

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

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**Limit State Design of Wall Footings for
Axial Load & Uniaxial Bending,
Isolated Flat/Sloped Rectangular/Circular Footings
with or without Pedestals
for Axial Load, Uniaxial & Biaxial Bending,
Combined Rectangular/Trapezoidal Footings
with or without Pedestals
for Axial Load & Uniaxial Bending
in accordance with IS:456-2000 and IS:6403-1973.**

Introduction:-

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

The given Footing is considered for flexural design and the output contains the following portions:

1. Footing Input Data
2. Flexural Design Output for Footing
3. Flexural Design Output for Pedestal, if provided
4. One Way Shear Check Output
5. Two Way Shear Check Output
6. Development Length / Bond Design Output

While detailed design will be carried out for Flexure and Bond, only checks for stresses are made for Shear.

Global Material Data

Concrete Clear Cover	=	50	mm.
Char. Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Strength of Main Steel	=	415	N/sq.mm.
Main Rod Size-1	=	10	mm.
Main Rod Size-2	=	12	mm.
Yield Strength of Distribution Steel	=	415	N/sq.mm.
Distbn. Rod Size-1	=	10	mm.
Distbn. Rod Size-2	=	12	mm.
Yield Strength of Dowel/Pedestal Steel	=	415	N/sq.mm.
Dowel/Pedestal Rod Size-1	=	12	mm.
Dowel/Pedestal Rod Size-2	=	16	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.
Yield Stress of Secondary Steel	=	415	N/sq.mm.
Yield Stress of Dowel/Pedestal Steel	=	415	N/sq.mm.

As Per IS:456-2000, Clause 26.2.1.1,

Design Bond Stress for Main Rods	=	1.92	N/sq.mm.
Design Bond Stress for Secondary Rods	=	1.92	N/sq.mm.
Design Bond Stress for Dowel/Pedestal Rods	=	1.92	N/sq.mm.

Rods in Tension:-

Main Rod Diameter-1	=	10	mm.
Corresponding Development Length	=	470.117	mm.

Main Rod Diameter-2	=	12	mm.
Corresponding Development Length	=	564.141	mm.

Secondary Rod Diameter-1	=	10	mm.
Corresponding Development Length	=	470.117	mm.

Secondary Rod Diameter-2	=	12	mm.
Corresponding Development Length	=	564.141	mm.

Rods in Compression:-

Dowel/Pedestal Rod Diameter-1	=	12	mm.
Corresponding Development Length	=	564.141	mm.

Dowel/Pedestal Rod Diameter-2	=	16	mm.
Corresponding Development Length	=	752.188	mm.

F08 : Global Input Data (LC No. : 1)

The footing is to be designed as an Isolated Footing.

Width of Column	=	230	mm.
Length of Column	=	450	mm.
Footing Shape	=	Rectangular	
Initial Depth at the Face of Wall/Column	=	300	mm.
Initial Depth at the End	=	150	mm.

The footing is subjected to Axial Load & Biaxial Bending.

Working Axial Load	=	74.527	KN.
Working Moment about ZZ-axis	=	2.448	KN m.
Working Moment about XX-axis	=	0.048	KN m.
Safe Bearing Capacity of Soil	=	150	KN/sq.m.
Factor of Safety for Safe Bearing Capacity	=	1.5	

F08 : Flexure Output (LC No. : 1)

Working Axial Load on Footing	=	74.527	KN.
Factored Axial Load on Footing	=	74.527	KN.
Percentage Factor for Self Weight of Footing	=	5	%
Factored Self Weight of Footing	=	3.726	KN.
Total Factored Axial Load on Footing	=	78.253	KN.
Working Moment about ZZ-axis	=	2.448	KN m.
Factored Moment about ZZ-axis	=	2.448	KN m.
Working Moment about XX-axis	=	0.048	KN m.
Factored Moment about XX-axis	=	0.048	KN m.
Ultimate Bearing Capacity of Soil	=	225	KN/sq.m.
From Vertical Load and Bending considerations, Area of Footing Required	=	0.434	sq.m.
Equal Projections were initially assumed from the Column Faces to arrive at the Footing Size.			
Width of Footing Required	=	0.558	m.
Length of Footing Required	=	0.778	m.
Width of Footing Provided	=	0.575	m.
Length of Footing Provided	=	0.8	m.
Actual Bearing Area Provided	=	0.46	sq.m.

Max. Bearing Pressure at the Base	=	211.131	KN/sq.m.
Min. Bearing Pressure at the Base	=	129.101	KN/sq.m.

Bending about ZZ-axis:-

Load Eccentricity lies within the limit causing total Compression.
Hence, the Footing Base about ZZ-axis will be in touch with the Soil.

Net Bearing Pressure at the Base - Right End	=	203.03	KN/sq.m.
Net Bearing Pressure at the Base - Left End	=	123.201	KN/sq.m.
Net Bearing Pressure at the Column Face	=	185.567	KN/sq.m.
Net Bearing Pressure - 'd' from Face	=	203.03	KN/sq.m.

As Per IS:456-2000, Clause 34.2.3,
the critical section for Bending Moment is at the Face of the Column.

Projection of Footing from Critical Section	=	175	mm.
Design Bending Moment	=	1.736	KN m.
Modified Depth of Footing at the Face of Wall	=	300	mm.
Modified Depth of Footing at the End	=	150	mm.
Effective Depth Required	=	46.346	mm.
Effective Depth Provided	=	244	mm.

Hence SAFE.

Percentage of Steel Required	=	0.014	%
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As Per IS:456-2000, Clause 26.5.2.1,
the required percentage of Steel is less than the Minimum to be provided. Hence, Minimum Steel is provided.

Percentage of Main Steel Provided	=	0.12	%
Area of Steel Provided	=	168.36	sq.mm.
Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	268.237	mm.
Max. Spacing allowed (Rounded off)	=	250	mm.
Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	386.261	mm.
Max. Spacing allowed (Rounded off)	=	250	mm.

Bending about XX-axis:-

Load Eccentricity lies within the limit causing total Compression.
Hence, the Footing Base about XX-axis will be in touch with the Soil.

Net Bearing Pressure at the Base - Right End	=	203.03	KN/sq.m.
Net Bearing Pressure at the Base - Left End	=	200.83	KN/sq.m.

Net Bearing Pressure at the Column Face	=	202.37	KN/sq.m.
Net Bearing Pressure - 'd' from Face	=	203.03	KN/sq.m.

As Per IS:456-2000, Clause 34.2.3,
the critical section for Bending Moment is at the Face of the Column.

Projection of Footing from Critical Section	=	172.5	mm.
Design Bending Moment	=	2.414	KN m.
Modified Depth of Footing at the Face of Wall	=	300	mm.
Modified Depth of Footing at the End	=	150	mm.
Effective Depth Required	=	41.253	mm.
Effective Depth Provided	=	232	mm.

Hence SAFE.

Percentage of Steel Required	=	0.016	%
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As Per IS:456-2000, Clause 26.5.2.1,
the required percentage of Steel is less than the Minimum to be provided. Hence, Minimum Steel is provided.

Percentage of Main Steel Provided	=	0.12	%
Area of Steel Provided	=	222.72	sq.mm.
Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	282.111	mm.
Max. Spacing allowed (Rounded off)	=	250	mm.
Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	406.24	mm.
Max. Spacing allowed (Rounded off)	=	250	mm.

Note (1):- The required Spacing of Main Rods will be compared with 300 mm. or 3d (450 mm. or 5d for Dist. Rods) whichever is less. If the required spacing exceeds this limit, the least value will be automatically provided. This is done in accordance with IS:456-2000 Clause 26.3.3.

Note (2):- The required minimum area of reinforcement will be also as per IS:456-2000, Clause 34.5.2, if the Footing Thickness exceeds 1000 mm. This minimum area is 360.0 sq.mm. for each side or face.

Note (3):- The assumed Depth of Footing will be automatically modified so that a SAFE design is arrived at from both flexure as well as Shear considerations.

Note (4):- Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

Factored Axial Load on Column	=	74.527	KN.
Char. Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Pedestal Steel	=	415	N/sq.mm.
Width of Column Section	=	230	mm.
Depth of Column Section	=	450	mm.
Area of Column Section	=	103500	sq.mm.
Width of Footing	=	0.575	m.
Length of Footing	=	0.8	m.
Area of Footing	=	0.46	sq.m.
As Per IS:456-2000, Clause 34.4,			
Basic Permissible Bearing Stress	=	9	N/sq.mm.
Max. Bearing Stress based on Area Ratio	=	18	N/sq.mm.
Actual Bearing Stress	=	0.72	N/sq.mm.
As Per IS:456-2000, Clause 34.4.3,			
Reinforcement is NOT required. However, Minimum Steel is Provided.			
Percentage of Steel Required	=	0.5	%
Area of Steel Provided	=	517.5	sq.mm.
Dowel Rod Size-1	=	12	mm.
No. of Rods to be Provided	=	5	Nos.
Corresponding Steel Area	=	565.487	sq.mm.
Dowel Rod Size-2	=	16	mm.
No. of Rods to be Provided	=	3	Nos.
Corresponding Steel Area	=	603.186	sq.mm.

*Note :- Calculation for Dowel Rods is only optionally provided.
However, Dowel Rods may not be required in all cases.*

F08 : One Way Shear Output (LC No. : 1)

As Per IS:456-2000, Clause 34.2.4,

the critical section for Shear Force is at a distance equal to the Effective Depth of the Footing, from the Face of the Column.

Design Shear Force about Length	=	0	KN.
Modified Depth of Footing at the Face of Wall	=	300	mm.
Modified Depth of Footing at the End	=	150	mm.
Depth of Footing at Critical Section	=	244	mm.
Projection of Footing from Critical Section	=	0	mm.

As Per IS:456-2000, Clause 40.1,

Actual Shear Stress = 0 N/sq.mm.

As Per IS:456-2000, Table 19,
Design Shear Strength of Concrete = 0.269 N/sq.mm.

As Per IS:456-2000, Table 20,
Max. Permissible Shear Stress = 2.794 N/sq.mm.

The section is SAFE in Shear, about ZZ-axis.

Design Shear Force about Width = 0 KN.

Depth of Footing at Critical Section = 232 mm.

Projection of Footing from Critical Section = 0 mm.

As Per IS:456-2000, Clause 40.1,
Actual Shear Stress = 0 N/sq.mm.

As Per IS:456-2000, Table 19,
Design Shear Strength of Concrete = 0.275 N/sq.mm.

As Per IS:456-2000, Table 20,
Max. Permissible Shear Stress = 2.794 N/sq.mm.

The section is SAFE in Shear, about XX-axis.

F08 : Punching Shear Output (LC No. : 1)

As Per IS:456-2000, Clause 34.2.4,
the critical section for Shear Force is at a distance equal to the Half the Effective Depth of the Footing, from the Face of the Column.

Length of Footing at Critical Section = 0.682 m.

Width of Footing at Critical Section = 0.462 m.

Ratio of Width to Length at Critical Section = 0.677

Modified Depth of Footing at the Face of Wall = 300 mm.

Modified Depth of Footing at the End = 150 mm.

Depth of Footing at Critical Section = 232 mm.

Design Shear Force = 21.231 KN.

As Per IS:456-2000, Clause 31.6.2.1,
Actual Shear Stress = 0.04 N/sq.mm.

As Per IS:456-2000, Clause 31.6.3.1,
Coefficient, k_s = 1

Max. Permissible Shear Stress = 1.118 N/sq.mm.

The section is SAFE in Shear.

F08 : Global Input Data (LC No. : 2)

The footing is to be designed as an Isolated Footing.

Width of Column	=	230	mm.
Length of Column	=	450	mm.
Footing Shape	=	Rectangular	
Initial Depth at the Face of Wall/Column	=	300	mm.
Initial Depth at the End	=	150	mm.

The footing is subjected to Axial Load & Biaxial Bending.

Working Axial Load	=	251.421	KN.
Working Moment about ZZ-axis	=	11.648	KN m.
Working Moment about XX-axis	=	0.364	KN m.
Safe Bearing Capacity of Soil	=	150	KN/sq.m.
Factor of Safety for Safe Bearing Capacity	=	1.5	

F08 : Flexure Output (LC No. : 2)

Working Axial Load on Footing	=	251.421	KN.
Factored Axial Load on Footing	=	251.421	KN.
Percentage Factor for Self Weight of Footing	=	5	%
Factored Self Weight of Footing	=	12.571	KN.
Total Factored Axial Load on Footing	=	263.992	KN.
Working Moment about ZZ-axis	=	11.648	KN m.
Factored Moment about ZZ-axis	=	11.648	KN m.
Working Moment about XX-axis	=	0.364	KN m.
Factored Moment about XX-axis	=	0.364	KN m.
Ultimate Bearing Capacity of Soil	=	225	KN/sq.m.
From Vertical Load and Bending considerations, Area of Footing Required	=	1.42	sq.m.
Equal Projections were initially assumed from the Column Faces to arrive at the Footing Size.			
Width of Footing Required	=	1.087	m.
Length of Footing Required	=	1.307	m.
Width of Footing Provided	=	1.1	m.
Length of Footing Provided	=	1.325	m.
Actual Bearing Area Provided	=	1.458	sq.m.
Max. Bearing Pressure at the Base	=	218.677	KN/sq.m.
Min. Bearing Pressure at the Base	=	143.575	KN/sq.m.

Bending about ZZ-axis:-

Load Eccentricity lies within the limit causing total Compression.
Hence, the Footing Base about ZZ-axis will be in touch with the Soil.

Net Bearing Pressure at the Base - Right End	=	210.052	KN/sq.m.
Net Bearing Pressure at the Base - Left End	=	137.677	KN/sq.m.
Net Bearing Pressure at the Column Face	=	186.155	KN/sq.m.
Net Bearing Pressure - 'd' from Face	=	199.483	KN/sq.m.

As Per IS:456-2000, Clause 34.2.3,
the critical section for Bending Moment is at the Face of the Column.

Projection of Footing from Critical Section	=	437.5	mm.
Design Bending Moment	=	21.274	KN m.
Modified Depth of Footing at the Face of Wall	=	300	mm.
Modified Depth of Footing at the End	=	150	mm.
Effective Depth Required	=	140.878	mm.
Effective Depth Provided	=	244	mm.

Hence SAFE.

Percentage of Steel Required	=	0.092	%
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As Per IS:456-2000, Clause 26.5.2.1,
the required percentage of Steel is less than the Minimum to be provided. Hence, Minimum Steel is provided.

Percentage of Main Steel Provided	=	0.12	%
Area of Steel Provided	=	322.08	sq.mm.
Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	268.237	mm.
Max. Spacing allowed (Rounded off)	=	250	mm.
Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	386.261	mm.
Max. Spacing allowed (Rounded off)	=	250	mm.

Bending about XX-axis:-

Load Eccentricity lies within the limit causing total Compression.
Hence, the Footing Base about XX-axis will be in touch with the Soil.

Net Bearing Pressure at the Base - Right End	=	210.052	KN/sq.m.
Net Bearing Pressure at the Base - Left End	=	207.326	KN/sq.m.
Net Bearing Pressure at the Column Face	=	208.974	KN/sq.m.
Net Bearing Pressure - 'd' from Face	=	209.579	KN/sq.m.

