axial Bending.

Main Reinforcement is provided along all the FOUR Sides.

Characteristic Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Main Steel	=	415	N/sq.mm.
Min. Percentage of Reinforcement Required	=	0.8	%
Max. Percentage of Reinforcement Allowed	=	6	%
Percentage of Reinforcement Required	=	0.001	%

As Per IS:456-2000, 26.5.3.1,

the required percentage of Reinforcement is less than the Minimum value to be provided. Therefore, Minimum Reinforcement will be provided.

Depth of Neutral Axis about ZZ-axis	=	124.65	mm.
Depth of Neutral Axis about YY-axis	=	124.65	mm.
Ultimate Axial Load, Puz	=	931.813	KN.
Ratio of Pu/Puz	=	0.221	
Value of Coefficient, Alpha-n	=	1.036	
Ultimate Moment Capacity about ZZ-axis	=	35.782	KN m.
Ultimate Moment Capacity about YY-axis	=	18.279	KN m.
Ratio of Actual to Ultimate Moment, Mux/Mux1	=	0.214	

Ratio of Actual to Ultimate Moment, M_{uy}/M_{uy1}	=	0.226	
Sum of above Ratios, applied with Alpha-n	=	0.417	
Width of Column	=	230	mm.
Depth of Column	=	450	mm.
Gross Sectional Area	=	103500	sq.mm.
Percentage of Reinforcement to be Provided	=	0.8	%
Area of Longitudinal Reinforcement Required	=	828	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	4.118	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	804.248	sq.mm.
Main Rod Size-2	=	20	mm.
No. of Rods Required	=	2.636	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	1256.637	sq.mm.

Note:- Please note that the minimum number of Rods to be provided will be always FOUR for Rectangular Columns and SIX for Circular Columns, as per IS:456-2000 Clause 26.5.3.1.(c)

C51 : Tie Pitch Output (LC No. : 4)

Tie Rod Size-1	=	8	mm.
Tie Rod Size-2	=	10	mm.
Main Rod Size-1	=	16	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	256	mm.
Maximum allowable value as per Code	=	300	mm.
Minimum of the above values for 16# Rods	=	225	mm.
Main Rod Size-2	=	20	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	320	mm.
Maximum allowable value as per Code	=	300	mm.
Minimum of the above values for 20# Rods	=	225	mm.

Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

C51 : Global Input Data (LC No. : 5)

Column Section	=	Rectangular
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Width of Column	=	230	mm.
Depth of Column	=	450	mm.

The Effective Lengths about ZZ and YY axes were calculated based on actual framing conditions from the 3D Model.

Effective Length Coeff. about ZZ axis	=	0.945	
Effective Length Coeff. about YY axis	=	0.657	
Unsupported Length-ZZ of Column	=	2.7	m.
Unsupported Length-YY of Column	=	2.4	m.
Effective Length-ZZ of Column	=	2.552	m.
Effective Length-YY of Column	=	1.577	m.
Working Axial Load on Column	=	681.189	KN.
Working Moment about ZZ-axis at Top	=	-34.361	KN m.
Working Moment about YY-axis at Top	=	-1.301	KN m.
Working Moment about ZZ-axis at Bottom	=	-42.237	KN m.
Working Moment about YY-axis at Bottom	=	-1.861	KN m.

C51 : Slenderness & Eccentricity Output (LC No. : 5)

Effective Length-ZZ of Column	=	2.552	m.
Effective Length-YY of Column	=	1.577	m.
Slenderness Ratio about ZZ-axis	=	6.858	
The Column is Short about the ZZ-axis.			
Slenderness Ratio about YY-axis	=	5.671	
The Column is Short about the YY-axis.			
As Per IS:456-2000, 25.4,			
Minimum Eccentricity	=	20	mm.
Lo/500 + b/30	=	12.467	mm.
Lo/500 + D/30	=	20.4	mm.
Actual Minimum Eccentricity about ZZ	=	20.4	mm.
Actual Minimum Eccentricity about YY	=	20	mm.
As Per IS:456-2000, 39.3,			
0.05 times D (Limiting Value about ZZ)	=	22.5	mm.
0.05 times b (Limiting Value about YY)	=	11.5	mm.
Actual Eccentricity about ZZ due to Moment-ZZ	=	62.005	mm.
Actual Eccentricity about YY due to Moment-YY	=	2.733	mm.
Design Eccentricity about ZZ due to Moment-ZZ	=	62.005	mm.
Design Eccentricity about YY due to Moment-YY	=	20	mm.
As Per IS:456-2000, 39.3,			
Design Eccentricity about ZZ is more than the Limiting Value. Hence, the Column has Axial Load & Bending about ZZ.			
Revised Design Bending Moment about ZZ	=	42.237	KN m.
<i>Design Eccentricity about YY is more than the Limiting Value.</i>			

Hence, the Column has Axial Load & Bending about YY.

Revised Design Bending Moment about YY = 13.624 KN m.

C51 : Flexural Design Output (LC No. : 5)

Axial Load on Column = 681.189 KN.

Factored Axial Load = 681.189 KN.

Revised Design Moment about ZZ axis = 42.237 KN m.

Revised Design Moment about YY axis = 13.624 KN m.

The Column is subjected to Axial Load & Bi-axial Bending.

Main Reinforcement is provided along all the FOUR Sides.

Characteristic Comp. Strength of Concrete = 20 N/sq.mm.

Yield Stress of Main Steel = 415 N/sq.mm.

Min. Percentage of Reinforcement Required = 0.8 %

Max. Percentage of Reinforcement Allowed = 6 %

Percentage of Reinforcement Required = 0.361 %

As Per IS:456-2000, 26.5.3.1,

the required percentage of Reinforcement is less than the Minimum value to be provided. Therefore, Minimum Reinforcement will be provided.

