

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

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**Limit State Design of Singly/Doubly Reinforced
Rectangular/Tee/Ell Beam Sections
subjected to Moment/Torsion/Shear
in accordance with IS:456-2000.**

Introduction:-

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

The given Beam Section is considered for flexural and shear design and the output contains the following portions:

1. Global Input Data
2. Development Length Output
3. Flexural Design Output
4. Shear Design Output
5. Side Face Steel Output
6. Deflection Check Output
7. Slender Beam Check Output
8. Deep Beam Check Output

While detailed design will be carried out for Flexure, Shear, Bond and Side Face Steel, only checks are made for items 6, 7 and 8.

Global Material Data

Concrete Clear Cover	=	25	mm.
Char. Comp. Strength of Concrete	=	20	N/sq.mm.
Yield Strength of Main Steel	=	415	N/sq.mm.
Main Rod Size-1	=	16	mm.
Yield Strength of Tie Steel	=	415	N/sq.mm.
Stirrup Rod Size-1	=	8	mm.
Factor of Safety for Load	=	1	
Partial Safety Factor for Concrete	=	1.5	
Partial Safety Factor for Steel	=	1.15	
Max. Strain in Concrete	=	0.0035	mm./mm.
Max. Strain in Steel	=	0.0055	mm./mm.
Young's Modulus of Concrete	=	22360.68	N/sq.mm.
Young's Modulus of Steel	=	200000	N/sq.mm.

Bond / Development Length Output

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

As Per IS:456-2000, Clause 26.2.1.1,

Design Bond Stress for Main Rods	=	1.92	N/sq.mm.
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Rods in Tension:-

Main Rod Diameter-1	=	16	mm.
Corresponding Development Length	=	752.188	mm.

Rods in Compression:-

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

B66 : Global Input Data

Effective Span	=	3	m.
Section Type	=	Rectangular	
Width of Web	=	230	mm.
Overall Depth	=	300	mm.
Effective Cover at Top	=	40	mm.
Effective Cover at Bottom	=	40	mm.
Number of Stirrup Legs	=	2	Nos.
Max. Bending Moment at End-1	=	23.717	KN m.
Min. Bending Moment at End-1	=	-7.11	KN m.
Max. Bending Moment at End-2	=	37.183	KN m.
Min. Bending Moment at End-2	=	-14.781	KN m.
Max. Bending Moment at Middle	=	0.072	KN m.
Min. Bending Moment at Middle	=	-14.781	KN m.
Max. Shear Force at Left	=	50.989	KN.
Max. Shear Force at Right	=	59.966	KN.
Max. Torsional Moment	=	1.066	KN m.
Ignore Torsion Limit	=	10	%

If Torsion is less than the above % of the Bending Moment at each Section, it will be ignored for the Design. This is a User-controlled feature.

B66 : End-1 Max - Flexure Output

Bending Moment	=	23.717	KN m.
Factored Moment	=	23.717	KN m.
Overall Depth of Section	=	300	mm.
Bottom Effective Cover	=	40	mm.
Effective Depth	=	260	mm.
Maximum N.A. Ratio	=	0.479	
Total Limiting Moment	=	42.948	KN m.
Total Design Moment	=	23.717	KN m.
Depth of Neutral Axis	=	61.043	mm.
Tensile Reinforcement Required	=	0.468	%

Compression Reinforcement is NOT Necessary.

As Per IS:456-2000, Clause 26.5.1.1.a, Min. Tensile Reinforcement Percentage	=	0.205	%
As Per IS:456-2000, Clause 26.5.1.1.b, Max. Reinforcement Percentage	=	4	%
Area of Tensile Reinforcement	=	279.983	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	1.393	Nos.
No. of Rods Provided	=	2	Nos.
Corresponding Steel Area	=	402.124	sq.mm.

Compression Steel is NOT required. However, 2 Nos. of Rods are provided, irrespective of the size, for holding Stirrups.

Main Rod Size-1	=	16	mm.
No. of Rods Provided	=	2	Nos.
Corresponding Steel Area	=	402.124	sq.mm.

Note:- Please note that the minimum number of Rods provided should be always TWO, even if the number of Rods required is ONE or less. This is to be done during detailing.

B66 : End-1 Max - Shear Output

Shear Force	=	50.989	KN.
Factored Shear	=	50.989	KN.
As Per IS:456-2000, Clause 40.1, Actual Shear Stress	=	0.853	N/sq.mm.
As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.537	N/sq.mm.
As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.
Stirrups have to be Designed for Shear.			
Shear for which Stirrups are Provided	=	18.862	KN.
Stirrup Steel Yield Strength	=	415	N/sq.mm.
No. of Stirrup Legs	=	2	Nos.
Stirrup Rod Diameter-1	=	8	mm.
Spacing of Stirrups Required	=	200	mm.

As per IS:456-2000 Clause 26.5.1.5, if the stirrup spacing exceeds 0.75d or 300 mm., whichever is less, the lesser value will be provided as the Spacing of Stirrups.

B66 : End-1 Min - Flexure Output

Bending Moment	=	7.11	KN m.
Factored Moment	=	7.11	KN m.

Torsional Moment	=	1.066	KN m.
Factored Torsion	=	1.066	KN m.
Overall Depth of Section	=	300	mm.
Bottom Effective Cover	=	40	mm.
Effective Depth	=	260	mm.
Maximum N.A. Ratio	=	0.479	
Total Limiting Moment	=	42.948	KN m.
As Per IS:456-2000, Clause 41.4.2,			
Equivalent Torsional Moment	=	1.445	KN m.
Total Design Moment	=	8.554	KN m.
Depth of Neutral Axis	=	20.543	mm.
Tensile Reinforcement Required	=	0.205	%

Compression Reinforcement is NOT Necessary.

As Per IS:456-2000, Clause 26.5.1.1.a,			
Min. Tensile Reinforcement Percentage	=	0.205	%

As Per IS:456-2000, Clause 26.5.1.1.b,			
Max. Reinforcement Percentage	=	4	%

Area of Tensile Reinforcement	=	122.482	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	0.609	Nos.
No. of Rods Provided	=	1	Nos.
Corresponding Steel Area	=	201.062	sq.mm.

Compression Steel is NOT required. However, 2 Nos. of Rods are provided, irrespective of the size, for holding Stirrups.

