Design of Box Bridge of 2X6.23m clear span with 2.0m height aligned in Stright

A1 Basic design parameters for structural design of RCC box culvert .

A1.1 **Basis**

Basic design criteria have been prepared with a view to satisfy all the relevant technical requirements specified in the contract.

A1.2 **Structure Description**

The box culvert consists of one span RCC box of clear span 2X6.23 m & Clear height of 2.2m aligned

A1.3 **Material :**

a) Grades of concrete are as follows:

i)	Foundation	:M35
ii)	Substructure	:M35
iii)	Superstructure	:M35

b) Grade of Reinforcement :Fe-500D

A1.4 **LOADS :**

a) Unit Weight of Materials :

i)	Unit weight of RCC substructure & foundatioı	=	25.0 KN/m^3
ii)	Unit weight of Structural steel	=	78.5 KN/m^3
iii)	Unit weight of Wearing course	=	22.0 KN/m^3
iv)	Unit weight of Earth	=	20.0 KN/m^3

b) Dead Load (SW) :

Selfweight of RCC deck, wall & base slab have been considered for analysis & design of structure.

c)Super Imposed Dead Load (SIDL) :

Weight of BC+DBM, parapets have been calculated and applied

as UDL
on deck
slab.

d) Live Load (LL) :

Normal overall culvert width is 10.5m,

Excluding two outer parapet width of 2x0.5=1.0m ,the clear structure width is 11.0m.

As per IRC : 6 :2017, Live loads on three lane carriageway superstructure are as follows:

i) Single lane of 70R wheeled and Single lane ‹ or
ii) Single lane of 70R Tracked and Single lane cl or
ii) Three lane class-A, whichever governs

e) Impact (IL)

Impact factor of live load has been calculated as per IRC: 6-2017

f) Braking Force (BR F)

Braking has been calculated as per IRC: 6-2017
Braking force = 0.20 x First vehicle + 0.05 x Succeeding Vehicle

g) Earth Pressure (EP) :

Value of f for backfill = 30 deg Value of d of backfill = 20 deg
Active earth pressure Co-efficient has been calculated as per Coulomb's formula.
It is used in trough design.Earth pressure at rest as per clause no. 214.1.3 IRC :6-2017 is considered in box design.Neglect the vertical component active earth pressure and Passive earth pressure resistance.

h) Wind Load (WL)

Wind Loads has been calculated as per clause 212 of IRC: 6-2017. For buried structure, wind Loads need not be considered.

i) Seismic Load (EQ)
Earthquake Loads has been calculated as per IS:1893 and IRC: 6-2017.
Project is located in earthquake zone III. Horizontal seismic forces has been computed as per clause no. 219.2 of IRC : 6-2017 for zone III.

z = zone factor =	For Zone III	= 0.16	I = Importance factor	= 1.20
R = Response Reduction fa	= 2.50		S_a/g =	= 2.50

As for small span culvert no seismic forces are considered in design.

j) Water current force (Fwc)
In general, water current force is calculated as per clause no. 210 of IRC:6-2017 based on design hydrology for the particular structure. For box structure, obstructed area of substructure and foundation are negligible and the transverse rigidity is much more compare to longitudinal rigidity.So, water current force for box structure need not be considered.

k) Force due to Support Settlement (SS)
For box structure, forces due to differential settlement of supports need not be considered.

l) Temperature Load (TL)
Force due to temperature rise & fall has been considered in Box analysis & Design.

m) Load & Load Combination (LC)
The following loads shall be considered for design
LOAD 1: Selfweight (SW)
LOAD 2: Surfacing or SIDL (SIDL)
LOAD 3: Earth pressure in dry condition in both side (EP(BS))
LOAD 4: Maximum live load (LL)
LOAD 5: Live load surcharge both side (SUR(BS))
LOAD 6: Live load surcharge Left side (SUR(LS))
LOAD 7: Live load surcharge Right side (SUR(RS))
LOAD 8: Braking left side (BR F (LS)
LOAD 9: Braking Right side (BR F (RS))
LOAD 10: Tempareture load uniform rise (TUR)
LOAD 11: Tempareture load uniform fall (TUF)
LOAD 12: Tempareture load Gradient rise (TGR)
LOAD 13: Tempareture load Gradient fall (TGF)

For Various load combinations are analysed in staad input file as per IRC 6:2017
Load Combinations for base pressure check: Unfactored loads are considered.
Load combination 101 TO 118.
Load Combinations for ULS Strength check: As per Table-3.2 Column 2.
Load combination 119 TO 129.
Load Combinations for SLS Crack check: As per Table-3.3 Column 4.
Load combination 130 TO 147.
Load Combinations for SLS Stress check: As per Table-3.3 Column 2.
Load combination 148 TO 204.