Depth of Neutral Axis about ZZ-axis = 370.8 mm.

Depth of Neutral Axis about YY-axis = 400.95 mm.

Ultimate Axial Load, Puz = 1044.431 KN.

Ratio of Pu/Puz = 0.652

Value of Coefficient, Alpha-n = 1.754

Ultimate Moment Capacity about ZZ-axis = 52.515 KN m.

Ultimate Moment Capacity about YY-axis = 26.238 KN m.

Ratio of Actual to Ultimate Moment, Mux/Mux1 = 0.804

Ratio of Actual to Ultimate Moment, Muy/Muy1 = 0.519

Sum of above Ratios, applied with Alpha-n = 0.999

Width of Column = 230 mm.

Depth of Column = 450 mm.

Gross Sectional Area = 103500 sq.mm.

Percentage of Reinforcement to be Provided = 0.8 %

Area of Longitudinal Reinforcement Required = 828 sq.mm.

Main Rod Size-1 = 16 mm.

No. of Rods Required = 4.118 Nos.

No. of Rods Provided = 4 Nos.

Corresponding Steel Area	=	804.248	sq.mm.
Main Rod Size-2	=	20	mm.
No. of Rods Required	=	2.636	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	1256.637	sq.mm.

Note:- Please note that the minimum number of Rods to be provided will be always FOUR for Rectangular Columns and SIX for Circular Columns, as per IS:456-2000 Clause 26.5.3.1.(c)

C51 : Tie Pitch Output (LC No. : 5)

Tie Rod Size-1	=	8	mm.
Tie Rod Size-2	=	10	mm.
Main Rod Size-1	=	16	mm.

As Per IS:456-2000, 26.5.3.2,

Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	256	mm.
Maximum allowable value as per Code	=	300	mm.

Minimum of the above values for 16# Rods = 225 mm.

Main Rod Size-2 = 20 mm.

As Per IS:456-2000, 26.5.3.2,

Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	320	mm.
Maximum allowable value as per Code	=	300	mm.

Minimum of the above values for 20# Rods = 225 mm.

Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

C51 : Global Input Data (LC No. : 6)

Column Section	=	Rectangular	
Width of Column	=	230	mm.
Depth of Column	=	450	mm.

The Effective Lengths about ZZ and YY axes were calculated based on actual framing conditions from the 3D Model.

Effective Length Coeff. about ZZ axis	=	0.945	
Effective Length Coeff. about YY axis	=	0.657	

Unsupported Length-ZZ of Column	=	2.7	m.
Unsupported Length-YY of Column	=	2.4	m.

Effective Length-ZZ of Column	=	2.552	m.
Effective Length-YY of Column	=	1.577	m.

Working Axial Load on Column = 990.762 KN.

Working Moment about ZZ-axis at Top	=	-39.875	KN m.
Working Moment about YY-axis at Top	=	-1.162	KN m.
Working Moment about ZZ-axis at Bottom	=	-53.736	KN m.
Working Moment about YY-axis at Bottom	=	-1.926	KN m.

C51 : Slenderness & Eccentricity Output (LC No. : 6)

Effective Length-ZZ of Column	=	2.552	m.
Effective Length-YY of Column	=	1.577	m.
Slenderness Ratio about ZZ-axis	=	6.858	
The Column is Short about the ZZ-axis.			
Slenderness Ratio about YY-axis	=	5.671	
The Column is Short about the YY-axis.			
As Per IS:456-2000, 25.4,			
Minimum Eccentricity	=	20	mm.
Lo/500 + b/30	=	12.467	mm.
Lo/500 + D/30	=	20.4	mm.
Actual Minimum Eccentricity about ZZ	=	20.4	mm.
Actual Minimum Eccentricity about YY	=	20	mm.
As Per IS:456-2000, 39.3,			
0.05 times D (Limiting Value about ZZ)	=	22.5	mm.
0.05 times b (Limiting Value about YY)	=	11.5	mm.
Actual Eccentricity about ZZ due to Moment-ZZ	=	54.237	mm.
Actual Eccentricity about YY due to Moment-YY	=	1.944	mm.
Design Eccentricity about ZZ due to Moment-ZZ	=	54.237	mm.
Design Eccentricity about YY due to Moment-YY	=	20	mm.
As Per IS:456-2000, 39.3,			
Design Eccentricity about ZZ is more than the Limiting Value.			
Hence, the Column has Axial Load & Bending about ZZ.			
Revised Design Bending Moment about ZZ	=	53.736	KN m.
<i>Design Eccentricity about YY is more than the Limiting Value.</i>			
<i>Hence, the Column has Axial Load & Bending about YY.</i>			
Revised Design Bending Moment about YY	=	19.815	KN m.

C51 : Flexural Design Output (LC No. : 6)

Axial Load on Column	=	990.762	KN.
Factored Axial Load	=	990.762	KN.
Revised Design Moment about ZZ axis	=	53.736	KN m.
Revised Design Moment about YY axis	=	19.815	KN m.
The Column is subjected to Axial Load & Bi-axial Bending.			
Main Reinforcement is provided along all the FOUR Sides.			