Main Rod Size-1	=	16	mm.
No. of Rods Provided	=	2	Nos.
Corresponding Steel Area	=	402.124	sq.mm.

Note:- Please note that the minimum number of Rods provided should be always TWO, even if the number of Rods required is ONE or less. This is to be done during detailing.

B66 : End-1 Min - Shear Output

Shear Force	=	50.989	KN.
Factored Shear	=	50.989	KN.

As Per IS:456-2000, Clause 41.3.1,			
Equivalent Shear due to Torsion	=	58.404	KN.

As Per IS:456-2000, Clause 40.1,

Actual Shear Stress	=	0.977	N/sq.mm.
As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.407	N/sq.mm.
As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.
Stirrups have to be Designed for Shear.			
Shear for which Stirrups are Provided	=	34.063	KN.
Stirrup Steel Yield Strength	=	415	N/sq.mm.
No. of Stirrup Legs	=	2	Nos.
Stirrup Rod Diameter-1	=	8	mm.
Spacing of Stirrups Required	=	75	mm.

As per IS:456-2000 Clause 26.5.1.5, if the stirrup spacing exceeds 0.75d or 300 mm., whichever is less, the lesser value will be provided as the Spacing of Stirrups.

B66 : End-2 Max - Flexure Output

Bending Moment	=	37.183	KN m.
Factored Moment	=	37.183	KN m.
Overall Depth of Section	=	300	mm.
Bottom Effective Cover	=	40	mm.
Effective Depth	=	260	mm.
Maximum N.A. Ratio	=	0.479	
Total Limiting Moment	=	42.948	KN m.
Total Design Moment	=	37.183	KN m.
Depth of Neutral Axis	=	103.49	mm.
Tensile Reinforcement Required	=	0.794	%
Compression Reinforcement is NOT Necessary.			
As Per IS:456-2000, Clause 26.5.1.1.a, Min. Tensile Reinforcement Percentage	=	0.205	%
As Per IS:456-2000, Clause 26.5.1.1.b, Max. Reinforcement Percentage	=	4	%
Area of Tensile Reinforcement	=	474.669	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	2.361	Nos.
No. of Rods Provided	=	3	Nos.
Corresponding Steel Area	=	603.186	sq.mm.

Compression Steel is NOT required. However, 2 Nos. of Rods are provided, irrespective of the size, for holding Stirrups.

Main Rod Size-1	=	16	mm.
No. of Rods Provided	=	2	Nos.
Corresponding Steel Area	=	402.124	sq.mm.

Note:- Please note that the minimum number of Rods provided should be always TWO, even if the number of Rods required is ONE or less. This is to be done during detailing.

B66 : End-2 Max - Shear Output

Shear Force	=	59.966	KN.
Factored Shear	=	59.966	KN.
As Per IS:456-2000, Clause 40.1, Actual Shear Stress	=	1.003	N/sq.mm.
As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.624	N/sq.mm.
As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.
Stirrups have to be Designed for Shear.			
Shear for which Stirrups are Provided	=	22.622	KN.
Stirrup Steel Yield Strength	=	415	N/sq.mm.
No. of Stirrup Legs	=	2	Nos.
Stirrup Rod Diameter-1	=	8	mm.
Spacing of Stirrups Required	=	200	mm.

As per IS:456-2000 Clause 26.5.1.5, if the stirrup spacing exceeds 0.75d or 300 mm., whichever is less, the lesser value will be provided as the Spacing of Stirrups.

B66 : End-2 Min - Flexure Output

Bending Moment	=	14.781	KN m.
Factored Moment	=	14.781	KN m.
Torsional Moment	=	1.066	KN m.
Factored Torsion	=	1.066	KN m.
Overall Depth of Section	=	300	mm.
Bottom Effective Cover	=	40	mm.
Effective Depth	=	260	mm.
Maximum N.A. Ratio	=	0.479	
Total Limiting Moment	=	42.948	KN m.

As Per IS:456-2000, Clause 41.4.2,

Equivalent Torsional Moment	=	1.445	KN m.
Total Design Moment	=	16.226	KN m.
Depth of Neutral Axis	=	40.279	mm.
Tensile Reinforcement Required	=	0.309	%

Compression Reinforcement is NOT Necessary.

As Per IS:456-2000, Clause 26.5.1.1.a,

Min. Tensile Reinforcement Percentage	=	0.205	%
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As Per IS:456-2000, Clause 26.5.1.1.b,

Max. Reinforcement Percentage	=	4	%
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Area of Tensile Reinforcement	=	184.744	sq.mm.
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Main Rod Size-1	=	16	mm.
No. of Rods Required	=	0.919	Nos.
No. of Rods Provided	=	1	Nos.
Corresponding Steel Area	=	201.062	sq.mm.

Compression Steel is NOT required. However, 2 Nos. of Rods are provided, irrespective of the size, for holding Stirrups.

Main Rod Size-1	=	16	mm.
No. of Rods Provided	=	2	Nos.
Corresponding Steel Area	=	402.124	sq.mm.

Note:- Please note that the minimum number of Rods provided should be always TWO, even if the number of Rods required is ONE or less. This is to be done during detailing.

B66 : End-2 Min - Shear Output

Shear Force	=	59.966	KN.
Factored Shear	=	59.966	KN.

As Per IS:456-2000, Clause 41.3.1,

Equivalent Shear due to Torsion	=	67.381	KN.
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As Per IS:456-2000, Clause 40.1,

Actual Shear Stress	=	1.127	N/sq.mm.
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As Per IS:456-2000, Table 19,

Design Shear Strength of Concrete	=	0.407	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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Stirrups have to be Designed for Shear.

Shear for which Stirrups are Provided	=	43.04	KN.
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Stirrup Steel Yield Strength	=	415	N/sq.mm.
No. of Stirrup Legs	=	2	Nos.

Stirrup Rod Diameter-1	=	8	mm.
Spacing of Stirrups Required	=	75	mm.

As per IS:456-2000 Clause 26.5.1.5, if the stirrup spacing exceeds 0.75d or 300 mm., whichever is less, the lesser value will be provided as the Spacing of Stirrups.

B66 : Mid. Max - Flexure Output

Bending Moment	=	14.781	KN m.
Factored Moment	=	14.781	KN m.
Torsional Moment	=	1.066	KN m.
Factored Torsion	=	1.066	KN m.
Overall Depth of Section	=	300	mm.
Bottom Effective Cover	=	40	mm.