A1.6 **Analysis**

Dead load, SIDL, Live load , live load surcharge - force analyses for box structure have been done by staad pro and in excel spreadsheet.

A1.7 **Construction Methodology**

Cast-in Situ construction shall be adopted for Box construction.
Cast-in-situ construction shall also be adopted RCC wing wall

A1.8 **Referrance codes & books**

1) IRC: 5-2015
2) IRC: 6-2017
3) IRC: 78-2014
4) IRC: 112-2011

DESIGN OF BOX CULVERT FOR 2X6.23m SPAN

1.1 Input Data

Density of concrete				=	25	KN/m^3
Density of dry soil				=	15	KN/m^3
Density of wearing coat				=	22	KN/m^3
Coefficient of active earth pressure				=	0.5	
Skew angle					0	degree
Size of Box	Size of Box			=	2X6.23X2.0	m
	Clear span			=	6.23	m
	Clear span in skew			=	6.23	m
	Opening	Height		=	2.00	m
	thk. of	Wall		=	0.400	m
		intermediate wall		=	0.300	m
		Top slab		=	0.400	m
		Bottom slab		=	0.450	m
		Haunch		=	0.150	m
		Skew		=	0	deg
		FRL	Right	=	2.9	m
			Left	=	2.9	m
		Soffit level		=	2.450	m
		Invert	Right	=	0.000	m
			Left	=	0.000	m
		Camber Slope		=	2.5%	
Total Width of Box for Design				=	1	m
Total Width				=	12	m
Thickness of wearing coat				=	0.15	m
Effective Span				=	6.23	m
Thickness of Profile corrective course				=	0.00	m
Thickness of earth fill				=	0.00	m
Thickness of earth fill over bottom slab				=	0	m
Width of Parapet wall				=	0.5	m
Soil Bearing Capacity				=	120	KN/m^2
Permissible Settlement				=	75	mm
Subgrade Reaction				=	16000	KN/m^2
Total length of Box in traffic direction				=	13.56	m

1.2 Design Parameter

1	Grade of Concrete	=	M35
2	Grade of steel	=	Fe500
3	Clear Cover for earth face structural component	=	75 mm
4	Clear Cover for inside face structural component	=	50 mm