Characteristic Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Main Steel	=	415	N/sq.mm.
Min. Percentage of Reinforcement Required	=	0.8	%
Max. Percentage of Reinforcement Allowed	=	6	%
Depth of Neutral Axis about ZZ-axis	=	409.5	mm.
Depth of Neutral Axis about YY-axis	=	400.95	mm.
Ultimate Axial Load, Puz	=	1369.773	KN.
Ratio of Pu/Puz	=	0.723	
Value of Coefficient, Alpha-n	=	1.872	
Ultimate Moment Capacity about ZZ-axis	=	68.468	KN m.
Ultimate Moment Capacity about YY-axis	=	44.92	KN m.
Ratio of Actual to Ultimate Moment, Mux/Mux1	=	0.785	
Ratio of Actual to Ultimate Moment, Muy/Muy1	=	0.441	
Sum of above Ratios, applied with Alpha-n	=	0.851	
Width of Column	=	230	mm.
Depth of Column	=	450	mm.
Gross Sectional Area	=	103500	sq.mm.
Percentage of Reinforcement to be Provided	=	1.401	%
Area of Longitudinal Reinforcement Required	=	1450.035	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	7.212	Nos.
No. of Rods Provided	=	8	Nos.
Corresponding Steel Area	=	1608.495	sq.mm.
Main Rod Size-2	=	20	mm.
No. of Rods Required	=	4.616	Nos.
No. of Rods Provided	=	5	Nos.
Corresponding Steel Area	=	1570.796	sq.mm.

Note:- Please note that the minimum number of Rods to be provided will be always FOUR for Rectangular Columns and SIX for Circular Columns, as per IS:456-2000 Clause 26.5.3.1.(c)

C51 : Tie Pitch Output (LC No. : 6)

Tie Rod Size-1	=	8	mm.
Tie Rod Size-2	=	10	mm.
Main Rod Size-1	=	16	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	256	mm.
Maximum allowable value as per Code	=	300	mm.

Minimum of the above values for 16# Rods = 225 mm.

Main Rod Size-2 = 20 mm.

As Per IS:456-2000, 26.5.3.2,

Least Lateral Dimension = 230 mm.

16 times dia. of Main Rod = 320 mm.

Maximum allowable value as per Code = 300 mm.

Minimum of the above values for 20# Rods = 225 mm.

Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

C91 : Global Input Data (LC No. : 1)

Column Section	=	Rectangular	
Width of Column	=	230	mm.
Depth of Column	=	450	mm.
The Effective Lengths about ZZ and YY axes were calculated based on actual framing conditions from the 3D Model.			
Effective Length Coeff. about ZZ axis	=	0.908	
Effective Length Coeff. about YY axis	=	0.614	
Unsupported Length-ZZ of Column	=	2.7	m.
Unsupported Length-YY of Column	=	2.4	m.
Effective Length-ZZ of Column	=	2.453	m.
Effective Length-YY of Column	=	1.474	m.
Working Axial Load on Column	=	34.592	KN.
Working Moment about ZZ-axis at Top	=	-4.42	KN m.
Working Moment about YY-axis at Top	=	-0.105	KN m.
Working Moment about ZZ-axis at Bottom	=	-5.627	KN m.
Working Moment about YY-axis at Bottom	=	-0.191	KN m.

C91 : Slenderness & Eccentricity Output (LC No. : 1)

Effective Length-ZZ of Column	=	2.453	m.
Effective Length-YY of Column	=	1.474	m.
Slenderness Ratio about ZZ-axis	=	6.41	
The Column is Short about the ZZ-axis.			
Slenderness Ratio about YY-axis	=	5.451	
The Column is Short about the YY-axis.			
As Per IS:456-2000, 25.4,			
Minimum Eccentricity	=	20	mm.
$L_0/500 + b/30$	=	12.467	mm.
$L_0/500 + D/30$	=	20.4	mm.
Actual Minimum Eccentricity about ZZ	=	20.4	mm.
Actual Minimum Eccentricity about YY	=	20	mm.
As Per IS:456-2000, 39.3,			
0.05 times D (Limiting Value about ZZ)	=	22.5	mm.
0.05 times b (Limiting Value about YY)	=	11.5	mm.
Actual Eccentricity about ZZ due to Moment-ZZ	=	162.655	mm.
Actual Eccentricity about YY due to Moment-YY	=	5.531	mm.
Design Eccentricity about ZZ due to Moment-ZZ	=	162.655	mm.
Design Eccentricity about YY due to Moment-YY	=	20	mm.

As Per IS:456-2000, 39.3,

Design Eccentricity about ZZ is more than the Limiting Value.
Hence, the Column has Axial Load & Bending about ZZ.

Revised Design Bending Moment about ZZ = 5.627 KN m.

*Design Eccentricity about YY is more than the Limiting Value.
Hence, the Column has Axial Load & Bending about YY.*

Revised Design Bending Moment about YY = 0.692 KN m.

C91 : Flexural Design Output (LC No. : 1)

Axial Load on Column = 34.592 KN.
Factored Axial Load = 34.592 KN.

Revised Design Moment about ZZ axis = 5.627 KN m.
Revised Design Moment about YY axis = 0.692 KN m.

The Column is subjected to Axial Load & Bi-axial Bending.

Main Reinforcement is provided along all the FOUR Sides.

Characteristic Comp. Strength of Concrete = 20 N/sq.mm.
Yield Stress of Main Steel = 415 N/sq.mm.

Min. Percentage of Reinforcement Required = 0.8 %
Max. Percentage of Reinforcement Allowed = 6 %

Percentage of Reinforcement Required = 0.001 %

As Per IS:456-2000, 26.5.3.1,

the required percentage of Reinforcement is less than the Minimum value to be provided. Therefore, Minimum Reinforcement will be provided.

Depth of Neutral Axis about ZZ-axis = 20.7 mm.
Depth of Neutral Axis about YY-axis = 20.7 mm.