Effective Depth	=	260	mm.
Maximum N.A. Ratio	=	0.479	
Total Limiting Moment	=	42.948	KN m.

As Per IS:456-2000, Clause 41.4.2, Equivalent Torsional Moment	=	1.445	KN m.
Total Design Moment	=	16.226	KN m.

Depth of Neutral Axis	=	40.279	mm.
Tensile Reinforcement Required	=	0.309	%

Compression Reinforcement is NOT Necessary.

As Per IS:456-2000, Clause 26.5.1.1.a, Min. Tensile Reinforcement Percentage	=	0.205	%
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As Per IS:456-2000, Clause 26.5.1.1.b, Max. Reinforcement Percentage	=	4	%
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Area of Tensile Reinforcement	=	184.744	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	0.919	Nos.
No. of Rods Provided	=	1	Nos.
Corresponding Steel Area	=	201.062	sq.mm.

Compression Steel is NOT required. However, 2 Nos. of Rods are provided, irrespective of the size, for holding Stirrups.

Main Rod Size-1	=	16	mm.
No. of Rods Provided	=	2	Nos.
Corresponding Steel Area	=	402.124	sq.mm.

Note:- Please note that the minimum number of Rods provided

should be always TWO, even if the number of Rods required is ONE or less. This is to be done during detailing.

B66 : Mid. Max - Shear Output

Shear Force	=	33.765	KN.
Factored Shear	=	33.765	KN.
As Per IS:456-2000, Clause 41.3.1,			
Equivalent Shear due to Torsion	=	41.18	KN.
As Per IS:456-2000, Clause 40.1,			
Actual Shear Stress	=	0.689	N/sq.mm.
As Per IS:456-2000, Table 19,			
Design Shear Strength of Concrete	=	0.407	N/sq.mm.
As Per IS:456-2000, Table 20,			
Max. Permissible Shear Stress	=	2.794	N/sq.mm.
Stirrups have to be Designed for Shear.			
Shear for which Stirrups are Provided	=	16.84	KN.
Stirrup Steel Yield Strength	=	415	N/sq.mm.
No. of Stirrup Legs	=	2	Nos.
Stirrup Rod Diameter-1	=	8	mm.
Spacing of Stirrups Required	=	75	mm.

As per IS:456-2000 Clause 26.5.1.5, if the stirrup spacing exceeds 0.75d or 300 mm., whichever is less, the lesser value will be provided as the Spacing of Stirrups.

B66 : Mid. Min - Flexure Output

Bending Moment	=	0.072	KN m.
Factored Moment	=	0.072	KN m.
Torsional Moment	=	1.066	KN m.
Factored Torsion	=	1.066	KN m.
Overall Depth of Section	=	300	mm.
Bottom Effective Cover	=	40	mm.
Effective Depth	=	260	mm.
Maximum N.A. Ratio	=	0.479	
Total Limiting Moment	=	42.948	KN m.
As Per IS:456-2000, Clause 41.4.2,			
Equivalent Torsional Moment	=	1.445	KN m.
Total Design Moment	=	1.517	KN m.

Factored Torsion is more than Factored Moment.

Additional Moment for Compression Steel	=	0	KN m.
Total Moment for Compression Steel	=	1.372	KN m.
Depth of Neutral Axis	=	3.544	mm.
Tensile Reinforcement Required	=	0.205	%
Compression Reinforcement Required.	=	0.037	%
As Per IS:456-2000, Clause 26.5.1.1.a, Min. Tensile Reinforcement Percentage	=	0.205	%
As Per IS:456-2000, Clause 26.5.1.1.b, Max. Reinforcement Percentage	=	4	%
Area of Tensile Reinforcement	=	122.482	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	0.609	Nos.
No. of Rods Provided	=	1	Nos.
Corresponding Steel Area	=	201.062	sq.mm.
Area of Compression Reinforcement	=	22.297	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	0.111	Nos.
No. of Rods Provided	=	1	Nos.
Corresponding Steel Area	=	201.062	sq.mm.

Note:- Please note that the minimum number of Rods provided should be always TWO, even if the number of Rods required is ONE or less. This is to be done during detailing.

B66 : Mid. Min - Shear Output

Shear Force	=	33.765	KN.
Factored Shear	=	33.765	KN.
As Per IS:456-2000, Clause 41.3.1, Equivalent Shear due to Torsion	=	41.18	KN.
As Per IS:456-2000, Clause 40.1, Actual Shear Stress	=	0.689	N/sq.mm.
As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.407	N/sq.mm.
As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.
Stirrups have to be Designed for Shear.			
Shear for which Stirrups are Provided	=	16.84	KN.
Stirrup Steel Yield Strength	=	415	N/sq.mm.

No. of Stirrup Legs	=	2	Nos.
Stirrup Rod Diameter-1	=	8	mm.
Spacing of Stirrups Required	=	75	mm.
<i>As per IS:456-2000 Clause 26.5.1.5, if the stirrup spacing exceeds 0.75d or 300 mm., whichever is less, the lesser value will be provided as the Spacing of Stirrups.</i>			
B66 : Side Face Steel Output			
Overall Depth of Section	=	300	mm.
As Per IS:456-2000, Clauses 26.5.1.3, 26.5.1.7, Side Face Reinforcement is NOT Required.			
B66 : Deflection Check Output			
Type of Beam	=	Ends	Fixed or Continuous
Effective Span of Beam	=	3	m.
Effective Depth of Beam	=	260	mm.
Actual Span to Depth Ratio	=	11.538	
As Per IS:456-2000, Clause 23.2.1.a, Factor Alpha	=	26	
As Per IS:456-2000, Clause 23.2.1.b, Factor Zigma	=	1	
As Per IS:456-2000, Clause 23.2.1.c, Factor Gamma	=	1.42	
As Per IS:456-2000, Clause 23.2.1.d, Factor Delta	=	1	
As Per IS:456-2000, Clause 23.2.1.e, Factor Lamda	=	1	
Allowable Span to Depth Ratio	=	36.921	
Deflection Requirements are O.K.			
B66 : Deep Beam Check Output			
Effective Span of Beam	=	3	m.
Overall Depth	=	300	mm.
Effective Span to Depth Ratio	=	10	
Minimum Value for the above	=	2.5	
As Per IS:456-2000, Clause 29.1, this Beam is NOT a Deep Beam.			
B66 : Slender Beam Check Output			
Clear Distance between Lateral Restraints	=	3	m.