As Per IS:456-2000, Clause 34.2.3,
the critical section for Bending Moment is at the Face of the Column.

Projection of Footing from Critical Section	=	435	mm.
Design Bending Moment	=	26.287	KN m.
Modified Depth of Footing at the Face of Wall	=	300	mm.
Modified Depth of Footing at the End	=	150	mm.
Effective Depth Required	=	125.015	mm.
Effective Depth Provided	=	232	mm.

Hence SAFE.

Percentage of Steel Required	=	0.104	%
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As Per IS:456-2000, Clause 26.5.2.1,
the required percentage of Steel is less than the Minimum to be provided. Hence, Minimum Steel is provided.

Percentage of Main Steel Provided	=	0.12	%
Area of Steel Provided	=	368.88	sq.mm.
Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	282.111	mm.
Max. Spacing allowed (Rounded off)	=	250	mm.
Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	406.24	mm.
Max. Spacing allowed (Rounded off)	=	250	mm.

Note (1):- The required Spacing of Main Rods will be compared with 300 mm. or 3d (450 mm. or 5d for Dist. Rods) whichever is less. If the required spacing exceeds this limit, the least value will be automatically provided. This is done in accordance with IS:456-2000 Clause 26.3.3.

Note (2):- The required minimum area of reinforcement will be also as per IS:456-2000, Clause 34.5.2, if the Footing Thickness exceeds 1000 mm. This minimum area is 360.0 sq.mm. for each side or face.

Note (3):- The assumed Depth of Footing will be automatically modified so that a SAFE design is arrived at from both flexure as well as Shear considerations.

Note (4):- Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

F08 : Dowel Bars Output (LC No. : 2)

Factored Axial Load on Column	=	251.421	KN.
Char. Comp. Strength of Concrete	=	20	N/sq.mm.

Yield Stress of Pedestal Steel	=	415	N/sq.mm.
Width of Column Section	=	230	mm.
Depth of Column Section	=	450	mm.
Area of Column Section	=	103500	sq.mm.
Width of Footing	=	1.1	m.
Length of Footing	=	1.325	m.
Area of Footing	=	1.458	sq.m.
As Per IS:456-2000, Clause 34.4,			
Basic Permissible Bearing Stress	=	9	N/sq.mm.
Max. Bearing Stress based on Area Ratio	=	18	N/sq.mm.
Actual Bearing Stress	=	2.429	N/sq.mm.
As Per IS:456-2000, Clause 34.4.3,			
Reinforcement is NOT required. However, Minimum Steel is Provided.			
Percentage of Steel Required	=	0.5	%
Area of Steel Provided	=	517.5	sq.mm.
Dowel Rod Size-1	=	12	mm.
No. of Rods to be Provided	=	5	Nos.
Corresponding Steel Area	=	565.487	sq.mm.
Dowel Rod Size-2	=	16	mm.
No. of Rods to be Provided	=	3	Nos.
Corresponding Steel Area	=	603.186	sq.mm.

*Note :- Calculation for Dowel Rods is only optionally provided.
However, Dowel Rods may not be required in all cases.*

F08 : One Way Shear Output (LC No. : 2)

As Per IS:456-2000, Clause 34.2.4,

the critical section for Shear Force is at a distance equal to the Effective Depth of the Footing, from the Face of the Column.

Design Shear Force about Length	=	43.585	KN.
Modified Depth of Footing at the Face of Wall	=	300	mm.
Modified Depth of Footing at the End	=	150	mm.
Depth of Footing at Critical Section	=	160.343	mm.
Projection of Footing from Critical Section	=	193.5	mm.
As Per IS:456-2000, Clause 40.1,			
Actual Shear Stress	=	0.247	N/sq.mm.
As Per IS:456-2000, Table 19,			
Design Shear Strength of Concrete	=	0.269	N/sq.mm.

As Per IS:456-2000, Table 20,
Max. Permissible Shear Stress = 2.794 N/sq.mm.

The section is SAFE in Shear, about ZZ-axis.

Design Shear Force about Width = 53.099 KN.

Depth of Footing at Critical Section = 147.862 mm.

Projection of Footing from Critical Section = 191 mm.

As Per IS:456-2000, Clause 40.1,
Actual Shear Stress = 0.271 N/sq.mm.

As Per IS:456-2000, Table 19,
Design Shear Strength of Concrete = 0.275 N/sq.mm.

As Per IS:456-2000, Table 20,
Max. Permissible Shear Stress = 2.794 N/sq.mm.

The section is SAFE in Shear, about XX-axis.

F08 : Punching Shear Output (LC No. : 2)

As Per IS:456-2000, Clause 34.2.4,
the critical section for Shear Force is at a distance equal to the Half the Effective Depth of the Footing, from the Face of the Column.

Length of Footing at Critical Section = 0.682 m.

Width of Footing at Critical Section = 0.462 m.

Ratio of Width to Length at Critical Section = 0.677

Modified Depth of Footing at the Face of Wall = 300 mm.

Modified Depth of Footing at the End = 150 mm.

Depth of Footing at Critical Section = 196.171 mm.

Design Shear Force = 194.675 KN.

As Per IS:456-2000, Clause 31.6.2.1,
Actual Shear Stress = 0.434 N/sq.mm.

As Per IS:456-2000, Clause 31.6.3.1,
Coefficient, ks = 1

Max. Permissible Shear Stress = 1.118 N/sq.mm.

The section is SAFE in Shear.

F08 : Global Input Data (LC No. : 3)

The footing is to be designed as an Isolated Footing.

Width of Column = 230 mm.

Length of Column	=	450	mm.
Footing Shape	=	Rectangular	
Initial Depth at the Face of Wall/Column	=	300	mm.
Initial Depth at the End	=	150	mm.

The footing is subjected to Axial Load & Biaxial Bending.

Working Axial Load	=	109.818	KN.
Working Moment about ZZ-axis	=	0.704	KN m.
Working Moment about XX-axis	=	0.096	KN m.
Safe Bearing Capacity of Soil	=	150	KN/sq.m.
Factor of Safety for Safe Bearing Capacity	=	1.5	

F08 : Flexure Output (LC No. : 3)

Working Axial Load on Footing	=	109.818	KN.
Factored Axial Load on Footing	=	109.818	KN.
Percentage Factor for Self Weight of Footing	=	5	%
Factored Self Weight of Footing	=	5.491	KN.
Total Factored Axial Load on Footing	=	115.309	KN.
Working Moment about ZZ-axis	=	0.704	KN m.
Factored Moment about ZZ-axis	=	0.704	KN m.
Working Moment about XX-axis	=	0.096	KN m.
Factored Moment about XX-axis	=	0.096	KN m.
Ultimate Bearing Capacity of Soil	=	225	KN/sq.m.
From Vertical Load and Bending considerations, Area of Footing Required	=	0.539	sq.m.
Equal Projections were initially assumed from the Column Faces to arrive at the Footing Size.			
Width of Footing Required	=	0.632	m.
Length of Footing Required	=	0.852	m.
Width of Footing Provided	=	0.65	m.
Length of Footing Provided	=	0.875	m.
Actual Bearing Area Provided	=	0.569	sq.m.
Max. Bearing Pressure at the Base	=	212.78	KN/sq.m.
Min. Bearing Pressure at the Base	=	192.701	KN/sq.m.

Bending about ZZ-axis:-

Load Eccentricity lies within the limit causing total Compression.
Hence, the Footing Base about ZZ-axis will be in touch with the Soil.

Net Bearing Pressure at the Base - Right End	=	203.126	KN/sq.m.
Net Bearing Pressure at the Base - Left End	=	186.147	KN/sq.m.
Net Bearing Pressure at the Column Face	=	199.002	KN/sq.m.
Net Bearing Pressure - 'd' from Face	=	203.126	KN/sq.m.

As Per IS:456-2000, Clause 34.2.3,
the critical section for Bending Moment is at the Face of the Column.

Projection of Footing from Critical Section	=	212.5	mm.
Design Bending Moment	=	2.961	KN m.
Modified Depth of Footing at the Face of Wall	=	300	mm.
Modified Depth of Footing at the End	=	150	mm.
Effective Depth Required	=	59.159	mm.
Effective Depth Provided	=	244	mm.

Hence SAFE.

Percentage of Steel Required	=	0.021	%
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As Per IS:456-2000, Clause 26.5.2.1,
the required percentage of Steel is less than the Minimum to be provided. Hence, Minimum Steel is provided.

Percentage of Main Steel Provided	=	0.12	%
Area of Steel Provided	=	190.32	sq.mm.
Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	268.237	mm.
Max. Spacing allowed (Rounded off)	=	250	mm.
Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	386.261	mm.
Max. Spacing allowed (Rounded off)	=	250	mm.

Bending about XX-axis:-

Load Eccentricity lies within the limit causing total Compression.
Hence, the Footing Base about XX-axis will be in touch with the Soil.

Net Bearing Pressure at the Base - Right End	=	203.126	KN/sq.m.
Net Bearing Pressure at the Base - Left End	=	200.026	KN/sq.m.
Net Bearing Pressure at the Column Face	=	202.124	KN/sq.m.
Net Bearing Pressure - 'd' from Face	=	203.126	KN/sq.m.

As Per IS:456-2000, Clause 34.2.3,
the critical section for Bending Moment is at the Face of the Column.

Projection of Footing from Critical Section	=	210	mm.
Design Bending Moment	=	3.913	KN m.
Modified Depth of Footing at the Face of Wall	=	300	mm.
Modified Depth of Footing at the End	=	150	mm.
Effective Depth Required	=	51.837	mm.
Effective Depth Provided	=	232	mm.

Hence SAFE.

Percentage of Steel Required	=	0.023	%
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As Per IS:456-2000, Clause 26.5.2.1,
the required percentage of Steel is less than the Minimum to be provided. Hence, Minimum Steel is provided.

Percentage of Main Steel Provided	=	0.12	%
Area of Steel Provided	=	243.6	sq.mm.
Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	282.111	mm.
Max. Spacing allowed (Rounded off)	=	250	mm.
Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	406.24	mm.
Max. Spacing allowed (Rounded off)	=	250	mm.

Note (1):- The required Spacing of Main Rods will be compared with 300 mm. or 3d (450 mm. or 5d for Dist. Rods) whichever is less. If the required spacing exceeds this limit, the least value will be automatically provided. This is done in accordance with IS:456-2000 Clause 26.3.3.

Note (2):- The required minimum area of reinforcement will be also as per IS:456-2000, Clause 34.5.2, if the Footing Thickness exceeds 1000 mm. This minimum area is 360.0 sq.mm. for each side or face.

Note (3):- The assumed Depth of Footing will be automatically modified so that a SAFE design is arrived at from both flexure as well as Shear considerations.

Note (4):- Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

F08 : Dowel Bars Output (LC No. : 3)

Factored Axial Load on Column	=	109.818	KN.
Char. Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Pedestal Steel	=	415	N/sq.mm.
Width of Column Section	=	230	mm.
Depth of Column Section	=	450	mm.

Area of Column Section	=	103500	sq.mm.
Width of Footing	=	0.65	m.
Length of Footing	=	0.875	m.
Area of Footing	=	0.569	sq.m.
As Per IS:456-2000, Clause 34.4,			
Basic Permissible Bearing Stress	=	9	N/sq.mm.
Max. Bearing Stress based on Area Ratio	=	18	N/sq.mm.
Actual Bearing Stress	=	1.061	N/sq.mm.
As Per IS:456-2000, Clause 34.4.3,			
Reinforcement is NOT required. However, Minimum Steel is Provided.			
Percentage of Steel Required	=	0.5	%
Area of Steel Provided	=	517.5	sq.mm.
Dowel Rod Size-1	=	12	mm.
No. of Rods to be Provided	=	5	Nos.
Corresponding Steel Area	=	565.487	sq.mm.
Dowel Rod Size-2	=	16	mm.
No. of Rods to be Provided	=	3	Nos.
Corresponding Steel Area	=	603.186	sq.mm.

*Note :- Calculation for Dowel Rods is only optionally provided.
However, Dowel Rods may not be required in all cases.*

F08 : One Way Shear Output (LC No. : 3)

As Per IS:456-2000, Clause 34.2.4,

the critical section for Shear Force is at a distance equal to the Effective Depth of the Footing, from the Face of the Column.

Design Shear Force about Length	=	0	KN.
Modified Depth of Footing at the Face of Wall	=	300	mm.
Modified Depth of Footing at the End	=	150	mm.
Depth of Footing at Critical Section	=	244	mm.
Projection of Footing from Critical Section	=	0	mm.
As Per IS:456-2000, Clause 40.1,			
Actual Shear Stress	=	0	N/sq.mm.
As Per IS:456-2000, Table 19,			
Design Shear Strength of Concrete	=	0.269	N/sq.mm.
As Per IS:456-2000, Table 20,			
Max. Permissible Shear Stress	=	2.794	N/sq.mm.

The section is SAFE in Shear, about ZZ-axis.

Design Shear Force about Width	=	0	KN.
Depth of Footing at Critical Section	=	232	mm.
Projection of Footing from Critical Section	=	0	mm.
As Per IS:456-2000, Clause 40.1, Actual Shear Stress	=	0	N/sq.mm.
As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.275	N/sq.mm.
As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.

The section is SAFE in Shear, about XX-axis.

F08 : Punching Shear Output (LC No. : 3)

As Per IS:456-2000, Clause 34.2.4,
the critical section for Shear Force is at a distance equal to the Half the Effective Depth of the Footing, from the Face of the Column.

Length of Footing at Critical Section	=	0.682	m.
Width of Footing at Critical Section	=	0.462	m.
Ratio of Width to Length at Critical Section	=	0.677	
Modified Depth of Footing at the Face of Wall	=	300	mm.
Modified Depth of Footing at the End	=	150	mm.
Depth of Footing at Critical Section	=	232	mm.
Design Shear Force	=	46.301	KN.
As Per IS:456-2000, Clause 31.6.2.1, Actual Shear Stress	=	0.087	N/sq.mm.
As Per IS:456-2000, Clause 31.6.3.1, Coefficient, ks	=	1	
Max. Permissible Shear Stress	=	1.118	N/sq.mm.

The section is SAFE in Shear.

F08 : Global Input Data (LC No. : 4)

The footing is to be designed as an Isolated Footing.

Width of Column	=	230	mm.
Length of Column	=	450	mm.
Footing Shape	=	Rectangular	

Initial Depth at the Face of Wall/Column	=	300	mm.
Initial Depth at the End	=	150	mm.

The footing is subjected to Axial Load & Biaxial Bending.