Ultimate Axial Load, Puz = 931.813 KN.
Ratio of Pu/Puz = 0.037

Value of Coefficient, Alpha-n = 1

Ultimate Moment Capacity about ZZ-axis = 7.437 KN m.
Ultimate Moment Capacity about YY-axis = 3.798 KN m.

Ratio of Actual to Ultimate Moment, Mux/Mux1 = 0.757
Ratio of Actual to Ultimate Moment, Muy/Muy1 = 0.182

Sum of above Ratios, applied with Alpha-n = 0.939

Width of Column = 230 mm.
Depth of Column = 450 mm.

Gross Sectional Area = 103500 sq.mm.

Percentage of Reinforcement to be Provided	=	0.8	%
Area of Longitudinal Reinforcement Required	=	828	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	4.118	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	804.248	sq.mm.
Main Rod Size-2	=	20	mm.
No. of Rods Required	=	2.636	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	1256.637	sq.mm.

Note:- Please note that the minimum number of Rods to be provided will be always FOUR for Rectangular Columns and SIX for Circular Columns, as per IS:456-2000 Clause 26.5.3.1.(c)

C91 : Tie Pitch Output (LC No. : 1)

Tie Rod Size-1	=	8	mm.
Tie Rod Size-2	=	10	mm.
Main Rod Size-1	=	16	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	256	mm.
Maximum allowable value as per Code	=	300	mm.
Minimum of the above values for 16# Rods	=	225	mm.
Main Rod Size-2	=	20	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	320	mm.
Maximum allowable value as per Code	=	300	mm.
Minimum of the above values for 20# Rods	=	225	mm.

Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

C91 : Global Input Data (LC No. : 2)

Column Section	=	Rectangular
Width of Column	=	230 mm.
Depth of Column	=	450 mm.
The Effective Lengths about ZZ and YY axes were calculated based on actual framing conditions from the 3D Model.		
Effective Length Coeff. about ZZ axis	=	0.908
Effective Length Coeff. about YY axis	=	0.614

Unsupported Length-ZZ of Column	=	2.7	m.
Unsupported Length-YY of Column	=	2.4	m.
Effective Length-ZZ of Column	=	2.453	m.
Effective Length-YY of Column	=	1.474	m.
Working Axial Load on Column	=	1.771	KN.
Working Moment about ZZ-axis at Top	=	-9.661	KN m.
Working Moment about YY-axis at Top	=	-0.537	KN m.
Working Moment about ZZ-axis at Bottom	=	-2.763	KN m.
Working Moment about YY-axis at Bottom	=	0.331	KN m.

C91 : Slenderness & Eccentricity Output (LC No. : 2)

Effective Length-ZZ of Column	=	2.453	m.
Effective Length-YY of Column	=	1.474	m.
Slenderness Ratio about ZZ-axis	=	6.41	
The Column is Short about the ZZ-axis.			
Slenderness Ratio about YY-axis	=	5.451	
The Column is Short about the YY-axis.			
As Per IS:456-2000, 25.4,			
Minimum Eccentricity	=	20	mm.
Lo/500 + b/30	=	12.467	mm.
Lo/500 + D/30	=	20.4	mm.
Actual Minimum Eccentricity about ZZ	=	20.4	mm.
Actual Minimum Eccentricity about YY	=	20	mm.
As Per IS:456-2000, 39.3,			
0.05 times D (Limiting Value about ZZ)	=	22.5	mm.
0.05 times b (Limiting Value about YY)	=	11.5	mm.
Actual Eccentricity about ZZ due to Moment-ZZ	=	5454.457	mm.
Actual Eccentricity about YY due to Moment-YY	=	303.274	mm.
Design Eccentricity about ZZ due to Moment-ZZ	=	5454.457	mm.
Design Eccentricity about YY due to Moment-YY	=	303.274	mm.
As Per IS:456-2000, 39.3,			
Design Eccentricity about ZZ is more than the Limiting Value.			
Hence, the Column has Axial Load & Bending about ZZ.			
Revised Design Bending Moment about ZZ	=	9.661	KN m.
<i>Design Eccentricity about YY is more than the Limiting Value.</i>			
<i>Hence, the Column has Axial Load & Bending about YY.</i>			
Revised Design Bending Moment about YY	=	0.537	KN m.

C91 : Flexural Design Output (LC No. : 2)

Axial Load on Column	=	1.771	KN.
Factored Axial Load	=	1.771	KN.

Revised Design Moment about ZZ axis	=	9.661	KN m.
Revised Design Moment about YY axis	=	0.537	KN m.

The Column is subjected to Axial Load & Bi-axial Bending.

Main Reinforcement is provided along all the FOUR Sides.

Characteristic Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Main Steel	=	415	N/sq.mm.
Min. Percentage of Reinforcement Required	=	0.8	%
Max. Percentage of Reinforcement Allowed	=	6	%
Percentage of Reinforcement Required	=	0.201	%

As Per IS:456-2000, 26.5.3.1,

the required percentage of Reinforcement is less than the Minimum value to be provided. Therefore, Minimum Reinforcement will be provided.

Depth of Neutral Axis about ZZ-axis	=	33.3	mm.
Depth of Neutral Axis about YY-axis	=	33.3	mm.
Ultimate Axial Load, Puz	=	994.379	KN.
Ratio of Pu/Puz	=	0.002	
Value of Coefficient, Alpha-n	=	1	
Ultimate Moment Capacity about ZZ-axis	=	15.483	KN m.
Ultimate Moment Capacity about YY-axis	=	7.391	KN m.
Ratio of Actual to Ultimate Moment, Mux/Mux1	=	0.624	
Ratio of Actual to Ultimate Moment, Muy/Muy1	=	0.073	
Sum of above Ratios, applied with Alpha-n	=	0.697	
Width of Column	=	230	mm.
Depth of Column	=	450	mm.
Gross Sectional Area	=	103500	sq.mm.
Percentage of Reinforcement to be Provided	=	0.8	%
Area of Longitudinal Reinforcement Required	=	828	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	4.118	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	804.248	sq.mm.
Main Rod Size-2	=	20	mm.
No. of Rods Required	=	2.636	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	1256.637	sq.mm.