Allowable Value for the above = 13.8 m.

As Per IS:456-2000, Clause 23.3,
this Beam is NOT a Slender Beam.

Note :-

Actually, the clear distance between lateral restraints has to be taken as against the effective span. But, the effective span is taken for simplifying the calculations. In fact, it's more safe to consider the effective span rather than the clear distance.

B67 : Global Input Data

Effective Span	=	5	m.
Section Type	=	Rectangular	
Width of Web	=	230	mm.
Overall Depth	=	450	mm.
Effective Cover at Top	=	55	mm.
Effective Cover at Bottom	=	55	mm.
Number of Stirrup Legs	=	2	Nos.
Max. Bending Moment at End-1	=	71.369	KN m.
Min. Bending Moment at End-1	=	-29.968	KN m.
Max. Bending Moment at End-2	=	122.376	KN m.
Min. Bending Moment at End-2	=	-54.753	KN m.
Max. Bending Moment at Middle	=	0	KN m.
Min. Bending Moment at Middle	=	-54.753	KN m.
Max. Shear Force at Left	=	99.041	KN.
Max. Shear Force at Right	=	119.444	KN.
Max. Torsional Moment	=	1.202	KN m.
Ignore Torsion Limit	=	10	%

If Torsion is less than the above % of the Bending Moment at each Section, it will be ignored for the Design. This is a User-controlled feature.

B67 : End-1 Max - Flexure Output

Bending Moment	=	71.369	KN m.
Factored Moment	=	71.369	KN m.
Overall Depth of Section	=	450	mm.
Bottom Effective Cover	=	55	mm.
Effective Depth	=	395	mm.
Maximum N.A. Ratio	=	0.479	
Total Limiting Moment	=	99.127	KN m.
Total Design Moment	=	71.369	KN m.
Depth of Neutral Axis	=	125.756	mm.
Tensile Reinforcement Required	=	0.635	%

Compression Reinforcement is NOT Necessary.

As Per IS:456-2000, Clause 26.5.1.1.a,

Min. Tensile Reinforcement Percentage	=	0.205	%
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As Per IS:456-2000, Clause 26.5.1.1.b,

Max. Reinforcement Percentage	=	4	%
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Area of Tensile Reinforcement	=	576.795	sq.mm.
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Main Rod Size-1	=	16	mm.
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No. of Rods Required	=	2.869	Nos.
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No. of Rods Provided	=	3	Nos.
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Corresponding Steel Area	=	603.186	sq.mm.
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Compression Steel is NOT required. However, 2 Nos. of Rods are provided, irrespective of the size, for holding Stirrups.

Main Rod Size-1	=	16	mm.
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No. of Rods Provided	=	2	Nos.
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Corresponding Steel Area	=	402.124	sq.mm.
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Note:- Please note that the minimum number of Rods provided should be always TWO, even if the number of Rods required is ONE or less. This is to be done during detailing.

B67 : End-1 Max - Shear Output

Shear Force	=	99.041	KN.
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Factored Shear	=	99.041	KN.
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As Per IS:456-2000, Clause 40.1,

Actual Shear Stress	=	1.09	N/sq.mm.
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As Per IS:456-2000, Table 19,

Design Shear Strength of Concrete	=	0.535	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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Stirrups have to be Designed for Shear.

Shear for which Stirrups are Provided	=	50.472	KN.
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Stirrup Steel Yield Strength	=	415	N/sq.mm.
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No. of Stirrup Legs	=	2	Nos.
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Stirrup Rod Diameter-1	=	8	mm.
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Spacing of Stirrups Required	=	250	mm.
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As per IS:456-2000 Clause 26.5.1.5, if the stirrup spacing exceeds 0.75d or 300 mm., whichever is less, the lesser value will be provided as the Spacing of Stirrups.

B67 : End-1 Min - Flexure Output

Bending Moment	=	29.968	KN m.
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Factored Moment	=	29.968	KN m.
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Torsional Moment	=	1.202	KN m.
Factored Torsion	=	1.202	KN m.
Overall Depth of Section	=	450	mm.
Bottom Effective Cover	=	55	mm.
Effective Depth	=	395	mm.
Maximum N.A. Ratio	=	0.479	
Total Limiting Moment	=	99.127	KN m.
As Per IS:456-2000, Clause 41.4.2,			
Equivalent Torsional Moment	=	2.09	KN m.
Total Design Moment	=	32.059	KN m.
Depth of Neutral Axis	=	51.838	mm.
Tensile Reinforcement Required	=	0.262	%

Compression Reinforcement is NOT Necessary.

As Per IS:456-2000, Clause 26.5.1.1.a,			
Min. Tensile Reinforcement Percentage	=	0.205	%

As Per IS:456-2000, Clause 26.5.1.1.b,			
Max. Reinforcement Percentage	=	4	%

Area of Tensile Reinforcement	=	237.762	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	1.183	Nos.
No. of Rods Provided	=	1	Nos.
Corresponding Steel Area	=	201.062	sq.mm.

Compression Steel is NOT required. However, 2 Nos. of Rods are provided, irrespective of the size, for holding Stirrups.

Main Rod Size-1	=	16	mm.
No. of Rods Provided	=	2	Nos.
Corresponding Steel Area	=	402.124	sq.mm.

Note:- Please note that the minimum number of Rods provided should be always TWO, even if the number of Rods required is ONE or less. This is to be done during detailing.

B67 : End-1 Min - Shear Output

Shear Force	=	99.041	KN.
Factored Shear	=	99.041	KN.

As Per IS:456-2000, Clause 41.3.1,			
Equivalent Shear due to Torsion	=	107.403	KN.

As Per IS:456-2000, Clause 40.1,

Actual Shear Stress	=	1.182	N/sq.mm.
As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.341	N/sq.mm.
As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.
Stirrups have to be Designed for Shear.			
Shear for which Stirrups are Provided	=	76.434	KN.
Stirrup Steel Yield Strength	=	415	N/sq.mm.
No. of Stirrup Legs	=	2	Nos.
Stirrup Rod Diameter-1	=	8	mm.
Spacing of Stirrups Required	=	125	mm.

As per IS:456-2000 Clause 26.5.1.5, if the stirrup spacing exceeds 0.75d or 300 mm., whichever is less, the lesser value will be provided as the Spacing of Stirrups.