Working Axial Load	=	108.073	KN.
Working Moment about ZZ-axis	=	0.693	KN m.
Working Moment about XX-axis	=	0.094	KN m.
Safe Bearing Capacity of Soil	=	150	KN/sq.m.
Factor of Safety for Safe Bearing Capacity	=	1.5	

F08 : Flexure Output (LC No. : 4)

Working Axial Load on Footing	=	108.073	KN.
Factored Axial Load on Footing	=	108.073	KN.
Percentage Factor for Self Weight of Footing	=	5	%
Factored Self Weight of Footing	=	5.404	KN.
Total Factored Axial Load on Footing	=	113.477	KN.
Working Moment about ZZ-axis	=	0.693	KN m.
Factored Moment about ZZ-axis	=	0.693	KN m.
Working Moment about XX-axis	=	0.094	KN m.
Factored Moment about XX-axis	=	0.094	KN m.
Ultimate Bearing Capacity of Soil	=	225	KN/sq.m.
From Vertical Load and Bending considerations, Area of Footing Required	=	0.53	sq.m.
Equal Projections were initially assumed from the Column Faces to arrive at the Footing Size.			
Width of Footing Required	=	0.626	m.
Length of Footing Required	=	0.846	m.
Width of Footing Provided	=	0.65	m.
Length of Footing Provided	=	0.85	m.
Actual Bearing Area Provided	=	0.553	sq.m.
Max. Bearing Pressure at the Base	=	215.811	KN/sq.m.
Min. Bearing Pressure at the Base	=	194.964	KN/sq.m.

Bending about ZZ-axis:-

Load Eccentricity lies within the limit causing total Compression.
Hence, the Footing Base about ZZ-axis will be in touch with the Soil.

Net Bearing Pressure at the Base - Right End	=	206.031	KN/sq.m.
Net Bearing Pressure at the Base - Left End	=	188.324	KN/sq.m.

Net Bearing Pressure at the Column Face	=	201.865	KN/sq.m.
Net Bearing Pressure - 'd' from Face	=	206.031	KN/sq.m.

As Per IS:456-2000, Clause 34.2.3,
the critical section for Bending Moment is at the Face of the Column.

Projection of Footing from Critical Section	=	200	mm.
Design Bending Moment	=	2.66	KN m.
Modified Depth of Footing at the Face of Wall	=	300	mm.
Modified Depth of Footing at the End	=	150	mm.
Effective Depth Required	=	56.076	mm.
Effective Depth Provided	=	244	mm.

Hence SAFE.

Percentage of Steel Required	=	0.019	%
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As Per IS:456-2000, Clause 26.5.2.1,
the required percentage of Steel is less than the Minimum to be provided. Hence, Minimum Steel is provided.

Percentage of Main Steel Provided	=	0.12	%
Area of Steel Provided	=	190.32	sq.mm.
Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	268.237	mm.
Max. Spacing allowed (Rounded off)	=	250	mm.
Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	386.261	mm.
Max. Spacing allowed (Rounded off)	=	250	mm.

Bending about XX-axis:-

Load Eccentricity lies within the limit causing total Compression.
Hence, the Footing Base about XX-axis will be in touch with the Soil.

Net Bearing Pressure at the Base - Right End	=	206.031	KN/sq.m.
Net Bearing Pressure at the Base - Left End	=	202.89	KN/sq.m.
Net Bearing Pressure at the Column Face	=	205.016	KN/sq.m.
Net Bearing Pressure - 'd' from Face	=	206.031	KN/sq.m.

As Per IS:456-2000, Clause 34.2.3,
the critical section for Bending Moment is at the Face of the Column.

Projection of Footing from Critical Section	=	210	mm.
Design Bending Moment	=	3.855	KN m.

Modified Depth of Footing at the Face of Wall	=	300	mm.
Modified Depth of Footing at the End	=	150	mm.

Effective Depth Required	=	51.679	mm.
Effective Depth Provided	=	232	mm.

Hence SAFE.

Percentage of Steel Required	=	0.023	%
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As Per IS:456-2000, Clause 26.5.2.1,
the required percentage of Steel is less than the Minimum to be provided. Hence, Minimum Steel is provided.

Percentage of Main Steel Provided	=	0.12	%
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Area of Steel Provided	=	236.64	sq.mm.
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Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	282.111	mm.
Max. Spacing allowed (Rounded off)	=	250	mm.

Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	406.24	mm.
Max. Spacing allowed (Rounded off)	=	250	mm.

Note (1):- The required Spacing of Main Rods will be compared with 300 mm. or 3d (450 mm. or 5d for Dist. Rods) whichever is less. If the required spacing exceeds this limit, the least value will be automatically provided. This is done in accordance with IS:456-2000 Clause 26.3.3.

Note (2):- The required minimum area of reinforcement will be also as per IS:456-2000, Clause 34.5.2, if the Footing Thickness exceeds 1000 mm. This minimum area is 360.0 sq.mm. for each side or face.

Note (3):- The assumed Depth of Footing will be automatically modified so that a SAFE design is arrived at from both flexure as well as Shear considerations.

Note (4):- Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

F08 : Dowel Bars Output (LC No. : 4)

Factored Axial Load on Column	=	108.073	KN.
Char. Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Pedestal Steel	=	415	N/sq.mm.
Width of Column Section	=	230	mm.
Depth of Column Section	=	450	mm.
Area of Column Section	=	103500	sq.mm.
Width of Footing	=	0.65	m.

Length of Footing	=	0.85	m.
Area of Footing	=	0.553	sq.m.
As Per IS:456-2000, Clause 34.4, Basic Permissible Bearing Stress	=	9	N/sq.mm.
Max. Bearing Stress based on Area Ratio	=	18	N/sq.mm.
Actual Bearing Stress	=	1.044	N/sq.mm.

As Per IS:456-2000, Clause 34.4.3,
Reinforcement is NOT required. However, Minimum Steel is Provided.

Percentage of Steel Required	=	0.5	%
Area of Steel Provided	=	517.5	sq.mm.
Dowel Rod Size-1	=	12	mm.
No. of Rods to be Provided	=	5	Nos.
Corresponding Steel Area	=	565.487	sq.mm.
Dowel Rod Size-2	=	16	mm.
No. of Rods to be Provided	=	3	Nos.
Corresponding Steel Area	=	603.186	sq.mm.

*Note :- Calculation for Dowel Rods is only optionally provided.
However, Dowel Rods may not be required in all cases.*

F08 : One Way Shear Output (LC No. : 4)

As Per IS:456-2000, Clause 34.2.4,
the critical section for Shear Force is at a distance equal to the Effective Depth of the Footing, from the Face of the Column.

Design Shear Force about Length	=	0	KN.
Modified Depth of Footing at the Face of Wall	=	300	mm.
Modified Depth of Footing at the End	=	150	mm.
Depth of Footing at Critical Section	=	244	mm.
Projection of Footing from Critical Section	=	0	mm.
As Per IS:456-2000, Clause 40.1, Actual Shear Stress	=	0	N/sq.mm.

As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.269	N/sq.mm.
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As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.
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The section is SAFE in Shear, about ZZ-axis.

Design Shear Force about Width	=	0	KN.
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Depth of Footing at Critical Section	=	232	mm.
Projection of Footing from Critical Section	=	0	mm.
As Per IS:456-2000, Clause 40.1, Actual Shear Stress	=	0	N/sq.mm.
As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.275	N/sq.mm.
As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.

The section is SAFE in Shear, about XX-axis.

F08 : Punching Shear Output (LC No. : 4)

As Per IS:456-2000, Clause 34.2.4,
the critical section for Shear Force is at a distance equal to the Half the Effective Depth of the Footing, from the Face of the Column.

Length of Footing at Critical Section	=	0.682	m.
Width of Footing at Critical Section	=	0.462	m.
Ratio of Width to Length at Critical Section	=	0.677	
Modified Depth of Footing at the Face of Wall	=	300	mm.
Modified Depth of Footing at the End	=	150	mm.
Depth of Footing at Critical Section	=	232	mm.
Design Shear Force	=	43.727	KN.
As Per IS:456-2000, Clause 31.6.2.1, Actual Shear Stress	=	0.082	N/sq.mm.
As Per IS:456-2000, Clause 31.6.3.1, Coefficient, k_s	=	1	
Max. Permissible Shear Stress	=	1.118	N/sq.mm.

The section is SAFE in Shear.

F08 : Global Input Data (LC No. : 5)

The footing is to be designed as an Isolated Footing.

Width of Column	=	230	mm.
Length of Column	=	450	mm.
Footing Shape	=	Rectangular	
Initial Depth at the Face of Wall/Column	=	300	mm.
Initial Depth at the End	=	150	mm.

The footing is subjected to Axial Load & Biaxial Bending.

Working Axial Load	=	653.648	KN.
Working Moment about ZZ-axis	=	20.087	KN m.
Working Moment about XX-axis	=	0.476	KN m.
Safe Bearing Capacity of Soil	=	150	KN/sq.m.
Factor of Safety for Safe Bearing Capacity	=	1.5	

F08 : Flexure Output (LC No. : 5)

Working Axial Load on Footing	=	653.648	KN.
Factored Axial Load on Footing	=	653.648	KN.
Percentage Factor for Self Weight of Footing	=	5	%
Factored Self Weight of Footing	=	32.682	KN.
Total Factored Axial Load on Footing	=	686.33	KN.
Working Moment about ZZ-axis	=	20.087	KN m.
Factored Moment about ZZ-axis	=	20.087	KN m.
Working Moment about XX-axis	=	0.476	KN m.
Factored Moment about XX-axis	=	0.476	KN m.
Ultimate Bearing Capacity of Soil	=	225	KN/sq.m.
From Vertical Load and Bending considerations, Area of Footing Required	=	3.334	sq.m.
Equal Projections were initially assumed from the Column Faces to arrive at the Footing Size.			
Width of Footing Required	=	1.719	m.
Length of Footing Required	=	1.939	m.
Width of Footing Provided	=	1.725	m.
Length of Footing Provided	=	1.95	m.
Actual Bearing Area Provided	=	3.364	sq.m.
Max. Bearing Pressure at the Base	=	222.904	KN/sq.m.
Min. Bearing Pressure at the Base	=	185.171	KN/sq.m.

Bending about ZZ-axis:-

Load Eccentricity lies within the limit causing total Compression.
Hence, the Footing Base about ZZ-axis will be in touch with the Soil.

Net Bearing Pressure at the Base - Right End	=	213.188	KN/sq.m.
Net Bearing Pressure at the Base - Left End	=	176.439	KN/sq.m.
Net Bearing Pressure at the Column Face	=	199.054	KN/sq.m.
Net Bearing Pressure - 'd' from Face	=	206.479	KN/sq.m.

As Per IS:456-2000, Clause 34.2.3,
the critical section for Bending Moment is at the Face
of the Column.

Projection of Footing from Critical Section	=	750	mm.
Design Bending Moment	=	101.144	KN m.
Modified Depth of Footing at the Face of Wall	=	450	mm.
Modified Depth of Footing at the End	=	300	mm.
Effective Depth Required	=	270.167	mm.
Effective Depth Provided	=	394	mm.

Hence SAFE.

Percentage of Steel Required	=	0.107	%
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As Per IS:456-2000, Clause 26.5.2.1,
the required percentage of Steel is less than the Minimum
to be provided. Hence, Minimum Steel is provided.

Percentage of Main Steel Provided	=	0.12	%
Area of Steel Provided	=	815.58	sq.mm.
Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	166.116	mm.
Max. Spacing allowed (Rounded off)	=	150	mm.
Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	239.208	mm.
Max. Spacing allowed (Rounded off)	=	225	mm.

Bending about XX-axis:-

Load Eccentricity lies within the limit causing total Compression.
Hence, the Footing Base about XX-axis will be in touch with the Soil.

Net Bearing Pressure at the Base - Right End	=	213.188	KN/sq.m.
Net Bearing Pressure at the Base - Left End	=	212.203	KN/sq.m.
Net Bearing Pressure at the Column Face	=	212.761	KN/sq.m.
Net Bearing Pressure - 'd' from Face	=	212.986	KN/sq.m.

As Per IS:456-2000, Clause 34.2.3,
the critical section for Bending Moment is at the Face
of the Column.

Projection of Footing from Critical Section	=	747.5	mm.
Design Bending Moment	=	116.065	KN m.
Modified Depth of Footing at the Face of Wall	=	450	mm.
Modified Depth of Footing at the End	=	300	mm.

Effective Depth Required	=	241.154	mm.
Effective Depth Provided	=	382	mm.

Hence SAFE.

Percentage of Steel Required	=	0.116	%
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As Per IS:456-2000, Clause 26.5.2.1,
the required percentage of Steel is less than the Minimum to be provided. Hence, Minimum Steel is provided.

Percentage of Main Steel Provided	=	0.12	%
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Area of Steel Provided	=	893.88	sq.mm.
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Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	171.335	mm.
Max. Spacing allowed (Rounded off)	=	175	mm.

Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	246.722	mm.
Max. Spacing allowed (Rounded off)	=	250	mm.

Note (1):- The required Spacing of Main Rods will be compared with 300 mm. or 3d (450 mm. or 5d for Dist. Rods) whichever is less. If the required spacing exceeds this limit, the least value will be automatically provided. This is done in accordance with IS:456-2000 Clause 26.3.3.

Note (2):- The required minimum area of reinforcement will be also as per IS:456-2000, Clause 34.5.2, if the Footing Thickness exceeds 1000 mm. This minimum area is 360.0 sq.mm. for each side or face.

Note (3):- The assumed Depth of Footing will be automatically modified so that a SAFE design is arrived at from both flexure as well as Shear considerations.

Note (4):- Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

F08 : Dowel Bars Output (LC No. : 5)

Factored Axial Load on Column	=	653.648	KN.
Char. Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Pedestal Steel	=	415	N/sq.mm.
Width of Column Section	=	230	mm.
Depth of Column Section	=	450	mm.
Area of Column Section	=	103500	sq.mm.
Width of Footing	=	1.725	m.
Length of Footing	=	1.95	m.
Area of Footing	=	3.364	sq.m.

As Per IS:456-2000, Clause 34.4,

Basic Permissible Bearing Stress	=	9	N/sq.mm.
Max. Bearing Stress based on Area Ratio	=	18	N/sq.mm.
Actual Bearing Stress	=	6.315	N/sq.mm.

As Per IS:456-2000, Clause 34.4.3,

Reinforcement is NOT required. However, Minimum Steel is Provided.

Percentage of Steel Required	=	0.5	%
Area of Steel Provided	=	517.5	sq.mm.
Dowel Rod Size-1	=	12	mm.
No. of Rods to be Provided	=	5	Nos.
Corresponding Steel Area	=	565.487	sq.mm.
Dowel Rod Size-2	=	16	mm.
No. of Rods to be Provided	=	3	Nos.
Corresponding Steel Area	=	603.186	sq.mm.

*Note :- Calculation for Dowel Rods is only optionally provided.
However, Dowel Rods may not be required in all cases.*

F08 : One Way Shear Output (LC No. : 5)**As Per IS:456-2000, Clause 34.2.4,**

the critical section for Shear Force is at a distance equal to the Effective Depth of the Footing, from the Face of the Column.

Design Shear Force about Length	=	128.859	KN.
Modified Depth of Footing at the Face of Wall	=	450	mm.
Modified Depth of Footing at the End	=	300	mm.
Depth of Footing at Critical Section	=	315.2	mm.
Projection of Footing from Critical Section	=	356	mm.