Note:- Please note that the minimum number of Rods to be provided will be always FOUR for Rectangular Columns and SIX for Circular

Columns, as per IS:456-2000 Clause 26.5.3.1.(c)

C91 : Tie Pitch Output (LC No. : 2)

Tie Rod Size-1	=	8	mm.
Tie Rod Size-2	=	10	mm.
Main Rod Size-1	=	16	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	256	mm.
Maximum allowable value as per Code	=	300	mm.
Minimum of the above values for 16# Rods	=	225	mm.
Main Rod Size-2	=	20	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	320	mm.
Maximum allowable value as per Code	=	300	mm.
Minimum of the above values for 20# Rods	=	225	mm.

Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

C91 : Global Input Data (LC No. : 3)

Column Section	=	Rectangular	
Width of Column	=	230	mm.
Depth of Column	=	450	mm.
The Effective Lengths about ZZ and YY axes were calculated based on actual framing conditions from the 3D Model.			
Effective Length Coeff. about ZZ axis	=	0.908	
Effective Length Coeff. about YY axis	=	0.614	
Unsupported Length-ZZ of Column	=	2.7	m.
Unsupported Length-YY of Column	=	2.4	m.
Effective Length-ZZ of Column	=	2.453	m.
Effective Length-YY of Column	=	1.474	m.
Working Axial Load on Column	=	106.483	KN.
Working Moment about ZZ-axis at Top	=	-18.267	KN m.
Working Moment about YY-axis at Top	=	-0.546	KN m.
Working Moment about ZZ-axis at Bottom	=	-21.356	KN m.
Working Moment about YY-axis at Bottom	=	-0.829	KN m.

C91 : Slenderness & Eccentricity Output (LC No. : 3)

Effective Length-ZZ of Column	=	2.453	m.
Effective Length-YY of Column	=	1.474	m.

Slenderness Ratio about ZZ-axis = 6.41
The Column is Short about the ZZ-axis.

Slenderness Ratio about YY-axis = 5.451
The Column is Short about the YY-axis.

As Per IS:456-2000, 25.4,

Minimum Eccentricity = 20 mm.
Lo/500 + b/30 = 12.467 mm.
Lo/500 + D/30 = 20.4 mm.

Actual Minimum Eccentricity about ZZ = 20.4 mm.
Actual Minimum Eccentricity about YY = 20 mm.

As Per IS:456-2000, 39.3,

0.05 times D (Limiting Value about ZZ) = 22.5 mm.
0.05 times b (Limiting Value about YY) = 11.5 mm.

Actual Eccentricity about ZZ due to Moment-ZZ = 200.553 mm.
Actual Eccentricity about YY due to Moment-YY = 7.788 mm.

Design Eccentricity about ZZ due to Moment-ZZ = 200.553 mm.
Design Eccentricity about YY due to Moment-YY = 20 mm.

As Per IS:456-2000, 39.3,

Design Eccentricity about ZZ is more than the Limiting Value.
Hence, the Column has Axial Load & Bending about ZZ.

Revised Design Bending Moment about ZZ = 21.356 KN m.

*Design Eccentricity about YY is more than the Limiting Value.
Hence, the Column has Axial Load & Bending about YY.*

Revised Design Bending Moment about YY = 2.13 KN m.

C91 : Flexural Design Output (LC No. : 3)

Axial Load on Column = 106.483 KN.
Factored Axial Load = 106.483 KN.

Revised Design Moment about ZZ axis = 21.356 KN m.
Revised Design Moment about YY axis = 2.13 KN m.

The Column is subjected to Axial Load & Bi-axial Bending.

Main Reinforcement is provided along all the FOUR Sides.

Characteristic Comp. Strength of Concrete = 20 N/sq.mm.
Yield Stress of Main Steel = 415 N/sq.mm.

Min. Percentage of Reinforcement Required = 0.8 %
Max. Percentage of Reinforcement Allowed = 6 %

Percentage of Reinforcement Required = 0.101 %

As Per IS:456-2000, 26.5.3.1,

the required percentage of Reinforcement is less than the Minimum value to be provided. Therefore, Minimum Reinforcement will be provided.

Depth of Neutral Axis about ZZ-axis	=	75.6	mm.
Depth of Neutral Axis about YY-axis	=	80.1	mm.
Ultimate Axial Load, Puz	=	963.096	KN.
Ratio of Pu/Puz	=	0.111	
Value of Coefficient, Alpha-n	=	1	
Ultimate Moment Capacity about ZZ-axis	=	27.556	KN m.
Ultimate Moment Capacity about YY-axis	=	13.722	KN m.
Ratio of Actual to Ultimate Moment, Mux/Mux1	=	0.775	
Ratio of Actual to Ultimate Moment, Muy/Muy1	=	0.155	
Sum of above Ratios, applied with Alpha-n	=	0.93	
Width of Column	=	230	mm.
Depth of Column	=	450	mm.
Gross Sectional Area	=	103500	sq.mm.
Percentage of Reinforcement to be Provided	=	0.8	%
Area of Longitudinal Reinforcement Required	=	828	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	4.118	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	804.248	sq.mm.
Main Rod Size-2	=	20	mm.
No. of Rods Required	=	2.636	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	1256.637	sq.mm.