B67 : End-2 Max - Flexure Output

Bending Moment	=	122.376	KN m.
Factored Moment	=	122.376	KN m.
Overall Depth of Section	=	450	mm.
Bottom Effective Cover	=	55	mm.
Effective Depth	=	395	mm.
Maximum N.A. Ratio	=	0.479	
Total Limiting Moment	=	99.127	KN m.
Total Design Moment	=	122.376	KN m.
Moment for Compression Steel	=	23.249	KN m.
Depth of Neutral Axis	=	189.254	mm.
Tensile Reinforcement Required	=	1.164	%
Compression Reinforcement Required.	=	0.224	%
As Per IS:456-2000, Clause 26.5.1.1.a, Min. Tensile Reinforcement Percentage	=	0.205	%
As Per IS:456-2000, Clause 26.5.1.1.b, Max. Reinforcement Percentage	=	4	%
Area of Tensile Reinforcement	=	1057.522	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	5.26	Nos.
No. of Rods Provided	=	6	Nos.

Corresponding Steel Area	=	1206.372	sq.mm.
Area of Compression Reinforcement	=	203.662	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	1.013	Nos.
No. of Rods Provided	=	1	Nos.
Corresponding Steel Area	=	201.062	sq.mm.

Note:- Please note that the minimum number of Rods provided should be always TWO, even if the number of Rods required is ONE or less. This is to be done during detailing.

B67 : End-2 Max - Shear Output

Shear Force	=	119.444	KN.
Factored Shear	=	119.444	KN.
As Per IS:456-2000, Clause 40.1,			
Actual Shear Stress	=	1.315	N/sq.mm.
As Per IS:456-2000, Table 19,			
Design Shear Strength of Concrete	=	0.687	N/sq.mm.
As Per IS:456-2000, Table 20,			
Max. Permissible Shear Stress	=	2.794	N/sq.mm.
Stirrups have to be Designed for Shear.			
Shear for which Stirrups are Provided	=	56.99	KN.
Stirrup Steel Yield Strength	=	415	N/sq.mm.
No. of Stirrup Legs	=	2	Nos.
Stirrup Rod Diameter-1	=	8	mm.
Spacing of Stirrups Required	=	250	mm.

As per IS:456-2000 Clause 26.5.1.5, if the stirrup spacing exceeds 0.75d or 300 mm., whichever is less, the lesser value will be provided as the Spacing of Stirrups.

B67 : End-2 Min - Flexure Output

Bending Moment	=	54.753	KN m.
Factored Moment	=	54.753	KN m.
Torsional Moment	=	1.202	KN m.
Factored Torsion	=	1.202	KN m.
Overall Depth of Section	=	450	mm.
Bottom Effective Cover	=	55	mm.
Effective Depth	=	395	mm.
Maximum N.A. Ratio	=	0.479	
Total Limiting Moment	=	99.127	KN m.

As Per IS:456-2000, Clause 41.4.2, Equivalent Torsional Moment	=	2.09	KN m.
Total Design Moment	=	56.843	KN m.
Depth of Neutral Axis	=	96.754	mm.
Tensile Reinforcement Required	=	0.488	%
Compression Reinforcement is NOT Necessary.			

As Per IS:456-2000, Clause 26.5.1.1.a, Min. Tensile Reinforcement Percentage	=	0.205	%
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As Per IS:456-2000, Clause 26.5.1.1.b, Max. Reinforcement Percentage	=	4	%
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Area of Tensile Reinforcement	=	443.775	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	2.207	Nos.
No. of Rods Provided	=	3	Nos.
Corresponding Steel Area	=	603.186	sq.mm.

Compression Steel is NOT required. However, 2 Nos. of Rods are provided, irrespective of the size, for holding Stirrups.

Main Rod Size-1	=	16	mm.
No. of Rods Provided	=	2	Nos.
Corresponding Steel Area	=	402.124	sq.mm.

Note:- Please note that the minimum number of Rods provided should be always TWO, even if the number of Rods required is ONE or less. This is to be done during detailing.

B67 : End-2 Min - Shear Output

Shear Force	=	119.444	KN.
Factored Shear	=	119.444	KN.
As Per IS:456-2000, Clause 41.3.1, Equivalent Shear due to Torsion	=	127.805	KN.
As Per IS:456-2000, Clause 40.1, Actual Shear Stress	=	1.407	N/sq.mm.
As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.535	N/sq.mm.
As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.
Stirrups have to be Designed for Shear.			
Shear for which Stirrups are Provided	=	79.236	KN.

Stirrup Steel Yield Strength	=	415	N/sq.mm.
No. of Stirrup Legs	=	2	Nos.
Stirrup Rod Diameter-1	=	8	mm.
Spacing of Stirrups Required	=	125	mm.

As per IS:456-2000 Clause 26.5.1.5, if the stirrup spacing exceeds 0.75d or 300 mm., whichever is less, the lesser value will be provided as the Spacing of Stirrups.

B67 : Mid. Max - Flexure Output

Bending Moment	=	54.753	KN m.
Factored Moment	=	54.753	KN m.
Torsional Moment	=	1.202	KN m.
Factored Torsion	=	1.202	KN m.
Overall Depth of Section	=	450	mm.
Bottom Effective Cover	=	55	mm.
Effective Depth	=	395	mm.
Maximum N.A. Ratio	=	0.479	
Total Limiting Moment	=	99.127	KN m.

As Per IS:456-2000, Clause 41.4.2,

Equivalent Torsional Moment	=	2.09	KN m.
Total Design Moment	=	56.843	KN m.
Depth of Neutral Axis	=	96.754	mm.
Tensile Reinforcement Required	=	0.488	%

Compression Reinforcement is NOT Necessary.

As Per IS:456-2000, Clause 26.5.1.1.a,

Min. Tensile Reinforcement Percentage	=	0.205	%
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As Per IS:456-2000, Clause 26.5.1.1.b,

Max. Reinforcement Percentage	=	4	%
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Area of Tensile Reinforcement	=	443.775	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	2.207	Nos.
No. of Rods Provided	=	3	Nos.
Corresponding Steel Area	=	603.186	sq.mm.

Compression Steel is NOT required. However, 2 Nos. of Rods are provided, irrespective of the size, for holding Stirrups.

Main Rod Size-1	=	16	mm.
No. of Rods Provided	=	2	Nos.
Corresponding Steel Area	=	402.124	sq.mm.