As Per IS:456-2000, Clause 40.1,

Actual Shear Stress	=	0.237	N/sq.mm.
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As Per IS:456-2000, Table 19,

Design Shear Strength of Concrete	=	0.272	N/sq.mm.
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As Per IS:456-2000, Table 20,

Max. Permissible Shear Stress	=	2.794	N/sq.mm.
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The section is SAFE in Shear, about ZZ-axis.

Design Shear Force about Width	=	146.886	KN.
Depth of Footing at Critical Section	=	302.936	mm.
Projection of Footing from Critical Section	=	353.5	mm.

As Per IS:456-2000, Clause 40.1, Actual Shear Stress	=	0.249	N/sq.mm.
As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.258	N/sq.mm.
As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.

The section is SAFE in Shear, about XX-axis.

F08 : Punching Shear Output (LC No. : 5)

As Per IS:456-2000, Clause 34.2.4,
the critical section for Shear Force is at a distance equal to the Half the Effective Depth of the Footing, from the Face of the Column.

Length of Footing at Critical Section	=	0.832	m.
Width of Footing at Critical Section	=	0.612	m.
Ratio of Width to Length at Critical Section	=	0.736	
Modified Depth of Footing at the Face of Wall	=	450	mm.
Modified Depth of Footing at the End	=	300	mm.
Depth of Footing at Critical Section	=	348.6	mm.
Design Shear Force	=	551.307	KN.

As Per IS:456-2000, Clause 31.6.2.1, Actual Shear Stress	=	0.548	N/sq.mm.
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As Per IS:456-2000, Clause 31.6.3.1, Coefficient, ks	=	1	
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Max. Permissible Shear Stress	=	1.118	N/sq.mm.
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The section is SAFE in Shear.

F08 : Global Input Data (LC No. : 6)

The footing is to be designed as an Isolated Footing.

Width of Column	=	230	mm.
Length of Column	=	450	mm.
Footing Shape	=	Rectangular	
Initial Depth at the Face of Wall/Column	=	300	mm.
Initial Depth at the End	=	150	mm.

The footing is subjected to Axial Load & Biaxial Bending.

Working Axial Load	=	815.757	KN.
Working Moment about ZZ-axis	=	19.048	KN m.

Working Moment about XX-axis	=	0.335	KN m.
Safe Bearing Capacity of Soil	=	150	KN/sq.m.
Factor of Safety for Safe Bearing Capacity	=	1.5	

F08 : Flexure Output (LC No. : 6)

Working Axial Load on Footing	=	815.757	KN.
Factored Axial Load on Footing	=	815.757	KN.
Percentage Factor for Self Weight of Footing	=	5	%
Factored Self Weight of Footing	=	40.788	KN.
Total Factored Axial Load on Footing	=	856.545	KN.
Working Moment about ZZ-axis	=	19.048	KN m.
Factored Moment about ZZ-axis	=	19.048	KN m.
Working Moment about XX-axis	=	0.335	KN m.
Factored Moment about XX-axis	=	0.335	KN m.
Ultimate Bearing Capacity of Soil	=	225	KN/sq.m.
From Vertical Load and Bending considerations, Area of Footing Required	=	4.051	sq.m.
Equal Projections were initially assumed from the Column Faces to arrive at the Footing Size.			
Width of Footing Required	=	1.906	m.
Length of Footing Required	=	2.126	m.
Width of Footing Provided	=	1.925	m.
Length of Footing Provided	=	2.15	m.
Actual Bearing Area Provided	=	4.139	sq.m.
Max. Bearing Pressure at the Base	=	220.053	KN/sq.m.
Min. Bearing Pressure at the Base	=	193.862	KN/sq.m.

Bending about ZZ-axis:-

Load Eccentricity lies within the limit causing total Compression.
Hence, the Footing Base about ZZ-axis will be in touch with the Soil.

Net Bearing Pressure at the Base - Right End	=	210.198	KN/sq.m.
Net Bearing Pressure at the Base - Left End	=	184.511	KN/sq.m.
Net Bearing Pressure at the Column Face	=	200.043	KN/sq.m.
Net Bearing Pressure - 'd' from Face	=	205.109	KN/sq.m.

As Per IS:456-2000, Clause 34.2.3,
the critical section for Bending Moment is at the Face of the Column.

Projection of Footing from Critical Section	=	850	mm.
Design Bending Moment	=	143.819	KN m.
Modified Depth of Footing at the Face of Wall	=	480	mm.
Modified Depth of Footing at the End	=	330	mm.
Effective Depth Required	=	311.087	mm.
Effective Depth Provided	=	424	mm.

Hence SAFE.

Percentage of Steel Required	=	0.118	%
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As Per IS:456-2000, Clause 26.5.2.1,
the required percentage of Steel is less than the Minimum to be provided. Hence, Minimum Steel is provided.

Percentage of Main Steel Provided	=	0.12	%
Area of Steel Provided	=	979.44	sq.mm.
Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	154.363	mm.
Max. Spacing allowed (Rounded off)	=	150	mm.
Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	222.282	mm.
Max. Spacing allowed (Rounded off)	=	225	mm.

Bending about XX-axis:-

Load Eccentricity lies within the limit causing total Compression.
Hence, the Footing Base about XX-axis will be in touch with the Soil.

Net Bearing Pressure at the Base - Right End	=	210.198	KN/sq.m.
Net Bearing Pressure at the Base - Left End	=	209.694	KN/sq.m.
Net Bearing Pressure at the Column Face	=	209.976	KN/sq.m.
Net Bearing Pressure - 'd' from Face	=	210.087	KN/sq.m.

As Per IS:456-2000, Clause 34.2.3,
the critical section for Bending Moment is at the Face of the Column.

Projection of Footing from Critical Section	=	847.5	mm.
Design Bending Moment	=	162.242	KN m.
Modified Depth of Footing at the Face of Wall	=	480	mm.
Modified Depth of Footing at the End	=	330	mm.
Effective Depth Required	=	278.207	mm.
Effective Depth Provided	=	412	mm.

Hence SAFE.

Percentage of Steel Required	=	0.127	%
Area of Steel Provided	=	1120.649	sq.mm.
As Per IS:456-2000, Clause 34.3.1,			
Area of Steel in Central Band	=	1058.773	sq.mm.
Width of Central Band	=	1.925	m.
Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	142.797	mm.
Max. Spacing allowed (Rounded off)	=	125	mm.
Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	205.627	mm.
Max. Spacing allowed (Rounded off)	=	200	mm.
Area of Steel at Each End Band	=	30.938	sq.mm.
Width of Each End Band	=	112.5	mm.
Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	285.593	mm.
Max. Spacing allowed (Rounded off)	=	250	mm.
Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	411.254	mm.
Max. Spacing allowed (Rounded off)	=	250	mm.

Note (1):- The required Spacing of Main Rods will be compared with 300 mm. or 3d (450 mm. or 5d for Dist. Rods) whichever is less. If the required spacing exceeds this limit, the least value will be automatically provided. This is done in accordance with IS:456-2000 Clause 26.3.3.

Note (2):- The required minimum area of reinforcement will be also as per IS:456-2000, Clause 34.5.2, if the Footing Thickness exceeds 1000 mm. This minimum area is 360.0 sq.mm. for each side or face.

Note (3):- The assumed Depth of Footing will be automatically modified so that a SAFE design is arrived at from both flexure as well as Shear considerations.

Note (4):- Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

F08 : Dowel Bars Output (LC No. : 6)

Factored Axial Load on Column	=	815.757	KN.
Char. Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Pedestal Steel	=	415	N/sq.mm.
Width of Column Section	=	230	mm.
Depth of Column Section	=	450	mm.
Area of Column Section	=	103500	sq.mm.

Width of Footing	=	1.925	m.
Length of Footing	=	2.15	m.
Area of Footing	=	4.139	sq.m.
As Per IS:456-2000, Clause 34.4,			
Basic Permissible Bearing Stress	=	9	N/sq.mm.
Max. Bearing Stress based on Area Ratio	=	18	N/sq.mm.
Actual Bearing Stress	=	7.882	N/sq.mm.
As Per IS:456-2000, Clause 34.4.3,			
Reinforcement is NOT required. However, Minimum Steel is Provided.			
Percentage of Steel Required	=	0.5	%
Area of Steel Provided	=	517.5	sq.mm.
Dowel Rod Size-1	=	12	mm.
No. of Rods to be Provided	=	5	Nos.
Corresponding Steel Area	=	565.487	sq.mm.
Dowel Rod Size-2	=	16	mm.
No. of Rods to be Provided	=	3	Nos.
Corresponding Steel Area	=	603.186	sq.mm.

*Note :- Calculation for Dowel Rods is only optionally provided.
However, Dowel Rods may not be required in all cases.*

F08 : One Way Shear Output (LC No. : 6)

As Per IS:456-2000, Clause 34.2.4,			
the critical section for Shear Force is at a distance equal to the Effective Depth of the Footing, from the Face of the Column.			
Design Shear Force about Length	=	170.286	KN.
Modified Depth of Footing at the Face of Wall	=	480	mm.
Modified Depth of Footing at the End	=	330	mm.
Depth of Footing at Critical Section	=	349.176	mm.
Projection of Footing from Critical Section	=	426	mm.
As Per IS:456-2000, Clause 40.1,			
Actual Shear Stress	=	0.253	N/sq.mm.
As Per IS:456-2000, Table 19,			
Design Shear Strength of Concrete	=	0.264	N/sq.mm.
As Per IS:456-2000, Table 20,			
Max. Permissible Shear Stress	=	2.794	N/sq.mm.
The section is SAFE in Shear, about ZZ-axis.			
Design Shear Force about Width	=	191.34	KN.

Depth of Footing at Critical Section	=	336.956	mm.
Projection of Footing from Critical Section	=	423.5	mm.
As Per IS:456-2000, Clause 40.1, Actual Shear Stress	=	0.264	N/sq.mm.
As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.267	N/sq.mm.
As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.

The section is SAFE in Shear, about XX-axis.

F08 : Punching Shear Output (LC No. : 6)

As Per IS:456-2000, Clause 34.2.4,
the critical section for Shear Force is at a distance equal to the Half the Effective Depth of the Footing, from the Face of the Column.

Length of Footing at Critical Section	=	0.862	m.
Width of Footing at Critical Section	=	0.642	m.
Ratio of Width to Length at Critical Section	=	0.745	
Modified Depth of Footing at the Face of Wall	=	480	mm.
Modified Depth of Footing at the End	=	330	mm.
Depth of Footing at Critical Section	=	380.588	mm.
Design Shear Force	=	703.094	KN.
As Per IS:456-2000, Clause 31.6.2.1, Actual Shear Stress	=	0.614	N/sq.mm.
As Per IS:456-2000, Clause 31.6.3.1, Coefficient, ks	=	1	
Max. Permissible Shear Stress	=	1.118	N/sq.mm.

The section is SAFE in Shear.

F11 : Global Input Data (LC No. : 1)

The footing is to be designed as an Isolated Footing.

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

A Pedestal is provided at the Base of the Column.

Pedestal Projection from Column face = 150 mm.

Footing Shape = Rectangular

Initial Depth at the Face of Wall/Column = 450 mm.

Initial Depth at the End = 250 mm.

The footing is subjected to Axial Load & Biaxial Bending.

Working Axial Load = 98.908 KN.

Working Moment about ZZ-axis = 2.167 KN m.

Working Moment about XX-axis = 0.05 KN m.

Safe Bearing Capacity of Soil = 150 KN/sq.m.

Factor of Safety for Safe Bearing Capacity = 1.5

F11 : Flexure Output (LC No. : 1)

Working Axial Load on Footing = 98.908 KN.

Factored Axial Load on Footing = 98.908 KN.

Percentage Factor for Self Weight of Footing = 5 %

Factored Self Weight of Footing = 4.945 KN.

Total Factored Axial Load on Footing = 103.854 KN.

Working Moment about ZZ-axis = 2.167 KN m.

Factored Moment about ZZ-axis = 2.167 KN m.

Working Moment about XX-axis = 0.05 KN m.

Factored Moment about XX-axis = 0.05 KN m.

Ultimate Bearing Capacity of Soil = 225 KN/sq.m.

From Vertical Load and Bending considerations,
Area of Footing Required = 0.872 sq.m.

Equal Projections were initially assumed from the Column Faces
to arrive at the Footing Size.

Width of Footing Required = 0.83 m.

Length of Footing Required = 1.05 m.

Width of Footing Provided = 0.85 m.

Length of Footing Provided	=	1.05	m.
Actual Bearing Area Provided	=	0.893	sq.m.
Max. Bearing Pressure at the Base	=	130.634	KN/sq.m.
Min. Bearing Pressure at the Base	=	102.092	KN/sq.m.

Bending about ZZ-axis:-

Load Eccentricity lies within the limit causing total Compression.
Hence, the Footing Base about ZZ-axis will be in touch with the Soil.

Net Bearing Pressure at the Base - Right End	=	125.093	KN/sq.m.
Net Bearing Pressure at the Base - Left End	=	97.344	KN/sq.m.
Net Bearing Pressure at the Column Face	=	117.164	KN/sq.m.
Net Bearing Pressure at the Pedestal Face	=	121.128	KN/sq.m.
Net Bearing Pressure - 'd' from Face	=	125.093	KN/sq.m.

As Per IS:456-2000, Clause 34.2.3,
the critical section for Bending Moment is at the Face of the Column.

Projection of Footing from Critical Section	=	300	mm.
Design Bending Moment	=	4.684	KN m.
Modified Depth of Footing at the Face of Wall	=	450	mm.
Modified Depth of Footing at the End	=	250	mm.
Effective Depth Required	=	26.994	mm.
Effective Depth Provided	=	394	mm.

Hence SAFE.

Percentage of Steel Required	=	0.002	%
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As Per IS:456-2000, Clause 26.5.2.1,
the required percentage of Steel is less than the Minimum to be provided. Hence, Minimum Steel is provided.

Percentage of Main Steel Provided	=	0.12	%
Area of Steel Provided	=	401.88	sq.mm.
Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	166.116	mm.
Max. Spacing allowed (Rounded off)	=	150	mm.
Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	239.208	mm.
Max. Spacing allowed (Rounded off)	=	225	mm.

Bending about XX-axis:-

Load Eccentricity lies within the limit causing total Compression.

Hence, the Footing Base about XX-axis will be in touch with the Soil.

Net Bearing Pressure at the Base - Right End	=	125.093	KN/sq.m.
Net Bearing Pressure at the Base - Left End	=	124.3	KN/sq.m.
Net Bearing Pressure at the Column Face	=	124.803	KN/sq.m.
Net Bearing Pressure at the Pedestal Face	=	124.943	KN/sq.m.
Net Bearing Pressure - 'd' from Face	=	125.093	KN/sq.m.

As Per IS:456-2000, Clause 34.2.3,
the critical section for Bending Moment is at the Face of the Column.

Projection of Footing from Critical Section	=	310	mm.
Design Bending Moment	=	6.306	KN m.
Modified Depth of Footing at the Face of Wall	=	450	mm.
Modified Depth of Footing at the End	=	250	mm.
Effective Depth Required	=	27.503	mm.
Effective Depth Provided	=	382	mm.

Hence SAFE.

Percentage of Steel Required	=	0.003	%
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As Per IS:456-2000, Clause 26.5.2.1,
the required percentage of Steel is less than the Minimum to be provided. Hence, Minimum Steel is provided.