Note:- Please note that the minimum number of Rods to be provided will be always FOUR for Rectangular Columns and SIX for Circular Columns, as per IS:456-2000 Clause 26.5.3.1.(c)

C91 : Tie Pitch Output (LC No. : 3)

Tie Rod Size-1	=	8	mm.
Tie Rod Size-2	=	10	mm.
Main Rod Size-1	=	16	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	256	mm.
Maximum allowable value as per Code	=	300	mm.
Minimum of the above values for 16# Rods	=	225	mm.

Main Rod Size-2	=	20	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	320	mm.
Maximum allowable value as per Code	=	300	mm.
Minimum of the above values for 20# Rods	=	225	mm.

Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

C91 : Global Input Data (LC No. : 4)

Column Section	=	Rectangular	
Width of Column	=	230	mm.
Depth of Column	=	450	mm.
The Effective Lengths about ZZ and YY axes were calculated based on actual framing conditions from the 3D Model.			
Effective Length Coeff. about ZZ axis	=	0.908	
Effective Length Coeff. about YY axis	=	0.614	
Unsupported Length-ZZ of Column	=	2.7	m.
Unsupported Length-YY of Column	=	2.4	m.
Effective Length-ZZ of Column	=	2.453	m.
Effective Length-YY of Column	=	1.474	m.
Working Axial Load on Column	=	104.792	KN.
Working Moment about ZZ-axis at Top	=	-17.977	KN m.
Working Moment about YY-axis at Top	=	-0.537	KN m.
Working Moment about ZZ-axis at Bottom	=	-21.016	KN m.
Working Moment about YY-axis at Bottom	=	-0.816	KN m.

C91 : Slenderness & Eccentricity Output (LC No. : 4)

Effective Length-ZZ of Column	=	2.453	m.
Effective Length-YY of Column	=	1.474	m.
Slenderness Ratio about ZZ-axis	=	6.41	
The Column is Short about the ZZ-axis.			
Slenderness Ratio about YY-axis	=	5.451	
The Column is Short about the YY-axis.			
As Per IS:456-2000, 25.4,			
Minimum Eccentricity	=	20	mm.
Lo/500 + b/30	=	12.467	mm.
Lo/500 + D/30	=	20.4	mm.
Actual Minimum Eccentricity about ZZ	=	20.4	mm.
Actual Minimum Eccentricity about YY	=	20	mm.

As Per IS:456-2000, 39.3,

0.05 times D (Limiting Value about ZZ)	=	22.5	mm.
0.05 times b (Limiting Value about YY)	=	11.5	mm.
Actual Eccentricity about ZZ due to Moment-ZZ	=	200.553	mm.
Actual Eccentricity about YY due to Moment-YY	=	7.788	mm.
Design Eccentricity about ZZ due to Moment-ZZ	=	200.553	mm.
Design Eccentricity about YY due to Moment-YY	=	20	mm.

As Per IS:456-2000, 39.3,

Design Eccentricity about ZZ is more than the Limiting Value.
Hence, the Column has Axial Load & Bending about ZZ.

Revised Design Bending Moment about ZZ	=	21.016	KN m.
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*Design Eccentricity about YY is more than the Limiting Value.
Hence, the Column has Axial Load & Bending about YY.*

Revised Design Bending Moment about YY	=	2.096	KN m.
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C91 : Flexural Design Output (LC No. : 4)

Axial Load on Column	=	104.792	KN.
Factored Axial Load	=	104.792	KN.
Revised Design Moment about ZZ axis	=	21.016	KN m.
Revised Design Moment about YY axis	=	2.096	KN m.

The Column is subjected to Axial Load & Bi-axial Bending.

Main Reinforcement is provided along all the FOUR Sides.

Characteristic Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Main Steel	=	415	N/sq.mm.
Min. Percentage of Reinforcement Required	=	0.8	%
Max. Percentage of Reinforcement Allowed	=	6	%
Percentage of Reinforcement Required	=	0.101	%

As Per IS:456-2000, 26.5.3.1,

the required percentage of Reinforcement is less than the Minimum value to be provided. Therefore, Minimum Reinforcement will be provided.

Depth of Neutral Axis about ZZ-axis	=	74.7	mm.
Depth of Neutral Axis about YY-axis	=	79.2	mm.
Ultimate Axial Load, Puz	=	963.096	KN.
Ratio of Pu/Puz	=	0.109	
Value of Coefficient, Alpha-n	=	1	
Ultimate Moment Capacity about ZZ-axis	=	27.281	KN m.
Ultimate Moment Capacity about YY-axis	=	13.601	KN m.
Ratio of Actual to Ultimate Moment, Mux/Mux1	=	0.77	

Ratio of Actual to Ultimate Moment, M_{uy}/M_{uy1}	=	0.154	
Sum of above Ratios, applied with Alpha-n	=	0.924	
Width of Column	=	230	mm.
Depth of Column	=	450	mm.
Gross Sectional Area	=	103500	sq.mm.
Percentage of Reinforcement to be Provided	=	0.8	%
Area of Longitudinal Reinforcement Required	=	828	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	4.118	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	804.248	sq.mm.
Main Rod Size-2	=	20	mm.
No. of Rods Required	=	2.636	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	1256.637	sq.mm.