Note:- Please note that the minimum number of Rods provided should be always TWO, even if the number of Rods required is ONE or less. This is to be done during detailing.

B67 : Mid. Max - Shear Output

Shear Force	=	69.784	KN.
Factored Shear	=	69.784	KN.
As Per IS:456-2000, Clause 41.3.1,			
Equivalent Shear due to Torsion	=	78.145	KN.
As Per IS:456-2000, Clause 40.1,			
Actual Shear Stress	=	0.86	N/sq.mm.
As Per IS:456-2000, Table 19,			
Design Shear Strength of Concrete	=	0.535	N/sq.mm.
As Per IS:456-2000, Table 20,			
Max. Permissible Shear Stress	=	2.794	N/sq.mm.
Stirrups have to be Designed for Shear.			
Shear for which Stirrups are Provided	=	29.575	KN.
Stirrup Steel Yield Strength	=	415	N/sq.mm.
No. of Stirrup Legs	=	2	Nos.
Stirrup Rod Diameter-1	=	8	mm.
Spacing of Stirrups Required	=	125	mm.

As per IS:456-2000 Clause 26.5.1.5, if the stirrup spacing exceeds $0.75d$ or 300 mm. , whichever is less, the lesser value will be provided as the Spacing of Stirrups.

B67 : Side Face Steel Output

Overall Depth of Section	=	450	mm.
As Per IS:456-2000, Clauses 26.5.1.3, 26.5.1.7,			
Side Face Reinforcement is Required.			
Area of Reinforcement per Face	=	51.75	sq.mm.
Spacing of such Rods along the face	=	230	mm. or Less.
Dia of Side face Rods (assumed)	=	10	mm.
No. of Side face Rods on Each Face	=	1	Nos.
Actual Spacing of Side face Rods	=	192	mm.

B67 : Deflection Check Output

Type of Beam	=	Ends	Fixed or Continuous
Effective Span of Beam	=	5	m.
Effective Depth of Beam	=	395	mm.
Actual Span to Depth Ratio	=	12.658	

As Per IS:456-2000, Clause 23.2.1.a, Factor Alpha	=	26
As Per IS:456-2000, Clause 23.2.1.b, Factor Zigma	=	1
As Per IS:456-2000, Clause 23.2.1.c, Factor Gamma	=	1.125
As Per IS:456-2000, Clause 23.2.1.d, Factor Delta	=	1
As Per IS:456-2000, Clause 23.2.1.e, Factor Lamda	=	1
Allowable Span to Depth Ratio	=	29.25

Deflection Requirements are O.K.

B67 : Deep Beam Check Output

Effective Span of Beam	=	5 m.
Overall Depth	=	450 mm.
Effective Span to Depth Ratio	=	11.111
Minimum Value for the above	=	2.5

As Per IS:456-2000, Clause 29.1,
this Beam is NOT a Deep Beam.

B67 : Slender Beam Check Output

Clear Distance between Lateral Restraints	=	5 m.
Allowable Value for the above	=	13.8 m.

As Per IS:456-2000, Clause 23.3,
this Beam is NOT a Slender Beam.

Note :-

Actually, the clear distance between lateral restraints has to be taken as against the effective span. But, the effective span is taken for simplifying the calculations. In fact, it's more safe to consider the effective span rather than the clear distance.

B68 : Global Input Data

Effective Span	=	7	m.
Section Type	=	Rectangular	
Width of Web	=	230	mm.
Overall Depth	=	600	mm.
Effective Cover at Top	=	70	mm.
Effective Cover at Bottom	=	70	mm.
Number of Stirrup Legs	=	2	Nos.
Max. Bending Moment at End-1	=	215.204	KN m.
Min. Bending Moment at End-1	=	-46.869	KN m.
Max. Bending Moment at End-2	=	153.725	KN m.
Min. Bending Moment at End-2	=	-134.659	KN m.
Max. Bending Moment at Middle	=	0	KN m.
Min. Bending Moment at Middle	=	-134.659	KN m.
Max. Shear Force at Left	=	175.841	KN.
Max. Shear Force at Right	=	158.275	KN.
Max. Torsional Moment	=	1.082	KN m.
Ignore Torsion Limit	=	10	%

If Torsion is less than the above % of the Bending Moment at each Section, it will be ignored for the Design. This is a User-controlled feature.

B68 : End-1 Max - Flexure Output

Bending Moment	=	215.204	KN m.
Factored Moment	=	215.204	KN m.
Overall Depth of Section	=	600	mm.
Bottom Effective Cover	=	70	mm.
Effective Depth	=	530	mm.
Maximum N.A. Ratio	=	0.479	
Total Limiting Moment	=	178.464	KN m.
Total Design Moment	=	215.204	KN m.
Moment for Compression Steel	=	36.74	KN m.
Depth of Neutral Axis	=	253.935	mm.
Tensile Reinforcement Required	=	1.137	%

Compression Reinforcement Required.	=	0.194	%
As Per IS:456-2000, Clause 26.5.1.1.a, Min. Tensile Reinforcement Percentage	=	0.205	%
As Per IS:456-2000, Clause 26.5.1.1.b, Max. Reinforcement Percentage	=	4	%
Area of Tensile Reinforcement	=	1386.031	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	6.894	Nos.
No. of Rods Provided	=	7	Nos.
Corresponding Steel Area	=	1407.434	sq.mm.
Area of Compression Reinforcement	=	236.933	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	1.178	Nos.
No. of Rods Provided	=	1	Nos.
Corresponding Steel Area	=	201.062	sq.mm.

Note:- Please note that the minimum number of Rods provided should be always TWO, even if the number of Rods required is ONE or less. This is to be done during detailing.

B68 : End-1 Max - Shear Output

Shear Force	=	175.841	KN.
Factored Shear	=	175.841	KN.
As Per IS:456-2000, Clause 40.1, Actual Shear Stress	=	1.443	N/sq.mm.
As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.655	N/sq.mm.
As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.
Stirrups have to be Designed for Shear.			
Shear for which Stirrups are Provided	=	95.986	KN.
Stirrup Steel Yield Strength	=	415	N/sq.mm.
No. of Stirrup Legs	=	2	Nos.
Stirrup Rod Diameter-1	=	8	mm.
Spacing of Stirrups Required	=	200	mm.