1.3 Calculation Height of Cushion

Input

	Right	Left
FRL	2.9	2.9
Invert	0.000	0.000

Clear Height 2.000

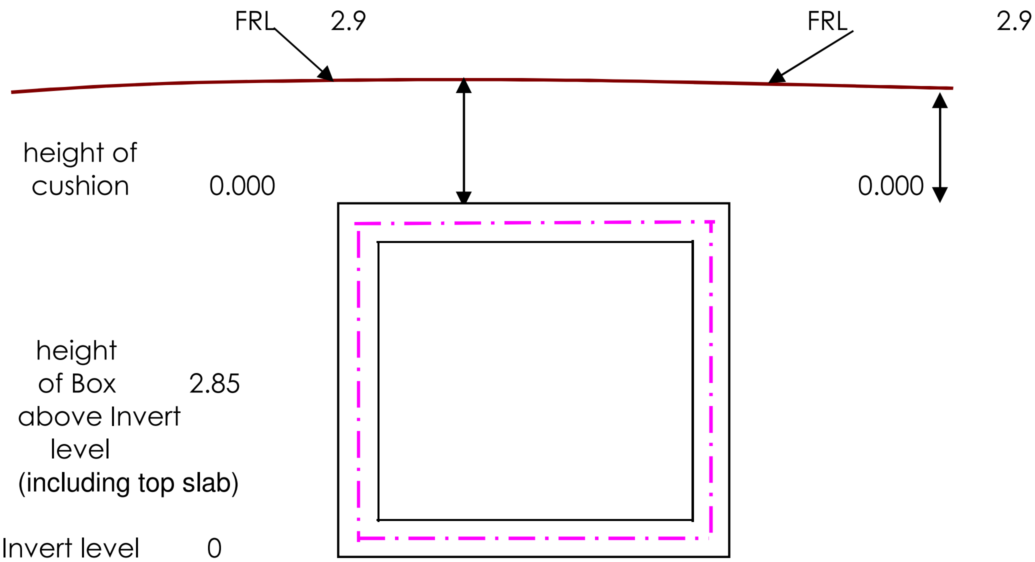
op Slab hickne 0.400

height of cushion 0.000

Total height of Box 2.85

height of Box above Invert level (including top slab) 2.85

Invert level 0



2.0 Load Calculations for the Box Structure

2.1 Dead Load

Self weight of the structure has been calculated directly in STAAD file by the comment "SELFWEIGHT -1".

2.2 Super Imposed Dead Load

(a) Top Slab

Thickness of (wearing coat+earth fill)	=	0.15 m
Thickness of Profile corrective course	=	0.00 m
Load (UDL) on top slab =	=	2.3 KN/m

(b) Bottom Slab

Thickness of earth fill	=	0 m
Load (UDL) on bottom slab = 0.000 * 15	=	0 KN/m

2.3 Earth Pressure

Thickness of top slab	=	0.400 m
Height of top haunch	=	0.150 m
Clear height between top & bottom slab	=	2.000 m
Height of bottom haunch	=	0.150 m
Thickness of bottom slab	=	0.450 m

1. Dry Soil Pressure:

Height from top (m)		Intensity of Earth pressure (KN/m^2)		
		Dry soil		
0.35	0.35	0.5*15*0.350	=	2.63
0.20	0.6	0.5*15*0.550	=	4.13
0.15	0.70	0.5*15*0.700	=	5.25
1.700	2.40	0.5*15*2.400	=	18.00
0.150	2.55	0.5*15*2.550	=	19.13
0.225	2.78	0.5*15*2.775	=	20.81

2.4 Live Load Surcharge

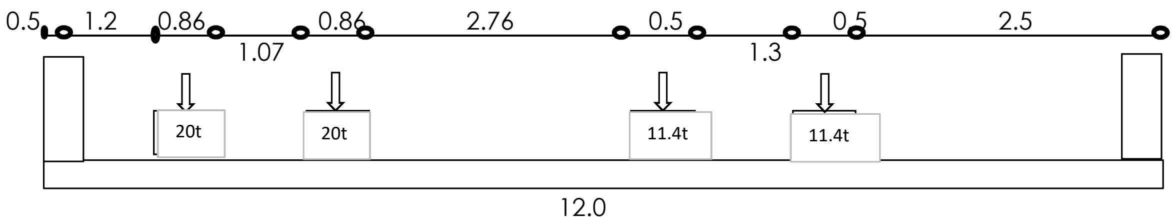
Equivalent height	=	1.2 m
Uniform Intensity of loading = 1.2 * 15 * 0.5	=	9.00 KN/m^2

2.5 Braking Load

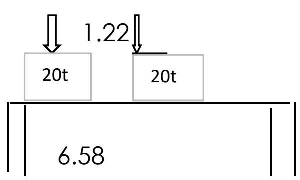
Carriageway Braking Load	=	45.7 KN
EffectiveWidth of the box for braking consideration	=	12 m
Braking Load/m =	=	3.81 KN/m

2.6) Calculation of Live load intensity for different load cases

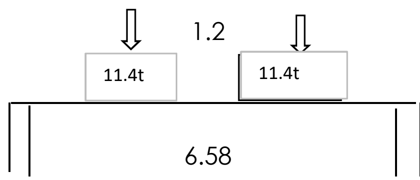
A) Class 70R vehicle 1Lane + Class A 1 Lane:



Position of Live Load along Tranverse Direction



Longitudnal position 40t Load



Longitudnal position ClassA Load

i) Single Lane 70R Wheeled Loading **40T Bogie loading**

Dispersion of 70R along tranverse direction as per cl. No. B3.2 of IRC: 112-2011

b_{ef} = $\alpha a(1-a/l_o)+b_1$

Where, b The effective width of slab

l_o=	The effective span	6.580	m
a =	The distance of the C.G. of loading from nearest sup	3.29	m
b_1=	The breadth of concentration area of the wheel ove	0.86	m
α =	A constant depending upon the ratio b/l_o = 1.82	2.6	

b_{ef}	5.14	>	1.93 m, two wheels of 70R wheeled are overlapped each others.
	2.57	>	2.13 m, edge is fully effected due to live load.
	2.57	>	1.81 m, wheels of 70R wheeled & Class-A are overlapped each others.