Note:- Please note that the minimum number of Rods to be provided will be always FOUR for Rectangular Columns and SIX for Circular Columns, as per IS:456-2000 Clause 26.5.3.1.(c)

C91 : Tie Pitch Output (LC No. : 4)

Tie Rod Size-1	=	8	mm.
Tie Rod Size-2	=	10	mm.
Main Rod Size-1	=	16	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	256	mm.
Maximum allowable value as per Code	=	300	mm.
Minimum of the above values for 16# Rods	=	225	mm.
Main Rod Size-2	=	20	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	320	mm.
Maximum allowable value as per Code	=	300	mm.
Minimum of the above values for 20# Rods	=	225	mm.

Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

C91 : Global Input Data (LC No. : 5)

Column Section	=	Rectangular
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Width of Column	=	230	mm.
Depth of Column	=	450	mm.

The Effective Lengths about ZZ and YY axes were calculated based on actual framing conditions from the 3D Model.

Effective Length Coeff. about ZZ axis	=	0.908	
Effective Length Coeff. about YY axis	=	0.614	
Unsupported Length-ZZ of Column	=	2.7	m.
Unsupported Length-YY of Column	=	2.4	m.
Effective Length-ZZ of Column	=	2.453	m.
Effective Length-YY of Column	=	1.474	m.
Working Axial Load on Column	=	208.957	KN.
Working Moment about ZZ-axis at Top	=	-48.521	KN m.
Working Moment about YY-axis at Top	=	-1.782	KN m.
Working Moment about ZZ-axis at Bottom	=	-44.618	KN m.
Working Moment about YY-axis at Bottom	=	-1.035	KN m.

C91 : Slenderness & Eccentricity Output (LC No. : 5)

Effective Length-ZZ of Column	=	2.453	m.
Effective Length-YY of Column	=	1.474	m.
Slenderness Ratio about ZZ-axis	=	6.41	
The Column is Short about the ZZ-axis.			
Slenderness Ratio about YY-axis	=	5.451	
The Column is Short about the YY-axis.			
As Per IS:456-2000, 25.4,			
Minimum Eccentricity	=	20	mm.
Lo/500 + b/30	=	12.467	mm.
Lo/500 + D/30	=	20.4	mm.
Actual Minimum Eccentricity about ZZ	=	20.4	mm.
Actual Minimum Eccentricity about YY	=	20	mm.
As Per IS:456-2000, 39.3,			
0.05 times D (Limiting Value about ZZ)	=	22.5	mm.
0.05 times b (Limiting Value about YY)	=	11.5	mm.
Actual Eccentricity about ZZ due to Moment-ZZ	=	232.207	mm.
Actual Eccentricity about YY due to Moment-YY	=	8.527	mm.
Design Eccentricity about ZZ due to Moment-ZZ	=	232.207	mm.
Design Eccentricity about YY due to Moment-YY	=	20	mm.

As Per IS:456-2000, 39.3,

Design Eccentricity about ZZ is more than the Limiting Value.
Hence, the Column has Axial Load & Bending about ZZ.

Revised Design Bending Moment about ZZ	=	48.521	KN m.
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Design Eccentricity about YY is more than the Limiting Value.

Hence, the Column has Axial Load & Bending about YY.

Revised Design Bending Moment about YY = 4.179 KN m.

C91 : Flexural Design Output (LC No. : 5)

Axial Load on Column = 208.957 KN.

Factored Axial Load = 208.957 KN.

Revised Design Moment about ZZ axis = 48.521 KN m.

Revised Design Moment about YY axis = 4.179 KN m.

The Column is subjected to Axial Load & Bi-axial Bending.

Main Reinforcement is provided along all the FOUR Sides.

Characteristic Comp. Strength of Concrete = 20 N/sq.mm.

Yield Stress of Main Steel = 415 N/sq.mm.

Min. Percentage of Reinforcement Required = 0.8 %

Max. Percentage of Reinforcement Allowed = 6 %

Percentage of Reinforcement Required = 0.401 %

As Per IS:456-2000, 26.5.3.1,

the required percentage of Reinforcement is less than the Minimum value to be provided. Therefore, Minimum Reinforcement will be provided.

Depth of Neutral Axis about ZZ-axis = 148.05 mm.

Depth of Neutral Axis about YY-axis = 155.7 mm.

Ultimate Axial Load, Puz = 1056.944 KN.

Ratio of Pu/Puz = 0.198

Value of Coefficient, Alpha-n = 1

Ultimate Moment Capacity about ZZ-axis = 57.578 KN m.

Ultimate Moment Capacity about YY-axis = 26.943 KN m.

Ratio of Actual to Ultimate Moment, Mux/Mux1 = 0.843

Ratio of Actual to Ultimate Moment, Muy/Muy1 = 0.155

Sum of above Ratios, applied with Alpha-n = 0.998

Width of Column = 230 mm.

Depth of Column = 450 mm.

Gross Sectional Area = 103500 sq.mm.

Percentage of Reinforcement to be Provided = 0.8 %

Area of Longitudinal Reinforcement Required = 828 sq.mm.

Main Rod Size-1 = 16 mm.

No. of Rods Required = 4.118 Nos.

No. of Rods Provided = 4 Nos.

Corresponding Steel Area	=	804.248	sq.mm.
Main Rod Size-2	=	20	mm.
No. of Rods Required	=	2.636	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	1256.637	sq.mm.

Note:- Please note that the minimum number of Rods to be provided will be always FOUR for Rectangular Columns and SIX for Circular Columns, as per IS:456-2000 Clause 26.5.3.1.(c)

C91 : Tie Pitch Output (LC No. : 5)

Tie Rod Size-1	=	8	mm.
Tie Rod Size-2	=	10	mm.
Main Rod Size-1	=	16	mm.

As Per IS:456-2000, 26.5.3.2,

Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	256	mm.
Maximum allowable value as per Code	=	300	mm.

Minimum of the above values for 16# Rods = 225 mm.