As per IS:456-2000 Clause 26.5.1.5, if the stirrup spacing exceeds 0.75d or 300 mm., whichever is less, the lesser value will be provided as the Spacing of Stirrups.

B68 : End-1 Min - Flexure Output

Bending Moment	=	46.869	KN m.
Factored Moment	=	46.869	KN m.
Torsional Moment	=	1.082	KN m.
Factored Torsion	=	1.082	KN m.

Overall Depth of Section	=	600	mm.
Bottom Effective Cover	=	70	mm.

Effective Depth	=	530	mm.
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Maximum N.A. Ratio	=	0.479	
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Total Limiting Moment	=	178.464	KN m.
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As Per IS:456-2000, Clause 41.4.2,

Equivalent Torsional Moment	=	2.298	KN m.
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Total Design Moment	=	49.166	KN m.
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Depth of Neutral Axis	=	58.723	mm.
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Tensile Reinforcement Required	=	0.221	%
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Compression Reinforcement is NOT Necessary.

As Per IS:456-2000, Clause 26.5.1.1.a,

Min. Tensile Reinforcement Percentage	=	0.205	%
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As Per IS:456-2000, Clause 26.5.1.1.b,

Max. Reinforcement Percentage	=	4	%
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Area of Tensile Reinforcement	=	269.339	sq.mm.
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Main Rod Size-1	=	16	mm.
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No. of Rods Required	=	1.34	Nos.
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No. of Rods Provided	=	2	Nos.
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Corresponding Steel Area	=	402.124	sq.mm.
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Compression Steel is NOT required. However, 2 Nos. of Rods are provided, irrespective of the size, for holding Stirrups.

Main Rod Size-1	=	16	mm.
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No. of Rods Provided	=	2	Nos.
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Corresponding Steel Area	=	402.124	sq.mm.
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Note:- Please note that the minimum number of Rods provided should be always TWO, even if the number of Rods required is ONE or less. This is to be done during detailing.

B68 : End-1 Min - Shear Output

Shear Force	=	175.841	KN.
Factored Shear	=	175.841	KN.

As Per IS:456-2000, Clause 41.3.1,

Equivalent Shear due to Torsion	=	183.371	KN.
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As Per IS:456-2000, Clause 40.1,

Actual Shear Stress	=	1.504	N/sq.mm.
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As Per IS:456-2000, Table 19,

Design Shear Strength of Concrete	=	0.404	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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Stirrups have to be Designed for Shear.

Shear for which Stirrups are Provided	=	134.146	KN.
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Stirrup Steel Yield Strength	=	415	N/sq.mm.
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No. of Stirrup Legs	=	2	Nos.
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Stirrup Rod Diameter-1	=	8	mm.
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Spacing of Stirrups Required	=	125	mm.
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As per IS:456-2000 Clause 26.5.1.5, if the stirrup spacing exceeds 0.75d or 300 mm., whichever is less, the lesser value will be provided as the Spacing of Stirrups.

B68 : End-2 Max - Flexure Output

Bending Moment	=	153.725	KN m.
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Factored Moment	=	153.725	KN m.
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Overall Depth of Section	=	600	mm.
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Bottom Effective Cover	=	70	mm.
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Effective Depth	=	530	mm.
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Maximum N.A. Ratio	=	0.479	
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Total Limiting Moment	=	178.464	KN m.
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Total Design Moment	=	153.725	KN m.
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Depth of Neutral Axis	=	209.63	mm.
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Tensile Reinforcement Required	=	0.789	%
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Compression Reinforcement is NOT Necessary.

As Per IS:456-2000, Clause 26.5.1.1.a,

Min. Tensile Reinforcement Percentage	=	0.205	%
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As Per IS:456-2000, Clause 26.5.1.1.b,

Max. Reinforcement Percentage	=	4	%
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Area of Tensile Reinforcement	=	961.495	sq.mm.
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Main Rod Size-1	=	16	mm.
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No. of Rods Required	=	4.782	Nos.
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No. of Rods Provided	=	5	Nos.
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Corresponding Steel Area = 1005.31 sq.mm.

Compression Steel is NOT required. However, 2 Nos. of Rods are provided, irrespective of the size, for holding Stirrups.

Main Rod Size-1 = 16 mm.
No. of Rods Provided = 2 Nos.
Corresponding Steel Area = 402.124 sq.mm.

Note:- Please note that the minimum number of Rods provided should be always TWO, even if the number of Rods required is ONE or less. This is to be done during detailing.

B68 : End-2 Max - Shear Output

Shear Force = 158.275 KN.
Factored Shear = 158.275 KN.

As Per IS:456-2000, Clause 40.1,
Actual Shear Stress = 1.298 N/sq.mm.

As Per IS:456-2000, Table 19,
Design Shear Strength of Concrete = 0.58 N/sq.mm.

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

Stirrups have to be Designed for Shear.

Shear for which Stirrups are Provided = 87.546 KN.

Stirrup Steel Yield Strength = 415 N/sq.mm.
No. of Stirrup Legs = 2 Nos.

Stirrup Rod Diameter-1 = 8 mm.
Spacing of Stirrups Required = 200 mm.

As per IS:456-2000 Clause 26.5.1.5, if the stirrup spacing exceeds 0.75d or 300 mm., whichever is less, the lesser value will be provided as the Spacing of Stirrups.

B68 : End-2 Min - Flexure Output

Bending Moment = 134.659 KN m.
Factored Moment = 134.659 KN m.

Torsional Moment = 1.082 KN m.
Factored Torsion = 1.082 KN m.

Overall Depth of Section = 600 mm.
Bottom Effective Cover = 70 mm.

Effective Depth = 530 mm.

Maximum N.A. Ratio = 0.479

Total Limiting Moment = 178.464 KN m.

As Per IS:456-2000, Clause 41.4.2, Equivalent Torsional Moment	=	2.298	KN m.
Total Design Moment	=	136.957	KN m.
Depth of Neutral Axis	=	182.047	mm.
Tensile Reinforcement Required	=	0.685	%

Compression Reinforcement is NOT Necessary.

As Per IS:456-2000, Clause 26.5.1.1.a, Min. Tensile Reinforcement Percentage	=	0.205	%
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As Per IS:456-2000, Clause 26.5.1.1.b, Max. Reinforcement Percentage	=	4	%
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Area of Tensile Reinforcement	=	834.982	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	4.153	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	804.248	sq.mm.