Percentage of Main Steel Provided	=	0.12	%
Area of Steel Provided	=	481.32	sq.mm.
Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	171.335	mm.
Max. Spacing allowed (Rounded off)	=	175	mm.
Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	246.722	mm.
Max. Spacing allowed (Rounded off)	=	250	mm.

Note (1):- The required Spacing of Main Rods will be compared with 300 mm. or 3d (450 mm. or 5d for Dist. Rods) whichever is less. If the required spacing exceeds this limit, the least value will be automatically provided. This is done in accordance with IS:456-2000 Clause 26.3.3.

Note (2):- The required minimum area of reinforcement will be also as per IS:456-2000, Clause 34.5.2, if the Footing Thickness exceeds 1000 mm. This minimum area is 360.0 sq.mm. for each side or face.

Note (3):- The assumed Depth of Footing will be automatically modified so that a SAFE design is arrived at from both flexure as well as Shear considerations.

Note (4):- Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

F11 : Dowel Bars Output (LC No. : 1)

Factored Axial Load on Column	=	98.908	KN.
Char. Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Pedestal Steel	=	415	N/sq.mm.
Width of Pedestal Section	=	530	mm.
Depth of Pedestal Section	=	750	mm.
Area of Pedestal Section	=	397500	sq.mm.
Width of Footing	=	0.85	m.
Length of Footing	=	1.05	m.
Area of Footing	=	0.893	sq.m.
As Per IS:456-2000, Clause 34.4,			
Basic Permissible Bearing Stress	=	9	N/sq.mm.
Max. Bearing Stress based on Area Ratio	=	13.486	N/sq.mm.
Actual Bearing Stress	=	0.249	N/sq.mm.
As Per IS:456-2000, Clause 34.4.3,			
Reinforcement is NOT required. However, Minimum Steel is Provided.			
Percentage of Steel Required	=	0.5	%
Area of Steel Provided	=	1987.5	sq.mm.
Dowel Rod Size-1	=	12	mm.
No. of Rods to be Provided	=	18	Nos.
Corresponding Steel Area	=	2035.752	sq.mm.
Dowel Rod Size-2	=	16	mm.
No. of Rods to be Provided	=	10	Nos.
Corresponding Steel Area	=	2010.619	sq.mm.

Note :- Calculation for Dowel Rods is only optionally provided.
However, Dowel Rods may not be required in all cases.

F11 : Pedestal Output (LC No. : 1)

Factored Axial Load on Pedestal	=	98.908	KN.
Char. Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Pedestal Steel	=	415	N/sq.mm.
Pedestal Projection from Column Face	=	150	mm.
Width of Column Section	=	230	mm.
Depth of Column Section	=	450	mm.

Width of Pedestal Section	=	530	mm.
Depth of Pedestal Section	=	750	mm.
Area of Column Section	=	103500	sq.mm.
Area of Pedestal Section	=	397500	sq.mm.
As Per IS:456-2000, Clause 34.4,			
Basic Permissible Bearing Stress	=	9	N/sq.mm.
Max. Bearing Stress based on Area Ratio	=	17.638	N/sq.mm.
Actual Bearing Stress	=	0.249	N/sq.mm.
Reinforcement is NOT required. However, Minimum Steel is Provided.			
Percentage of Steel Required	=	0.4	%
Area of Steel Provided	=	1590	sq.mm.
Pedestal Rod Size-1	=	12	mm.
No. of such Rods to be provided	=	14	Nos.
Corresponding Steel Area	=	1583.363	sq.mm.
Pedestal Rod Size-2	=	16	mm.
No. of such Rods to be provided	=	8	Nos.
Corresponding Steel Area	=	1608.495	sq.mm.
Projection of Footing from Pedestal Face - ZZ	=	150	mm.
Bending Moment at Pedestal Face - ZZ	=	1.184	KN m.
Corresponding Effective Depth Required	=	23.08	mm.
Projection of Footing from Pedestal Face - XX	=	160	mm.
Bending Moment at Pedestal Face - XX	=	1.681	KN m.
Corresponding Effective Depth Required	=	32.166	mm.
Maximum of the above Two Eff. Depths	=	32.166	mm.
Eff. Depth of Footing Provided at Column Face	=	394	mm.
Max. Depth of Pedestal	=	361.834	mm.
Max. Depth of Pedestal Allowed (Rounded Off)	=	200	mm.

F11 : One Way Shear Output (LC No. : 1)

As Per IS:456-2000, Clause 34.2.4,

the critical section for Shear Force is at a distance equal to the Effective Depth of the Footing, from the Face of the Column.

Design Shear Force about Length	=	0	KN.
Modified Depth of Footing at the Face of Wall	=	450	mm.
Modified Depth of Footing at the End	=	250	mm.
Depth of Footing at Critical Section	=	394	mm.

Projection of Footing from Critical Section	=	0	mm.
As Per IS:456-2000, Clause 40.1, Actual Shear Stress	=	0	N/sq.mm.
As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.272	N/sq.mm.
As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.

The section is SAFE in Shear, about ZZ-axis.

Design Shear Force about Width	=	0	KN.
Depth of Footing at Critical Section	=	382	mm.
Projection of Footing from Critical Section	=	0	mm.
As Per IS:456-2000, Clause 40.1, Actual Shear Stress	=	0	N/sq.mm.
As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.258	N/sq.mm.
As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.

The section is SAFE in Shear, about XX-axis.

F11 : Punching Shear Output (LC No. : 1)

As Per IS:456-2000, Clause 34.2.4,
the critical section for Shear Force is at a distance equal to the Half the Effective Depth of the Footing, from the Face of the Column.

Length of Footing at Critical Section	=	0.832	m.
Width of Footing at Critical Section	=	0.612	m.
Ratio of Width to Length at Critical Section	=	0.736	
Modified Depth of Footing at the Face of Wall	=	450	mm.
Modified Depth of Footing at the End	=	250	mm.
Depth of Footing at Critical Section	=	382	mm.
Design Shear Force	=	40.543	KN.
As Per IS:456-2000, Clause 31.6.2.1, Actual Shear Stress	=	0.037	N/sq.mm.
As Per IS:456-2000, Clause 31.6.3.1, Coefficient, ks	=	1	
Max. Permissible Shear Stress	=	1.118	N/sq.mm.

The section is SAFE in Shear.

F11 : Global Input Data (LC No. : 2)

The footing is to be designed as an Isolated Footing.

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

A Pedestal is provided at the Base of the Column.

Pedestal Projection from Column face = 150 mm.

Footing Shape = Rectangular

Initial Depth at the Face of Wall/Column = 450 mm.
Initial Depth at the End = 250 mm.

The footing is subjected to Axial Load & Biaxial Bending.

Working Axial Load = 352.405 KN.

Working Moment about ZZ-axis = 8.754 KN m.

Working Moment about XX-axis = 0.378 KN m.

Safe Bearing Capacity of Soil = 150 KN/sq.m.
Factor of Safety for Safe Bearing Capacity = 1.5

F11 : Flexure Output (LC No. : 2)

Working Axial Load on Footing = 352.405 KN.
Factored Axial Load on Footing = 352.405 KN.

Percentage Factor for Self Weight of Footing = 5 %
Factored Self Weight of Footing = 17.62 KN.

Total Factored Axial Load on Footing = 370.026 KN.

Working Moment about ZZ-axis = 8.754 KN m.
Factored Moment about ZZ-axis = 8.754 KN m.

Working Moment about XX-axis = 0.378 KN m.
Factored Moment about XX-axis = 0.378 KN m.

Ultimate Bearing Capacity of Soil = 225 KN/sq.m.

From Vertical Load and Bending considerations,
Area of Footing Required = 1.813 sq.m.

Equal Projections were initially assumed from the Column Faces
to arrive at the Footing Size.

Width of Footing Required = 1.241 m.
Length of Footing Required = 1.461 m.

Width of Footing Provided = 1.25 m.

Length of Footing Provided	=	1.475	m.
Actual Bearing Area Provided	=	1.844	sq.m.
Max. Bearing Pressure at the Base	=	220.99	KN/sq.m.
Min. Bearing Pressure at the Base	=	180.394	KN/sq.m.

Bending about ZZ-axis:-

Load Eccentricity lies within the limit causing total Compression.
Hence, the Footing Base about ZZ-axis will be in touch with the Soil.

Net Bearing Pressure at the Base - Right End	=	211.433	KN/sq.m.
Net Bearing Pressure at the Base - Left End	=	172.804	KN/sq.m.
Net Bearing Pressure at the Column Face	=	198.011	KN/sq.m.
Net Bearing Pressure at the Pedestal Face	=	201.94	KN/sq.m.
Net Bearing Pressure - 'd' from Face	=	208.33	KN/sq.m.

As Per IS:456-2000, Clause 34.2.3,
the critical section for Bending Moment is at the Face of the Column.

Projection of Footing from Critical Section	=	512.5	mm.
Design Bending Moment	=	33.974	KN m.
Modified Depth of Footing at the Face of Wall	=	450	mm.
Modified Depth of Footing at the End	=	250	mm.
Effective Depth Required	=	96.809	mm.
Effective Depth Provided	=	394	mm.

Hence SAFE.

Percentage of Steel Required	=	0.025	%
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As Per IS:456-2000, Clause 26.5.2.1,
the required percentage of Steel is less than the Minimum to be provided. Hence, Minimum Steel is provided.

Percentage of Main Steel Provided	=	0.12	%
Area of Steel Provided	=	591	sq.mm.
Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	166.116	mm.
Max. Spacing allowed (Rounded off)	=	150	mm.
Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	239.208	mm.
Max. Spacing allowed (Rounded off)	=	225	mm.

Bending about XX-axis:-

Load Eccentricity lies within the limit causing total Compression.

Hence, the Footing Base about XX-axis will be in touch with the Soil.

Net Bearing Pressure at the Base - Right End	=	211.433	KN/sq.m.
Net Bearing Pressure at the Base - Left End	=	209.466	KN/sq.m.
Net Bearing Pressure at the Column Face	=	210.631	KN/sq.m.
Net Bearing Pressure at the Pedestal Face	=	210.867	KN/sq.m.
Net Bearing Pressure - 'd' from Face	=	211.251	KN/sq.m.

As Per IS:456-2000, Clause 34.2.3,
the critical section for Bending Moment is at the Face of the Column.

Projection of Footing from Critical Section	=	510	mm.
Design Bending Moment	=	40.507	KN m.
Modified Depth of Footing at the Face of Wall	=	450	mm.
Modified Depth of Footing at the End	=	250	mm.
Effective Depth Required	=	91.057	mm.
Effective Depth Provided	=	382	mm.

Hence SAFE.

Percentage of Steel Required	=	0.026	%
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As Per IS:456-2000, Clause 26.5.2.1,
the required percentage of Steel is less than the Minimum to be provided. Hence, Minimum Steel is provided.

Percentage of Main Steel Provided	=	0.12	%
Area of Steel Provided	=	676.14	sq.mm.
Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	171.335	mm.
Max. Spacing allowed (Rounded off)	=	175	mm.
Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	246.722	mm.
Max. Spacing allowed (Rounded off)	=	250	mm.

Note (1):- The required Spacing of Main Rods will be compared with 300 mm. or 3d (450 mm. or 5d for Dist. Rods) whichever is less. If the required spacing exceeds this limit, the least value will be automatically provided. This is done in accordance with IS:456-2000 Clause 26.3.3.

Note (2):- The required minimum area of reinforcement will be also as per IS:456-2000, Clause 34.5.2, if the Footing Thickness exceeds 1000 mm. This minimum area is 360.0 sq.mm. for each side or face.

Note (3):- The assumed Depth of Footing will be automatically modified so that a SAFE design is arrived at from both flexure as well as Shear considerations.

Note (4):- Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

F11 : Dowel Bars Output (LC No. : 2)

Factored Axial Load on Column	=	352.405	KN.
Char. Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Pedestal Steel	=	415	N/sq.mm.
Width of Pedestal Section	=	530	mm.
Depth of Pedestal Section	=	750	mm.
Area of Pedestal Section	=	397500	sq.mm.
Width of Footing	=	1.25	m.
Length of Footing	=	1.475	m.
Area of Footing	=	1.844	sq.m.
As Per IS:456-2000, Clause 34.4,			
Basic Permissible Bearing Stress	=	9	N/sq.mm.
Max. Bearing Stress based on Area Ratio	=	18	N/sq.mm.
Actual Bearing Stress	=	0.887	N/sq.mm.
As Per IS:456-2000, Clause 34.4.3,			
Reinforcement is NOT required. However, Minimum Steel is Provided.			
Percentage of Steel Required	=	0.5	%
Area of Steel Provided	=	1987.5	sq.mm.
Dowel Rod Size-1	=	12	mm.
No. of Rods to be Provided	=	18	Nos.
Corresponding Steel Area	=	2035.752	sq.mm.
Dowel Rod Size-2	=	16	mm.
No. of Rods to be Provided	=	10	Nos.
Corresponding Steel Area	=	2010.619	sq.mm.

Note :- Calculation for Dowel Rods is only optionally provided.
However, Dowel Rods may not be required in all cases.

F11 : Pedestal Output (LC No. : 2)

Factored Axial Load on Pedestal	=	352.405	KN.
Char. Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Pedestal Steel	=	415	N/sq.mm.
Pedestal Projection from Column Face	=	150	mm.
Width of Column Section	=	230	mm.
Depth of Column Section	=	450	mm.

Width of Pedestal Section	=	530	mm.
Depth of Pedestal Section	=	750	mm.
Area of Column Section	=	103500	sq.mm.
Area of Pedestal Section	=	397500	sq.mm.
As Per IS:456-2000, Clause 34.4,			
Basic Permissible Bearing Stress	=	9	N/sq.mm.
Max. Bearing Stress based on Area Ratio	=	17.638	N/sq.mm.
Actual Bearing Stress	=	0.887	N/sq.mm.
Reinforcement is NOT required. However, Minimum Steel is Provided.			
Percentage of Steel Required	=	0.4	%
Area of Steel Provided	=	1590	sq.mm.
Pedestal Rod Size-1	=	12	mm.
No. of such Rods to be provided	=	14	Nos.
Corresponding Steel Area	=	1583.363	sq.mm.
Pedestal Rod Size-2	=	16	mm.
No. of such Rods to be provided	=	8	Nos.
Corresponding Steel Area	=	1608.495	sq.mm.
Projection of Footing from Pedestal Face - ZZ	=	362.5	mm.
Bending Moment at Pedestal Face - ZZ	=	17.105	KN m.
Corresponding Effective Depth Required	=	83.81	mm.
Projection of Footing from Pedestal Face - XX	=	360	mm.
Bending Moment at Pedestal Face - XX	=	20.191	KN m.
Corresponding Effective Depth Required	=	105.18	mm.
Maximum of the above Two Eff. Depths	=	105.18	mm.
Eff. Depth of Footing Provided at Column Face	=	394	mm.
Max. Depth of Pedestal	=	288.82	mm.
Max. Depth of Pedestal Allowed (Rounded Off)	=	200	mm.