Main Rod Size-2 = 20 mm.

As Per IS:456-2000, 26.5.3.2,

Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	320	mm.
Maximum allowable value as per Code	=	300	mm.

Minimum of the above values for 20# Rods = 225 mm.

Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

C91 : Global Input Data (LC No. : 6)

Column Section	=	Rectangular	
Width of Column	=	230	mm.
Depth of Column	=	450	mm.

The Effective Lengths about ZZ and YY axes were calculated based on actual framing conditions from the 3D Model.

Effective Length Coeff. about ZZ axis	=	0.908	
Effective Length Coeff. about YY axis	=	0.614	

Unsupported Length-ZZ of Column	=	2.7	m.
Unsupported Length-YY of Column	=	2.4	m.

Effective Length-ZZ of Column	=	2.453	m.
Effective Length-YY of Column	=	1.474	m.

Working Axial Load on Column = 366.144 KN.

Working Moment about ZZ-axis at Top	=	-75.486	KN m.
Working Moment about YY-axis at Top	=	-2.587	KN m.
Working Moment about ZZ-axis at Bottom	=	-76.143	KN m.
Working Moment about YY-axis at Bottom	=	-2.259	KN m.

C91 : Slenderness & Eccentricity Output (LC No. : 6)

Effective Length-ZZ of Column	=	2.453	m.
Effective Length-YY of Column	=	1.474	m.
Slenderness Ratio about ZZ-axis	=	6.41	
The Column is Short about the ZZ-axis.			
Slenderness Ratio about YY-axis	=	5.451	
The Column is Short about the YY-axis.			
As Per IS:456-2000, 25.4,			
Minimum Eccentricity	=	20	mm.
Lo/500 + b/30	=	12.467	mm.
Lo/500 + D/30	=	20.4	mm.
Actual Minimum Eccentricity about ZZ	=	20.4	mm.
Actual Minimum Eccentricity about YY	=	20	mm.
As Per IS:456-2000, 39.3,			
0.05 times D (Limiting Value about ZZ)	=	22.5	mm.
0.05 times b (Limiting Value about YY)	=	11.5	mm.
Actual Eccentricity about ZZ due to Moment-ZZ	=	207.958	mm.
Actual Eccentricity about YY due to Moment-YY	=	7.066	mm.
Design Eccentricity about ZZ due to Moment-ZZ	=	207.958	mm.
Design Eccentricity about YY due to Moment-YY	=	20	mm.
As Per IS:456-2000, 39.3,			
Design Eccentricity about ZZ is more than the Limiting Value.			
Hence, the Column has Axial Load & Bending about ZZ.			
Revised Design Bending Moment about ZZ	=	76.143	KN m.
<i>Design Eccentricity about YY is more than the Limiting Value.</i>			
<i>Hence, the Column has Axial Load & Bending about YY.</i>			
Revised Design Bending Moment about YY	=	7.323	KN m.

C91 : Flexural Design Output (LC No. : 6)

Axial Load on Column	=	366.144	KN.
Factored Axial Load	=	366.144	KN.
Revised Design Moment about ZZ axis	=	76.143	KN m.
Revised Design Moment about YY axis	=	7.323	KN m.
The Column is subjected to Axial Load & Bi-axial Bending.			
Main Reinforcement is provided along all the FOUR Sides.			

Characteristic Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Main Steel	=	415	N/sq.mm.
Min. Percentage of Reinforcement Required	=	0.8	%
Max. Percentage of Reinforcement Allowed	=	6	%
Depth of Neutral Axis about ZZ-axis	=	223.65	mm.
Depth of Neutral Axis about YY-axis	=	243.9	mm.
Ultimate Axial Load, Puz	=	1191.461	KN.
Ratio of Pu/Puz	=	0.307	
Value of Coefficient, Alpha-n	=	1.179	
Ultimate Moment Capacity about ZZ-axis	=	86.552	KN m.
Ultimate Moment Capacity about YY-axis	=	39.841	KN m.
Ratio of Actual to Ultimate Moment, Mux/Mux1	=	0.88	
Ratio of Actual to Ultimate Moment, Muy/Muy1	=	0.184	
Sum of above Ratios, applied with Alpha-n	=	0.996	
Width of Column	=	230	mm.
Depth of Column	=	450	mm.
Gross Sectional Area	=	103500	sq.mm.
Percentage of Reinforcement to be Provided	=	0.831	%
Area of Longitudinal Reinforcement Required	=	860.085	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	4.278	Nos.
No. of Rods Provided	=	5	Nos.
Corresponding Steel Area	=	1005.31	sq.mm.
Main Rod Size-2	=	20	mm.
No. of Rods Required	=	2.738	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	1256.637	sq.mm.

Note:- Please note that the minimum number of Rods to be provided will be always FOUR for Rectangular Columns and SIX for Circular Columns, as per IS:456-2000 Clause 26.5.3.1.(c)

C91 : Tie Pitch Output (LC No. : 6)

Tie Rod Size-1	=	8	mm.
Tie Rod Size-2	=	10	mm.
Main Rod Size-1	=	16	mm.
As Per IS:456-2000, 26.5.3.2,			
Least Lateral Dimension	=	230	mm.
16 times dia. of Main Rod	=	256	mm.
Maximum allowable value as per Code	=	300	mm.

Minimum of the above values for 16# Rods = 225 mm.

Main Rod Size-2 = 20 mm.

As Per IS:456-2000, 26.5.3.2,

Least Lateral Dimension = 230 mm.

16 times dia. of Main Rod = 320 mm.

Maximum allowable value as per Code = 300 mm.

Minimum of the above values for 20# Rods = 225 mm.

Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.