So, effective contact area of wheels overlaps each other, but not excedes the slab edge and also not overlaps with Class-A load Modified effective width for 70R wheel only = **7.07** m

Dispersion of 70R along Longitudinal direction as per cl. No.B3.3 of IRC: 112-2011

Tyre contact width	=100/((0.86-0.05)x5.273x100)	0.234 m	
Effective width along span =	Width of track+twice of thickness of deck slab & W/C	**1.034** m	
		<	1.22

Total load of 70R wheeled = 200 kN Impact = 1.25

ii) Single Lane Class-A (Neglecting other minor loads)

Considered only 2 Nos. 11.4t axle loads neglecting other minor loads

Where, b_{ef} = The effective width of slab

l_o=	The effective span		6.58 m
a =	The distance of the C.G. of loading from nearest sup|		3.29 m
b_1=	The breadth of concentration area of the wheel ove|		0.5 m
a =	A constant depending upon the ratio b/l	1.82	2.6

b_{ef} 4.78 > 1.8 m, two Wheels of Class-A are overlapped each others.

2.39 > 1.63 m, Wheels of 70R tracked & Class-A are overlapped each others.

Modified effective width for Class -A only= **6.577** m

Dispersion of class-A along Longitudinal direction as per cl. No. B3.3 of IRC: 112-2011

Effective width along span = Width of track+twice of thickness of deck slab & W/C **1.05** m

< 1.2

For 70R Wheeled Load

Total are =1.03*7.07 7.31 m2

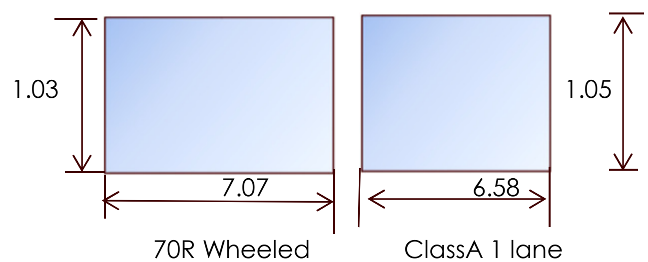
Total load incl. impact

=200*(1+1.25) 250 kN

Intensity of loading on deck slab

=250.00/7.31 34.2 kN/m^2

3.4 t/m2



For ClassA 1-Lane Load

Total are =1.05*6.58 6.91 m2

Total load incl. impact

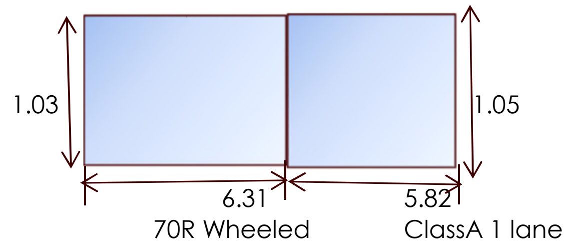
=114*(1+0.50) 171 kN

Intensity of loading on deck slab

=171.00/6.91	24.8	kN/m^2
	2.5	t/m2

For 70R Wheeled+classA 1-lane combined Load

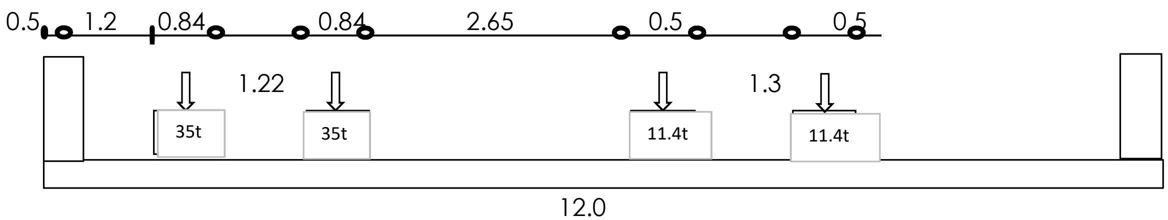
Effective width of 70R Wheel	**6.309**
Effective width of ClassA loa	**5.819**