F11 : One Way Shear Output (LC No. : 2)

As Per IS:456-2000, Clause 34.2.4,

the critical section for Shear Force is at a distance equal to the Effective Depth of the Footing, from the Face of the Column.

Design Shear Force about Length	=	31.089	KN.
Modified Depth of Footing at the Face of Wall	=	450	mm.
Modified Depth of Footing at the End	=	250	mm.
Depth of Footing at Critical Section	=	240.244	mm.

Projection of Footing from Critical Section	=	118.5	mm.
As Per IS:456-2000, Clause 40.1, Actual Shear Stress	=	0.104	N/sq.mm.
As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.272	N/sq.mm.
As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.

The section is SAFE in Shear, about ZZ-axis.

Design Shear Force about Width	=	36.161	KN.
Depth of Footing at Critical Section	=	227.49	mm.
Projection of Footing from Critical Section	=	116	mm.
As Per IS:456-2000, Clause 40.1, Actual Shear Stress	=	0.108	N/sq.mm.
As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.258	N/sq.mm.
As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.

The section is SAFE in Shear, about XX-axis.

F11 : Punching Shear Output (LC No. : 2)

As Per IS:456-2000, Clause 34.2.4,
the critical section for Shear Force is at a distance equal to the Half the Effective Depth of the Footing, from the Face of the Column.

Length of Footing at Critical Section	=	0.832	m.
Width of Footing at Critical Section	=	0.612	m.
Ratio of Width to Length at Critical Section	=	0.736	
Modified Depth of Footing at the Face of Wall	=	450	mm.
Modified Depth of Footing at the End	=	250	mm.
Depth of Footing at Critical Section	=	311.122	mm.
Design Shear Force	=	251.743	KN.
As Per IS:456-2000, Clause 31.6.2.1, Actual Shear Stress	=	0.28	N/sq.mm.
As Per IS:456-2000, Clause 31.6.3.1, Coefficient, ks	=	1	
Max. Permissible Shear Stress	=	1.118	N/sq.mm.

The section is SAFE in Shear.

F11 : Global Input Data (LC No. : 3)

The footing is to be designed as an Isolated Footing.

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

A Pedestal is provided at the Base of the Column.

Pedestal Projection from Column face = 150 mm.

Footing Shape = Rectangular

Initial Depth at the Face of Wall/Column = 450 mm.
Initial Depth at the End = 250 mm.

The footing is subjected to Axial Load & Biaxial Bending.

Working Axial Load = 208.56 KN.

Working Moment about ZZ-axis = 1.26 KN m.

Working Moment about XX-axis = 0.174 KN m.

Safe Bearing Capacity of Soil = 150 KN/sq.m.
Factor of Safety for Safe Bearing Capacity = 1.5

F11 : Flexure Output (LC No. : 3)

Working Axial Load on Footing = 208.56 KN.
Factored Axial Load on Footing = 208.56 KN.

Percentage Factor for Self Weight of Footing = 5 %
Factored Self Weight of Footing = 10.428 KN.

Total Factored Axial Load on Footing = 218.988 KN.

Working Moment about ZZ-axis = 1.26 KN m.
Factored Moment about ZZ-axis = 1.26 KN m.

Working Moment about XX-axis = 0.174 KN m.
Factored Moment about XX-axis = 0.174 KN m.

Ultimate Bearing Capacity of Soil = 225 KN/sq.m.

From Vertical Load and Bending considerations,
Area of Footing Required = 1.008 sq.m.

Equal Projections were initially assumed from the Column Faces
to arrive at the Footing Size.

Width of Footing Required = 0.9 m.
Length of Footing Required = 1.12 m.

Width of Footing Provided = 0.925 m.

Length of Footing Provided	=	1.125	m.
Actual Bearing Area Provided	=	1.041	sq.m.
Max. Bearing Pressure at the Base	=	217.982	KN/sq.m.
Min. Bearing Pressure at the Base	=	202.895	KN/sq.m.

Bending about ZZ-axis:-

Load Eccentricity lies within the limit causing total Compression.
Hence, the Footing Base about ZZ-axis will be in touch with the Soil.

Net Bearing Pressure at the Base - Right End	=	207.961	KN/sq.m.
Net Bearing Pressure at the Base - Left End	=	195.048	KN/sq.m.
Net Bearing Pressure at the Column Face	=	204.087	KN/sq.m.
Net Bearing Pressure at the Pedestal Face	=	205.809	KN/sq.m.
Net Bearing Pressure - 'd' from Face	=	207.961	KN/sq.m.

As Per IS:456-2000, Clause 34.2.3,
the critical section for Bending Moment is at the Face of the Column.

Projection of Footing from Critical Section	=	337.5	mm.
Design Bending Moment	=	10.888	KN m.
Modified Depth of Footing at the Face of Wall	=	450	mm.
Modified Depth of Footing at the End	=	250	mm.
Effective Depth Required	=	45.029	mm.
Effective Depth Provided	=	394	mm.

Hence SAFE.

Percentage of Steel Required	=	0.007	%
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As Per IS:456-2000, Clause 26.5.2.1,
the required percentage of Steel is less than the Minimum to be provided. Hence, Minimum Steel is provided.

Percentage of Main Steel Provided	=	0.12	%
Area of Steel Provided	=	437.34	sq.mm.
Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	166.116	mm.
Max. Spacing allowed (Rounded off)	=	150	mm.
Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	239.208	mm.
Max. Spacing allowed (Rounded off)	=	225	mm.

Bending about XX-axis:-

Load Eccentricity lies within the limit causing total Compression.

Hence, the Footing Base about XX-axis will be in touch with the Soil.

Net Bearing Pressure at the Base - Right End	=	207.961	KN/sq.m.
Net Bearing Pressure at the Base - Left End	=	205.787	KN/sq.m.
Net Bearing Pressure at the Column Face	=	207.145	KN/sq.m.
Net Bearing Pressure at the Pedestal Face	=	207.497	KN/sq.m.
Net Bearing Pressure - 'd' from Face	=	207.961	KN/sq.m.

As Per IS:456-2000, Clause 34.2.3,
the critical section for Bending Moment is at the Face of the Column.

Projection of Footing from Critical Section	=	347.5	mm.
Design Bending Moment	=	14.107	KN m.
Modified Depth of Footing at the Face of Wall	=	450	mm.
Modified Depth of Footing at the End	=	250	mm.
Effective Depth Required	=	44.922	mm.
Effective Depth Provided	=	382	mm.

Hence SAFE.

Percentage of Steel Required	=	0.008	%
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As Per IS:456-2000, Clause 26.5.2.1,
the required percentage of Steel is less than the Minimum to be provided. Hence, Minimum Steel is provided.

Percentage of Main Steel Provided	=	0.12	%
Area of Steel Provided	=	515.7	sq.mm.
Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	171.335	mm.
Max. Spacing allowed (Rounded off)	=	175	mm.
Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	246.722	mm.
Max. Spacing allowed (Rounded off)	=	250	mm.

Note (1):- The required Spacing of Main Rods will be compared with 300 mm. or 3d (450 mm. or 5d for Dist. Rods) whichever is less. If the required spacing exceeds this limit, the least value will be automatically provided. This is done in accordance with IS:456-2000 Clause 26.3.3.

Note (2):- The required minimum area of reinforcement will be also as per IS:456-2000, Clause 34.5.2, if the Footing Thickness exceeds 1000 mm. This minimum area is 360.0 sq.mm. for each side or face.

Note (3):- The assumed Depth of Footing will be automatically modified so that a SAFE design is arrived at from both flexure as well as Shear considerations.

Note (4):- Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

F11 : Dowel Bars Output (LC No. : 3)

Factored Axial Load on Column	=	208.56	KN.
Char. Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Pedestal Steel	=	415	N/sq.mm.
Width of Pedestal Section	=	530	mm.
Depth of Pedestal Section	=	750	mm.
Area of Pedestal Section	=	397500	sq.mm.
Width of Footing	=	0.925	m.
Length of Footing	=	1.125	m.
Area of Footing	=	1.041	sq.m.
As Per IS:456-2000, Clause 34.4,			
Basic Permissible Bearing Stress	=	9	N/sq.mm.
Max. Bearing Stress based on Area Ratio	=	14.562	N/sq.mm.
Actual Bearing Stress	=	0.525	N/sq.mm.
As Per IS:456-2000, Clause 34.4.3,			
Reinforcement is NOT required. However, Minimum Steel is Provided.			
Percentage of Steel Required	=	0.5	%
Area of Steel Provided	=	1987.5	sq.mm.
Dowel Rod Size-1	=	12	mm.
No. of Rods to be Provided	=	18	Nos.
Corresponding Steel Area	=	2035.752	sq.mm.
Dowel Rod Size-2	=	16	mm.
No. of Rods to be Provided	=	10	Nos.
Corresponding Steel Area	=	2010.619	sq.mm.

Note :- Calculation for Dowel Rods is only optionally provided.
However, Dowel Rods may not be required in all cases.

F11 : Pedestal Output (LC No. : 3)

Factored Axial Load on Pedestal	=	208.56	KN.
Char. Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Pedestal Steel	=	415	N/sq.mm.
Pedestal Projection from Column Face	=	150	mm.
Width of Column Section	=	230	mm.
Depth of Column Section	=	450	mm.

Width of Pedestal Section	=	530	mm.
Depth of Pedestal Section	=	750	mm.
Area of Column Section	=	103500	sq.mm.
Area of Pedestal Section	=	397500	sq.mm.
As Per IS:456-2000, Clause 34.4,			
Basic Permissible Bearing Stress	=	9	N/sq.mm.
Max. Bearing Stress based on Area Ratio	=	17.638	N/sq.mm.
Actual Bearing Stress	=	0.525	N/sq.mm.
Reinforcement is NOT required. However, Minimum Steel is Provided.			
Percentage of Steel Required	=	0.4	%
Area of Steel Provided	=	1590	sq.mm.
Pedestal Rod Size-1	=	12	mm.
No. of such Rods to be provided	=	14	Nos.
Corresponding Steel Area	=	1583.363	sq.mm.
Pedestal Rod Size-2	=	16	mm.
No. of such Rods to be provided	=	8	Nos.
Corresponding Steel Area	=	1608.495	sq.mm.
Projection of Footing from Pedestal Face - ZZ	=	187.5	mm.
Bending Moment at Pedestal Face - ZZ	=	3.37	KN m.
Corresponding Effective Depth Required	=	38.619	mm.
Projection of Footing from Pedestal Face - XX	=	197.5	mm.
Bending Moment at Pedestal Face - XX	=	4.559	KN m.
Corresponding Effective Depth Required	=	52.378	mm.
Maximum of the above Two Eff. Depths	=	52.378	mm.
Eff. Depth of Footing Provided at Column Face	=	394	mm.
Max. Depth of Pedestal	=	341.622	mm.
Max. Depth of Pedestal Allowed (Rounded Off)	=	200	mm.

F11 : One Way Shear Output (LC No. : 3)

As Per IS:456-2000, Clause 34.2.4,

the critical section for Shear Force is at a distance equal to the Effective Depth of the Footing, from the Face of the Column.

Design Shear Force about Length	=	0	KN.
Modified Depth of Footing at the Face of Wall	=	450	mm.
Modified Depth of Footing at the End	=	250	mm.
Depth of Footing at Critical Section	=	394	mm.

Projection of Footing from Critical Section	=	0	mm.
As Per IS:456-2000, Clause 40.1, Actual Shear Stress	=	0	N/sq.mm.
As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.272	N/sq.mm.
As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.

The section is SAFE in Shear, about ZZ-axis.

Design Shear Force about Width	=	0	KN.
Depth of Footing at Critical Section	=	382	mm.
Projection of Footing from Critical Section	=	0	mm.
As Per IS:456-2000, Clause 40.1, Actual Shear Stress	=	0	N/sq.mm.
As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.258	N/sq.mm.
As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.

The section is SAFE in Shear, about XX-axis.

F11 : Punching Shear Output (LC No. : 3)

As Per IS:456-2000, Clause 34.2.4,
the critical section for Shear Force is at a distance equal to the Half the Effective Depth of the Footing, from the Face of the Column.

Length of Footing at Critical Section	=	0.832	m.
Width of Footing at Critical Section	=	0.612	m.
Ratio of Width to Length at Critical Section	=	0.736	
Modified Depth of Footing at the Face of Wall	=	450	mm.
Modified Depth of Footing at the End	=	250	mm.
Depth of Footing at Critical Section	=	382	mm.
Design Shear Force	=	103.009	KN.
As Per IS:456-2000, Clause 31.6.2.1, Actual Shear Stress	=	0.093	N/sq.mm.
As Per IS:456-2000, Clause 31.6.3.1, Coefficient, ks	=	1	
Max. Permissible Shear Stress	=	1.118	N/sq.mm.

The section is SAFE in Shear.

F11 : Global Input Data (LC No. : 4)

The footing is to be designed as an Isolated Footing.

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

A Pedestal is provided at the Base of the Column.

Pedestal Projection from Column face = 150 mm.

Footing Shape = Rectangular

Initial Depth at the Face of Wall/Column = 450 mm.

Initial Depth at the End = 250 mm.

The footing is subjected to Axial Load & Biaxial Bending.

Working Axial Load = 205.246 KN.

Working Moment about ZZ-axis = 1.24 KN m.

Working Moment about XX-axis = 0.172 KN m.

Safe Bearing Capacity of Soil = 150 KN/sq.m.

Factor of Safety for Safe Bearing Capacity = 1.5

F11 : Flexure Output (LC No. : 4)

Working Axial Load on Footing = 205.246 KN.

Factored Axial Load on Footing = 205.246 KN.

Percentage Factor for Self Weight of Footing = 5 %

Factored Self Weight of Footing = 10.262 KN.

Total Factored Axial Load on Footing = 215.508 KN.

Working Moment about ZZ-axis = 1.24 KN m.

Factored Moment about ZZ-axis = 1.24 KN m.

Working Moment about XX-axis = 0.172 KN m.

Factored Moment about XX-axis = 0.172 KN m.

Ultimate Bearing Capacity of Soil = 225 KN/sq.m.

From Vertical Load and Bending considerations,

Area of Footing Required = 0.993 sq.m.

Equal Projections were initially assumed from the Column Faces to arrive at the Footing Size.

Width of Footing Required = 0.892 m.

Length of Footing Required = 1.112 m.

Width of Footing Provided = 0.9 m.

Length of Footing Provided	=	1.125	m.
Actual Bearing Area Provided	=	1.013	sq.m.
Max. Bearing Pressure at the Base	=	220.508	KN/sq.m.
Min. Bearing Pressure at the Base	=	205.187	KN/sq.m.

Bending about ZZ-axis:-

Load Eccentricity lies within the limit causing total Compression.
Hence, the Footing Base about ZZ-axis will be in touch with the Soil.

Net Bearing Pressure at the Base - Right End	=	210.373	KN/sq.m.
Net Bearing Pressure at the Base - Left End	=	197.312	KN/sq.m.
Net Bearing Pressure at the Column Face	=	206.454	KN/sq.m.
Net Bearing Pressure at the Pedestal Face	=	208.196	KN/sq.m.
Net Bearing Pressure - 'd' from Face	=	210.373	KN/sq.m.