Compression Steel is NOT required. However, 2 Nos. of Rods are provided, irrespective of the size, for holding Stirrups.

Main Rod Size-1	=	16	mm.
No. of Rods Provided	=	2	Nos.
Corresponding Steel Area	=	402.124	sq.mm.

Note:- Please note that the minimum number of Rods provided should be always TWO, even if the number of Rods required is ONE or less. This is to be done during detailing.

B68 : End-2 Min - Shear Output

Shear Force	=	158.275	KN.
Factored Shear	=	158.275	KN.
As Per IS:456-2000, Clause 41.3.1, Equivalent Shear due to Torsion	=	165.805	KN.
As Per IS:456-2000, Clause 40.1, Actual Shear Stress	=	1.36	N/sq.mm.
As Per IS:456-2000, Table 19, Design Shear Strength of Concrete	=	0.533	N/sq.mm.
As Per IS:456-2000, Table 20, Max. Permissible Shear Stress	=	2.794	N/sq.mm.
Stirrups have to be Designed for Shear.			
Shear for which Stirrups are Provided	=	100.794	KN.

Stirrup Steel Yield Strength	=	415	N/sq.mm.
No. of Stirrup Legs	=	2	Nos.
Stirrup Rod Diameter-1	=	8	mm.
Spacing of Stirrups Required	=	150	mm.

As per IS:456-2000 Clause 26.5.1.5, if the stirrup spacing exceeds 0.75d or 300 mm., whichever is less, the lesser value will be provided as the Spacing of Stirrups.

B68 : Mid. Max - Flexure Output

Bending Moment	=	134.659	KN m.
Factored Moment	=	134.659	KN m.
Torsional Moment	=	1.082	KN m.
Factored Torsion	=	1.082	KN m.
Overall Depth of Section	=	600	mm.
Bottom Effective Cover	=	70	mm.
Effective Depth	=	530	mm.
Maximum N.A. Ratio	=	0.479	
Total Limiting Moment	=	178.464	KN m.

As Per IS:456-2000, Clause 41.4.2,

Equivalent Torsional Moment	=	2.298	KN m.
Total Design Moment	=	136.957	KN m.
Depth of Neutral Axis	=	182.047	mm.
Tensile Reinforcement Required	=	0.685	%

Compression Reinforcement is NOT Necessary.

As Per IS:456-2000, Clause 26.5.1.1.a,

Min. Tensile Reinforcement Percentage	=	0.205	%
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As Per IS:456-2000, Clause 26.5.1.1.b,

Max. Reinforcement Percentage	=	4	%
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Area of Tensile Reinforcement	=	834.982	sq.mm.
Main Rod Size-1	=	16	mm.
No. of Rods Required	=	4.153	Nos.
No. of Rods Provided	=	4	Nos.
Corresponding Steel Area	=	804.248	sq.mm.

Compression Steel is NOT required. However, 2 Nos. of Rods are provided, irrespective of the size, for holding Stirrups.

Main Rod Size-1	=	16	mm.
No. of Rods Provided	=	2	Nos.
Corresponding Steel Area	=	402.124	sq.mm.

Note:- Please note that the minimum number of Rods provided should be always TWO, even if the number of Rods required is ONE or less. This is to be done during detailing.

B68 : Mid. Max - Shear Output

Shear Force	=	97.926	KN.
Factored Shear	=	97.926	KN.
As Per IS:456-2000, Clause 41.3.1,			
Equivalent Shear due to Torsion	=	105.456	KN.
As Per IS:456-2000, Clause 40.1,			
Actual Shear Stress	=	0.865	N/sq.mm.
As Per IS:456-2000, Table 19,			
Design Shear Strength of Concrete	=	0.533	N/sq.mm.
As Per IS:456-2000, Table 20,			
Max. Permissible Shear Stress	=	2.794	N/sq.mm.
Stirrups have to be Designed for Shear.			
Shear for which Stirrups are Provided	=	40.445	KN.
Stirrup Steel Yield Strength	=	415	N/sq.mm.
No. of Stirrup Legs	=	2	Nos.
Stirrup Rod Diameter-1	=	8	mm.
Spacing of Stirrups Required	=	150	mm.

As per IS:456-2000 Clause 26.5.1.5, if the stirrup spacing exceeds $0.75d$ or 300 mm. , whichever is less, the lesser value will be provided as the Spacing of Stirrups.

B68 : Side Face Steel Output

Overall Depth of Section	=	600	mm.
As Per IS:456-2000, Clauses 26.5.1.3, 26.5.1.7,			
Side Face Reinforcement is Required.			
Area of Reinforcement per Face	=	69	sq.mm.
Spacing of such Rods along the face	=	230	mm. or Less.
Dia of Side face Rods (assumed)	=	8	mm.
No. of Side face Rods on Each Face	=	2	Nos.
Actual Spacing of Side face Rods	=	178	mm.

B68 : Deflection Check Output

Type of Beam	=	Ends	Fixed or Continuous
Effective Span of Beam	=	7	m.
Effective Depth of Beam	=	530	mm.
Actual Span to Depth Ratio	=	13.208	

As Per IS:456-2000, Clause 23.2.1.a, Factor Alpha	=	26
As Per IS:456-2000, Clause 23.2.1.b, Factor Zigma	=	1
As Per IS:456-2000, Clause 23.2.1.c, Factor Gamma	=	1.127
As Per IS:456-2000, Clause 23.2.1.d, Factor Delta	=	1
As Per IS:456-2000, Clause 23.2.1.e, Factor Lamda	=	1
Allowable Span to Depth Ratio	=	29.307

Deflection Requirements are O.K.

B68 : Deep Beam Check Output

Effective Span of Beam	=	7 m.
Overall Depth	=	600 mm.
Effective Span to Depth Ratio	=	11.667
Minimum Value for the above	=	2.5

As Per IS:456-2000, Clause 29.1,
this Beam is NOT a Deep Beam.

B68 : Slender Beam Check Output

Clear Distance between Lateral Restraints	=	7 m.
Allowable Value for the above	=	13.8 m.

As Per IS:456-2000, Clause 23.3,
this Beam is NOT a Slender Beam.

Note :-

Actually, the clear distance between lateral restraints has to be taken as against the effective span. But, the effective span is taken for simplifying the calculations. In fact, it's more safe to consider the effective span rather than the clear distance.