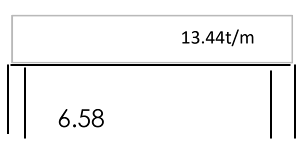
Intensity of loading on deck slab for combined effect of 70R wheeled+ClassA 1 lane load

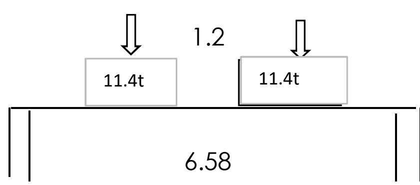
3.83 t/m2

B) <u>Class 70R Tracked + Class A 1 Lane:</u>



<u>Position of Live Load along Tranverse Direction</u>





<u>Longitudnal position 70R tracked Load</u> **<u>Longitudnal position ClassA Load</u>**

i) Single Lane 70R Tracked Loading

Dispersion of 70R along tranverse direction as per cl. No. B3.2 of IRC: 112-2011

b_{ef} = $\alpha a(1-a/l_o)+b_1$

Where, b The effective width of slab

l_o=	The effective span		6.58 m
a =	The distance of the C.G. of loading from nearest sup		3.29 m
b_1=	The breadth of concentration area of the wheel ove		0.84 m
α =	A constant depending upon the ratio b/l	1.82	2.6

b_{ef}	5.12	>	2.06	m, two wheels of 70R Tracked are overlapped each others.
	2.56	>	2.12	m, edge is fully effected due to live load.
	2.56	>	1.745	m, wheels of 70R Tracked & Class-A are overlapped each others.

So, effective contact area of wheels overlaps each other, but not excedes the slab edge
and also not overlaps with Class-A load Modified effective width for 70R tracked only = **7.177** m

Dispersion of 70R along Longitudinal direction as per cl. No.B3.3 of IRC: 112-2011
Effective width along span = Width of track+twice of thickness of deck slab & W/C **5.37** m
Total Load = 70 t So, load per metre run = 13.04 t/m
Impact = 1.25

ii) Single Lane Class-A (Neglecting other minor loads)
Considered only 2 Nos. 11.4t axle loads neglecting other minor loads
Where, b_{ef} = The effective width of slab

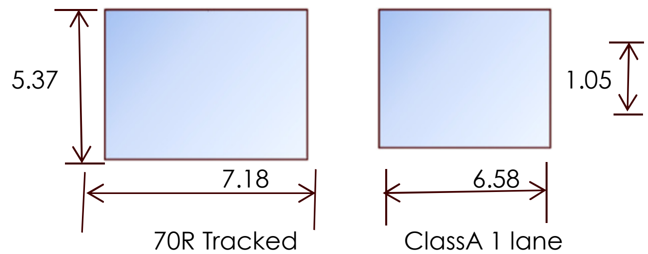
l_o=	The effective span		6.58 m
a =	The distance of the C.G. of loading from nearest sup		3.29 m
b_1=	The breadth of concentration area of the wheel ove		0.5 m
α =	A constant depending upon the ratio b/l	1.82	2.6

b_{ef}	4.777	>	1.8	m, two Wheels of Class-A are overlapped each others.
	2.3885	>	1.575	m, Wheels of 70R tracked & Class-A are overlapped each others.

Modified effective width for Class -A on **6.577** m
Dispersion of class-A along Longitudinal direction as per cl. No. B3.3 of IRC: 112-2011
Effective width along span = Width of track+twice of thickness of deck slab & W/C **1.05** m
< 1.2

For 70R Tracked Load

Total are =5.37*7.18	38.54	m2
Total load incl. impact		
=700*(1+1.25	875	kN
Intensity of loading on deck slab		
=875.00/38.54	22.7	kN/m^2
	2.3	t/m2