As Per IS:456-2000, Clause 34.2.3,
the critical section for Bending Moment is at the Face of the Column.

Projection of Footing from Critical Section	=	337.5	mm.
Design Bending Moment	=	10.716	KN m.
Modified Depth of Footing at the Face of Wall	=	450	mm.
Modified Depth of Footing at the End	=	250	mm.
Effective Depth Required	=	44.843	mm.
Effective Depth Provided	=	394	mm.

Hence SAFE.

Percentage of Steel Required	=	0.007	%
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As Per IS:456-2000, Clause 26.5.2.1,
the required percentage of Steel is less than the Minimum to be provided. Hence, Minimum Steel is provided.

Percentage of Main Steel Provided	=	0.12	%
Area of Steel Provided	=	425.52	sq.mm.
Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	166.116	mm.
Max. Spacing allowed (Rounded off)	=	150	mm.
Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	239.208	mm.
Max. Spacing allowed (Rounded off)	=	225	mm.

Bending about XX-axis:-

Load Eccentricity lies within the limit causing total Compression.

Hence, the Footing Base about XX-axis will be in touch with the Soil.

Net Bearing Pressure at the Base - Right End	=	210.373	KN/sq.m.
Net Bearing Pressure at the Base - Left End	=	208.113	KN/sq.m.
Net Bearing Pressure at the Column Face	=	209.531	KN/sq.m.
Net Bearing Pressure at the Pedestal Face	=	209.908	KN/sq.m.
Net Bearing Pressure - 'd' from Face	=	210.373	KN/sq.m.

As Per IS:456-2000, Clause 34.2.3,
the critical section for Bending Moment is at the Face of the Column.

Projection of Footing from Critical Section	=	335	mm.
Design Bending Moment	=	13.262	KN m.
Modified Depth of Footing at the Face of Wall	=	450	mm.
Modified Depth of Footing at the End	=	250	mm.
Effective Depth Required	=	42.322	mm.
Effective Depth Provided	=	382	mm.

Hence SAFE.

Percentage of Steel Required	=	0.007	%
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As Per IS:456-2000, Clause 26.5.2.1,
the required percentage of Steel is less than the Minimum to be provided. Hence, Minimum Steel is provided.

Percentage of Main Steel Provided	=	0.12	%
Area of Steel Provided	=	515.7	sq.mm.
Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	171.335	mm.
Max. Spacing allowed (Rounded off)	=	175	mm.
Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	246.722	mm.
Max. Spacing allowed (Rounded off)	=	250	mm.

Note (1):- The required Spacing of Main Rods will be compared with 300 mm. or 3d (450 mm. or 5d for Dist. Rods) whichever is less. If the required spacing exceeds this limit, the least value will be automatically provided. This is done in accordance with IS:456-2000 Clause 26.3.3.

Note (2):- The required minimum area of reinforcement will be also as per IS:456-2000, Clause 34.5.2, if the Footing Thickness exceeds 1000 mm. This minimum area is 360.0 sq.mm. for each side or face.

Note (3):- The assumed Depth of Footing will be automatically modified so that a SAFE design is arrived at from both flexure as well as Shear considerations.

Note (4):- Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

F11 : Dowel Bars Output (LC No. : 4)

Factored Axial Load on Column	=	205.246	KN.
Char. Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Pedestal Steel	=	415	N/sq.mm.
Width of Pedestal Section	=	530	mm.
Depth of Pedestal Section	=	750	mm.
Area of Pedestal Section	=	397500	sq.mm.
Width of Footing	=	0.9	m.
Length of Footing	=	1.125	m.
Area of Footing	=	1.013	sq.m.
As Per IS:456-2000, Clause 34.4,			
Basic Permissible Bearing Stress	=	9	N/sq.mm.
Max. Bearing Stress based on Area Ratio	=	14.364	N/sq.mm.
Actual Bearing Stress	=	0.516	N/sq.mm.
As Per IS:456-2000, Clause 34.4.3,			
Reinforcement is NOT required. However, Minimum Steel is Provided.			
Percentage of Steel Required	=	0.5	%
Area of Steel Provided	=	1987.5	sq.mm.
Dowel Rod Size-1	=	12	mm.
No. of Rods to be Provided	=	18	Nos.
Corresponding Steel Area	=	2035.752	sq.mm.
Dowel Rod Size-2	=	16	mm.
No. of Rods to be Provided	=	10	Nos.
Corresponding Steel Area	=	2010.619	sq.mm.

Note :- Calculation for Dowel Rods is only optionally provided.
However, Dowel Rods may not be required in all cases.

F11 : Pedestal Output (LC No. : 4)

Factored Axial Load on Pedestal	=	205.246	KN.
Char. Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Pedestal Steel	=	415	N/sq.mm.
Pedestal Projection from Column Face	=	150	mm.
Width of Column Section	=	230	mm.
Depth of Column Section	=	450	mm.

Width of Pedestal Section	=	530	mm.
Depth of Pedestal Section	=	750	mm.
Area of Column Section	=	103500	sq.mm.
Area of Pedestal Section	=	397500	sq.mm.
As Per IS:456-2000, Clause 34.4,			
Basic Permissible Bearing Stress	=	9	N/sq.mm.
Max. Bearing Stress based on Area Ratio	=	17.638	N/sq.mm.
Actual Bearing Stress	=	0.516	N/sq.mm.
Reinforcement is NOT required. However, Minimum Steel is Provided.			
Percentage of Steel Required	=	0.4	%
Area of Steel Provided	=	1590	sq.mm.
Pedestal Rod Size-1	=	12	mm.
No. of such Rods to be provided	=	14	Nos.
Corresponding Steel Area	=	1583.363	sq.mm.
Pedestal Rod Size-2	=	16	mm.
No. of such Rods to be provided	=	8	Nos.
Corresponding Steel Area	=	1608.495	sq.mm.
Projection of Footing from Pedestal Face - ZZ	=	187.5	mm.
Bending Moment at Pedestal Face - ZZ	=	3.317	KN m.
Corresponding Effective Depth Required	=	38.313	mm.
Projection of Footing from Pedestal Face - XX	=	185	mm.
Bending Moment at Pedestal Face - XX	=	4.047	KN m.
Corresponding Effective Depth Required	=	49.534	mm.
Maximum of the above Two Eff. Depths	=	49.534	mm.
Eff. Depth of Footing Provided at Column Face	=	394	mm.
Max. Depth of Pedestal	=	344.466	mm.
Max. Depth of Pedestal Allowed (Rounded Off)	=	200	mm.

F11 : One Way Shear Output (LC No. : 4)

As Per IS:456-2000, Clause 34.2.4,

the critical section for Shear Force is at a distance equal to the Effective Depth of the Footing, from the Face of the Column.

Design Shear Force about Length	=	0	KN.
Modified Depth of Footing at the Face of Wall	=	450	mm.
Modified Depth of Footing at the End	=	250	mm.
Depth of Footing at Critical Section	=	394	mm.

Projection of Footing from Critical Section	=	0	mm.
As Per IS:456-2000, Clause 40.1, Actual Shear Stress	=	0	N/sq.mm.
As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.272	N/sq.mm.
As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.

The section is SAFE in Shear, about ZZ-axis.

Design Shear Force about Width	=	0	KN.
Depth of Footing at Critical Section	=	382	mm.
Projection of Footing from Critical Section	=	0	mm.
As Per IS:456-2000, Clause 40.1, Actual Shear Stress	=	0	N/sq.mm.
As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.258	N/sq.mm.
As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.

The section is SAFE in Shear, about XX-axis.

F11 : Punching Shear Output (LC No. : 4)

As Per IS:456-2000, Clause 34.2.4,
the critical section for Shear Force is at a distance equal to the Half the Effective Depth of the Footing, from the Face of the Column.

Length of Footing at Critical Section	=	0.832	m.
Width of Footing at Critical Section	=	0.612	m.
Ratio of Width to Length at Critical Section	=	0.736	
Modified Depth of Footing at the Face of Wall	=	450	mm.
Modified Depth of Footing at the End	=	250	mm.
Depth of Footing at Critical Section	=	382	mm.
Design Shear Force	=	98.487	KN.
As Per IS:456-2000, Clause 31.6.2.1, Actual Shear Stress	=	0.089	N/sq.mm.
As Per IS:456-2000, Clause 31.6.3.1, Coefficient, ks	=	1	
Max. Permissible Shear Stress	=	1.118	N/sq.mm.

The section is SAFE in Shear.

F11 : Global Input Data (LC No. : 5)

The footing is to be designed as an Isolated Footing.

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

A Pedestal is provided at the Base of the Column.

Pedestal Projection from Column face = 150 mm.

Footing Shape = Rectangular

Initial Depth at the Face of Wall/Column = 450 mm.

Initial Depth at the End = 250 mm.

The footing is subjected to Axial Load & Biaxial Bending.

Working Axial Load = 989.81 KN.

Working Moment about ZZ-axis = 14.492 KN m.

Working Moment about XX-axis = 0.38 KN m.

Safe Bearing Capacity of Soil = 150 KN/sq.m.

Factor of Safety for Safe Bearing Capacity = 1.5

F11 : Flexure Output (LC No. : 5)

Working Axial Load on Footing = 989.81 KN.

Factored Axial Load on Footing = 989.81 KN.

Percentage Factor for Self Weight of Footing = 5 %

Factored Self Weight of Footing = 49.491 KN.

Total Factored Axial Load on Footing = 1039.301 KN.

Working Moment about ZZ-axis = 14.492 KN m.

Factored Moment about ZZ-axis = 14.492 KN m.

Working Moment about XX-axis = 0.38 KN m.

Factored Moment about XX-axis = 0.38 KN m.

Ultimate Bearing Capacity of Soil = 225 KN/sq.m.

From Vertical Load and Bending considerations,

Area of Footing Required = 4.792 sq.m.

Equal Projections were initially assumed from the Column Faces to arrive at the Footing Size.

Width of Footing Required = 2.082 m.

Length of Footing Required = 2.302 m.

Width of Footing Provided = 2.1 m.

Length of Footing Provided	=	2.325	m.
Actual Bearing Area Provided	=	4.882	sq.m.
Max. Bearing Pressure at the Base	=	220.745	KN/sq.m.
Min. Bearing Pressure at the Base	=	204.98	KN/sq.m.

Bending about ZZ-axis:-

Load Eccentricity lies within the limit causing total Compression.
Hence, the Footing Base about ZZ-axis will be in touch with the Soil.

Net Bearing Pressure at the Base - Right End	=	210.609	KN/sq.m.
Net Bearing Pressure at the Base - Left End	=	195.289	KN/sq.m.
Net Bearing Pressure at the Column Face	=	204.431	KN/sq.m.
Net Bearing Pressure at the Pedestal Face	=	205.42	KN/sq.m.
Net Bearing Pressure - 'd' from Face	=	207.555	KN/sq.m.

As Per IS:456-2000, Clause 34.2.3,
the critical section for Bending Moment is at the Face of the Column.

Projection of Footing from Critical Section	=	937.5	mm.
Design Bending Moment	=	192.46	KN m.
Modified Depth of Footing at the Face of Wall	=	530	mm.
Modified Depth of Footing at the End	=	330	mm.
Effective Depth Required	=	245.767	mm.
Effective Depth Provided	=	474	mm.

Hence SAFE.

Percentage of Steel Required	=	0.081	%
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As Per IS:456-2000, Clause 26.5.2.1,
the required percentage of Steel is less than the Minimum to be provided. Hence, Minimum Steel is provided.

Percentage of Main Steel Provided	=	0.12	%
Area of Steel Provided	=	1194.48	sq.mm.
Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	138.08	mm.
Max. Spacing allowed (Rounded off)	=	125	mm.
Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	198.835	mm.
Max. Spacing allowed (Rounded off)	=	200	mm.

Bending about XX-axis:-

Load Eccentricity lies within the limit causing total Compression.

Hence, the Footing Base about XX-axis will be in touch with the Soil.

Net Bearing Pressure at the Base - Right End	=	210.609	KN/sq.m.
Net Bearing Pressure at the Base - Left End	=	210.164	KN/sq.m.
Net Bearing Pressure at the Column Face	=	210.411	KN/sq.m.
Net Bearing Pressure at the Pedestal Face	=	210.442	KN/sq.m.
Net Bearing Pressure - 'd' from Face	=	210.511	KN/sq.m.

As Per IS:456-2000, Clause 34.2.3,
the critical section for Bending Moment is at the Face of the Column.

Projection of Footing from Critical Section	=	935	mm.
Design Bending Moment	=	213.972	KN m.
Modified Depth of Footing at the Face of Wall	=	530	mm.
Modified Depth of Footing at the End	=	330	mm.
Effective Depth Required	=	229.573	mm.
Effective Depth Provided	=	462	mm.

Hence SAFE.

Percentage of Steel Required	=	0.086	%
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As Per IS:456-2000, Clause 26.5.2.1,
the required percentage of Steel is less than the Minimum to be provided. Hence, Minimum Steel is provided.

Percentage of Main Steel Provided	=	0.12	%
Area of Steel Provided	=	1288.98	sq.mm.
Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	141.666	mm.
Max. Spacing allowed (Rounded off)	=	125	mm.
Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	204	mm.
Max. Spacing allowed (Rounded off)	=	200	mm.

Note (1):- The required Spacing of Main Rods will be compared with 300 mm. or 3d (450 mm. or 5d for Dist. Rods) whichever is less. If the required spacing exceeds this limit, the least value will be automatically provided. This is done in accordance with IS:456-2000 Clause 26.3.3.

Note (2):- The required minimum area of reinforcement will be also as per IS:456-2000, Clause 34.5.2, if the Footing Thickness exceeds 1000 mm. This minimum area is 360.0 sq.mm. for each side or face.

Note (3):- The assumed Depth of Footing will be automatically modified so that a SAFE design is arrived at from both flexure as well as Shear considerations.

Note (4):- Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

F11 : Dowel Bars Output (LC No. : 5)

Factored Axial Load on Column	=	989.81	KN.
Char. Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Pedestal Steel	=	415	N/sq.mm.
Width of Pedestal Section	=	530	mm.
Depth of Pedestal Section	=	750	mm.
Area of Pedestal Section	=	397500	sq.mm.
Width of Footing	=	2.1	m.
Length of Footing	=	2.325	m.
Area of Footing	=	4.882	sq.m.
As Per IS:456-2000, Clause 34.4,			
Basic Permissible Bearing Stress	=	9	N/sq.mm.
Max. Bearing Stress based on Area Ratio	=	18	N/sq.mm.
Actual Bearing Stress	=	2.49	N/sq.mm.
As Per IS:456-2000, Clause 34.4.3,			
Reinforcement is NOT required. However, Minimum Steel is Provided.			
Percentage of Steel Required	=	0.5	%
Area of Steel Provided	=	1987.5	sq.mm.
Dowel Rod Size-1	=	12	mm.
No. of Rods to be Provided	=	18	Nos.
Corresponding Steel Area	=	2035.752	sq.mm.
Dowel Rod Size-2	=	16	mm.
No. of Rods to be Provided	=	10	Nos.
Corresponding Steel Area	=	2010.619	sq.mm.

Note :- Calculation for Dowel Rods is only optionally provided.
However, Dowel Rods may not be required in all cases.

F11 : Pedestal Output (LC No. : 5)

Factored Axial Load on Pedestal	=	989.81	KN.
Char. Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Pedestal Steel	=	415	N/sq.mm.
Pedestal Projection from Column Face	=	150	mm.
Width of Column Section	=	230	mm.
Depth of Column Section	=	450	mm.

Width of Pedestal Section	=	530	mm.
Depth of Pedestal Section	=	750	mm.
Area of Column Section	=	103500	sq.mm.
Area of Pedestal Section	=	397500	sq.mm.
As Per IS:456-2000, Clause 34.4,			
Basic Permissible Bearing Stress	=	9	N/sq.mm.
Max. Bearing Stress based on Area Ratio	=	17.638	N/sq.mm.
Actual Bearing Stress	=	2.49	N/sq.mm.
Reinforcement is NOT required. However, Minimum Steel is Provided.			
Percentage of Steel Required	=	0.4	%
Area of Steel Provided	=	1590	sq.mm.
Pedestal Rod Size-1	=	12	mm.
No. of such Rods to be provided	=	14	Nos.
Corresponding Steel Area	=	1583.363	sq.mm.
Pedestal Rod Size-2	=	16	mm.
No. of such Rods to be provided	=	8	Nos.
Corresponding Steel Area	=	1608.495	sq.mm.
Projection of Footing from Pedestal Face - ZZ	=	787.5	mm.
Bending Moment at Pedestal Face - ZZ	=	136.015	KN m.
Corresponding Effective Depth Required	=	218.005	mm.
Projection of Footing from Pedestal Face - XX	=	785	mm.
Bending Moment at Pedestal Face - XX	=	150.832	KN m.
Corresponding Effective Depth Required	=	258.809	mm.
Maximum of the above Two Eff. Depths	=	258.809	mm.
Eff. Depth of Footing Provided at Column Face	=	474	mm.
Max. Depth of Pedestal	=	215.191	mm.
Max. Depth of Pedestal Allowed (Rounded Off)	=	200	mm.

F11 : One Way Shear Output (LC No. : 5)

As Per IS:456-2000, Clause 34.2.4,

the critical section for Shear Force is at a distance equal to the Effective Depth of the Footing, from the Face of the Column.

Design Shear Force about Length	=	203.51	KN.
Modified Depth of Footing at the Face of Wall	=	530	mm.
Modified Depth of Footing at the End	=	330	mm.
Depth of Footing at Critical Section	=	372.88	mm.

Projection of Footing from Critical Section	=	463.5	mm.
As Per IS:456-2000, Clause 40.1, Actual Shear Stress	=	0.26	N/sq.mm.
As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.272	N/sq.mm.
As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.

The section is SAFE in Shear, about ZZ-axis.

Design Shear Force about Width	=	225.683	KN.
Depth of Footing at Critical Section	=	360.61	mm.
Projection of Footing from Critical Section	=	461	mm.
As Per IS:456-2000, Clause 40.1, Actual Shear Stress	=	0.269	N/sq.mm.
As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.275	N/sq.mm.
As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.

The section is SAFE in Shear, about XX-axis.

F11 : Punching Shear Output (LC No. : 5)

As Per IS:456-2000, Clause 34.2.4,
the critical section for Shear Force is at a distance equal to the Half the Effective Depth of the Footing, from the Face of the Column.

Length of Footing at Critical Section	=	0.912	m.
Width of Footing at Critical Section	=	0.692	m.
Ratio of Width to Length at Critical Section	=	0.759	
Modified Depth of Footing at the Face of Wall	=	530	mm.
Modified Depth of Footing at the End	=	330	mm.
Depth of Footing at Critical Section	=	417.44	mm.
Design Shear Force	=	857.938	KN.
As Per IS:456-2000, Clause 31.6.2.1, Actual Shear Stress	=	0.641	N/sq.mm.
As Per IS:456-2000, Clause 31.6.3.1, Coefficient, ks	=	1	
Max. Permissible Shear Stress	=	1.118	N/sq.mm.

The section is SAFE in Shear.

F11 : Global Input Data (LC No. : 6)

The footing is to be designed as an Isolated Footing.

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

A Pedestal is provided at the Base of the Column.

Pedestal Projection from Column face = 150 mm.

Footing Shape = Rectangular

Initial Depth at the Face of Wall/Column = 450 mm.

Initial Depth at the End = 250 mm.

The footing is subjected to Axial Load & Biaxial Bending.

Working Axial Load = 1297.68 KN.

Working Moment about ZZ-axis = 12.633 KN m.

Working Moment about XX-axis = 0.123 KN m.

Safe Bearing Capacity of Soil = 150 KN/sq.m.

Factor of Safety for Safe Bearing Capacity = 1.5

F11 : Flexure Output (LC No. : 6)

Working Axial Load on Footing = 1297.68 KN.

Factored Axial Load on Footing = 1297.68 KN.

Percentage Factor for Self Weight of Footing = 5 %

Factored Self Weight of Footing = 64.884 KN.

Total Factored Axial Load on Footing = 1362.564 KN.

Working Moment about ZZ-axis = 12.633 KN m.

Factored Moment about ZZ-axis = 12.633 KN m.

Working Moment about XX-axis = 0.123 KN m.

Factored Moment about XX-axis = 0.123 KN m.

Ultimate Bearing Capacity of Soil = 225 KN/sq.m.

From Vertical Load and Bending considerations,

Area of Footing Required = 6.187 sq.m.

Equal Projections were initially assumed from the Column Faces to arrive at the Footing Size.

Width of Footing Required = 2.38 m.

Length of Footing Required = 2.6 m.

Width of Footing Provided = 2.4 m.

Length of Footing Provided	=	2.6	m.
Actual Bearing Area Provided	=	6.24	sq.m.
Max. Bearing Pressure at the Base	=	223.081	KN/sq.m.
Min. Bearing Pressure at the Base	=	213.638	KN/sq.m.

Bending about ZZ-axis:-

Load Eccentricity lies within the limit causing total Compression.
Hence, the Footing Base about ZZ-axis will be in touch with the Soil.

Net Bearing Pressure at the Base - Right End	=	212.683	KN/sq.m.
Net Bearing Pressure at the Base - Left End	=	203.339	KN/sq.m.
Net Bearing Pressure at the Column Face	=	208.819	KN/sq.m.
Net Bearing Pressure at the Pedestal Face	=	209.358	KN/sq.m.
Net Bearing Pressure - 'd' from Face	=	210.846	KN/sq.m.

As Per IS:456-2000, Clause 34.2.3,
the critical section for Bending Moment is at the Face of the Column.

Projection of Footing from Critical Section	=	1075	mm.
Design Bending Moment	=	293.152	KN m.
Modified Depth of Footing at the Face of Wall	=	620	mm.
Modified Depth of Footing at the End	=	420	mm.
Effective Depth Required	=	300.702	mm.
Effective Depth Provided	=	564	mm.

Hence SAFE.

Percentage of Steel Required	=	0.08	%
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As Per IS:456-2000, Clause 26.5.2.1,
the required percentage of Steel is less than the Minimum to be provided. Hence, Minimum Steel is provided.

Percentage of Main Steel Provided	=	0.12	%
Area of Steel Provided	=	1624.32	sq.mm.
Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	116.046	mm.
Max. Spacing allowed (Rounded off)	=	100	mm.
Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	167.106	mm.
Max. Spacing allowed (Rounded off)	=	150	mm.

Bending about XX-axis:-

Load Eccentricity lies within the limit causing total Compression.

Hence, the Footing Base about XX-axis will be in touch with the Soil.

Net Bearing Pressure at the Base - Right End	=	212.683	KN/sq.m.
Net Bearing Pressure at the Base - Left End	=	212.584	KN/sq.m.
Net Bearing Pressure at the Column Face	=	212.638	KN/sq.m.
Net Bearing Pressure at the Pedestal Face	=	212.644	KN/sq.m.
Net Bearing Pressure - 'd' from Face	=	212.661	KN/sq.m.

As Per IS:456-2000, Clause 34.2.3,
the critical section for Bending Moment is at the Face of the Column.

Projection of Footing from Critical Section	=	1085	mm.
Design Bending Moment	=	325.465	KN m.
Modified Depth of Footing at the Face of Wall	=	620	mm.
Modified Depth of Footing at the End	=	420	mm.
Effective Depth Required	=	283.843	mm.
Effective Depth Provided	=	552	mm.

Hence SAFE.

Percentage of Steel Required	=	0.086	%
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As Per IS:456-2000, Clause 26.5.2.1,
the required percentage of Steel is less than the Minimum to be provided. Hence, Minimum Steel is provided.

Percentage of Main Steel Provided	=	0.12	%
Area of Steel Provided	=	1722.24	sq.mm.
Dia. of Rod-1 in Central Band	=	10	mm.
Required Spacing of Rods	=	118.569	mm.
Max. Spacing allowed (Rounded off)	=	100	mm.
Dia. of Rod-2 in Central Band	=	12	mm.
Required Spacing of Rods	=	170.739	mm.
Max. Spacing allowed (Rounded off)	=	175	mm.

Note (1):- The required Spacing of Main Rods will be compared with 300 mm. or 3d (450 mm. or 5d for Dist. Rods) whichever is less. If the required spacing exceeds this limit, the least value will be automatically provided. This is done in accordance with IS:456-2000 Clause 26.3.3.

Note (2):- The required minimum area of reinforcement will be also as per IS:456-2000, Clause 34.5.2, if the Footing Thickness exceeds 1000 mm. This minimum area is 360.0 sq.mm. for each side or face.

Note (3):- The assumed Depth of Footing will be automatically modified so that a SAFE design is arrived at from both flexure as well as Shear considerations.

Note (4):- Spacing of Rods are also controlled by User-defined Increment Value, User-defined Minimum and Maximum Spacing Options, if activated.

F11 : Dowel Bars Output (LC No. : 6)

Factored Axial Load on Column	=	1297.68	KN.
Char. Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Pedestal Steel	=	415	N/sq.mm.
Width of Pedestal Section	=	530	mm.
Depth of Pedestal Section	=	750	mm.
Area of Pedestal Section	=	397500	sq.mm.
Width of Footing	=	2.4	m.
Length of Footing	=	2.6	m.
Area of Footing	=	6.24	sq.m.
As Per IS:456-2000, Clause 34.4,			
Basic Permissible Bearing Stress	=	9	N/sq.mm.
Max. Bearing Stress based on Area Ratio	=	18	N/sq.mm.
Actual Bearing Stress	=	3.265	N/sq.mm.
As Per IS:456-2000, Clause 34.4.3,			
Reinforcement is NOT required. However, Minimum Steel is Provided.			
Percentage of Steel Required	=	0.5	%
Area of Steel Provided	=	1987.5	sq.mm.
Dowel Rod Size-1	=	12	mm.
No. of Rods to be Provided	=	18	Nos.
Corresponding Steel Area	=	2035.752	sq.mm.
Dowel Rod Size-2	=	16	mm.
No. of Rods to be Provided	=	10	Nos.
Corresponding Steel Area	=	2010.619	sq.mm.

Note :- Calculation for Dowel Rods is only optionally provided.
However, Dowel Rods may not be required in all cases.

F11 : Pedestal Output (LC No. : 6)

Factored Axial Load on Pedestal	=	1297.68	KN.
Char. Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Stress of Pedestal Steel	=	415	N/sq.mm.
Pedestal Projection from Column Face	=	150	mm.
Width of Column Section	=	230	mm.
Depth of Column Section	=	450	mm.

Width of Pedestal Section	=	530	mm.
Depth of Pedestal Section	=	750	mm.
Area of Column Section	=	103500	sq.mm.
Area of Pedestal Section	=	397500	sq.mm.
As Per IS:456-2000, Clause 34.4,			
Basic Permissible Bearing Stress	=	9	N/sq.mm.
Max. Bearing Stress based on Area Ratio	=	17.638	N/sq.mm.
Actual Bearing Stress	=	3.265	N/sq.mm.
Reinforcement is NOT required. However, Minimum Steel is Provided.			
Percentage of Steel Required	=	0.4	%
Area of Steel Provided	=	1590	sq.mm.
Pedestal Rod Size-1	=	12	mm.
No. of such Rods to be provided	=	14	Nos.
Corresponding Steel Area	=	1583.363	sq.mm.
Pedestal Rod Size-2	=	16	mm.
No. of such Rods to be provided	=	8	Nos.
Corresponding Steel Area	=	1608.495	sq.mm.
Projection of Footing from Pedestal Face - ZZ	=	925	mm.
Bending Moment at Pedestal Face - ZZ	=	217.234	KN m.
Corresponding Effective Depth Required	=	269.096	mm.
Projection of Footing from Pedestal Face - XX	=	935	mm.
Bending Moment at Pedestal Face - XX	=	241.698	KN m.
Corresponding Effective Depth Required	=	317.182	mm.
Maximum of the above Two Eff. Depths	=	317.182	mm.
Eff. Depth of Footing Provided at Column Face	=	564	mm.
Max. Depth of Pedestal	=	246.818	mm.
Max. Depth of Pedestal Allowed (Rounded Off)	=	200	mm.

F11 : One Way Shear Output (LC No. : 6)

As Per IS:456-2000, Clause 34.2.4,

the critical section for Shear Force is at a distance equal to the Effective Depth of the Footing, from the Face of the Column.

Design Shear Force about Length	=	259.708	KN.
Modified Depth of Footing at the Face of Wall	=	620	mm.
Modified Depth of Footing at the End	=	420	mm.
Depth of Footing at Critical Section	=	459.07	mm.

Projection of Footing from Critical Section	=	511	mm.
As Per IS:456-2000, Clause 40.1, Actual Shear Stress	=	0.236	N/sq.mm.
As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.278	N/sq.mm.
As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.

The section is SAFE in Shear, about ZZ-axis.

Design Shear Force about Width	=	288.085	KN.
Depth of Footing at Critical Section	=	448.037	mm.
Projection of Footing from Critical Section	=	521	mm.
As Per IS:456-2000, Clause 40.1, Actual Shear Stress	=	0.247	N/sq.mm.
As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.281	N/sq.mm.
As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.

The section is SAFE in Shear, about XX-axis.

F11 : Punching Shear Output (LC No. : 6)

As Per IS:456-2000, Clause 34.2.4,
the critical section for Shear Force is at a distance equal to the Half the Effective Depth of the Footing, from the Face of the Column.

Length of Footing at Critical Section	=	1.002	m.
Width of Footing at Critical Section	=	0.782	m.
Ratio of Width to Length at Critical Section	=	0.78	
Modified Depth of Footing at the Face of Wall	=	620	mm.
Modified Depth of Footing at the End	=	420	mm.
Depth of Footing at Critical Section	=	505.535	mm.
Design Shear Force	=	1130.246	KN.
As Per IS:456-2000, Clause 31.6.2.1, Actual Shear Stress	=	0.627	N/sq.mm.
As Per IS:456-2000, Clause 31.6.3.1, Coefficient, ks	=	1	
Max. Permissible Shear Stress	=	1.118	N/sq.mm.

The section is SAFE in Shear.