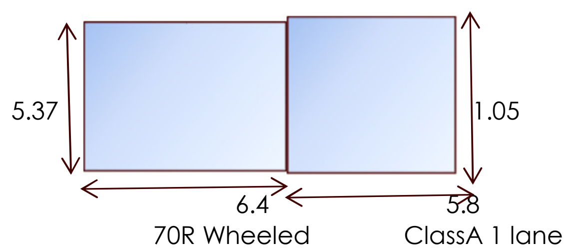


For ClassA 1-Lane Load

Total are =1.05*6.58	6.91	m2
Total load incl. impact		
=114*(1+0.50	171	kN
Intensity of loading on deck slab		
=171.00/6.91	24.8	kN/m^2
	2.5	t/m2

For 70R Tracked+classA 1-lane combined Load

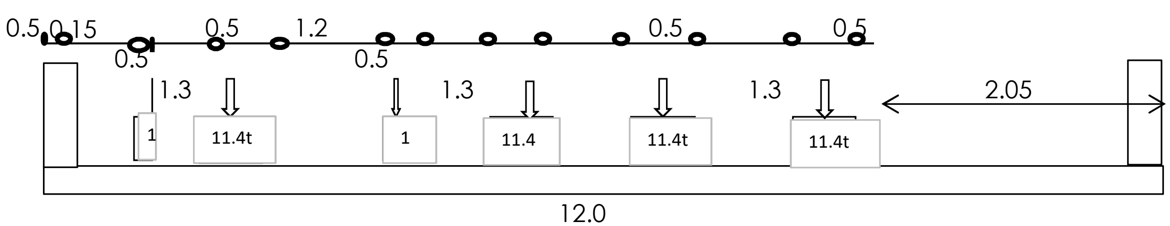
Effective width of 70R tracke	**6.364**
Effective width of ClassA loa	**5.764**



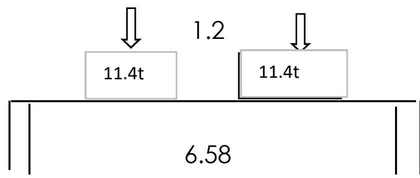
Intensity of loading on deck slab for combined effect of 70R wheeled+ClassA 1 lane load

2.83 t/m2

C) <u>3-Lane Class A 1 Lane:</u>



<u>Position of Live Load along Tranverse Direction</u>



Longitudnal position ClassA Load

i) Single Lane Class A Loading

Dispersion of Class A along tranverse direction as per cl. No. B3.2 of IRC: 112-2011

b_{ef} = $\alpha a(1-a/l_o)+b_1$

Where, b The effective width of slab

l_o=	The effective span		6.58 m
a =	The distance of the C.G. of loading from nearest sup		3.29 m
b_1=	The breadth of concentration area of the wheel ove		0.5 m
α =	A constant depending upon the ratio b/l	1.82	2.6

b_{ef} 4.78 > 1.8 m, two wheels of ClassA are overlapped each others.

2.39 > 0.9 m, edge is fully effected due to live load.

2.39 > 0.85 m, wheels of Class-A are overlapped each others.

So, effective contact area of wheels overlaps each other, excedes the slab edge and also overlaps with Class-A loading. Modified effective width **12.000** m

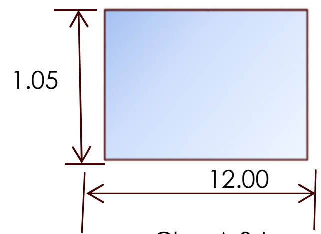
Dispersion of class-A along Longitudinal direction as per cl. No. B3.3 of IRC: 112-2011

Effective width along span = Width of track+twice of thickness of deck slab & W/C **1.05** m

< 1.2

For ClassA 3-Lane Load

Total are =1.05*12.00	12.60	m2
Total load incl. impact		
=342*(1+0.50	513	kN
Intensity of loading on deck slab		
=513.00/12.60	40.7	kN/m^2
	4.07	t/m2



LOAD SUMMARY

Vehicle	Load (t/m^2)
70R Wheel (40T)	3.42
R Wheel (40T)+Cla	3.83
70R Tracked	2.27
0R Tracked+Class	2.83
Class A 1-Lane	2.48
Class A 3-Lane	4.07

Design LL intensity for analysis = = **4.07** t/m^2

2.7 CALCULATIONS FOR UNIFORM TEMPERATURE RISE

UNIFORM TEMPERATURE CASE

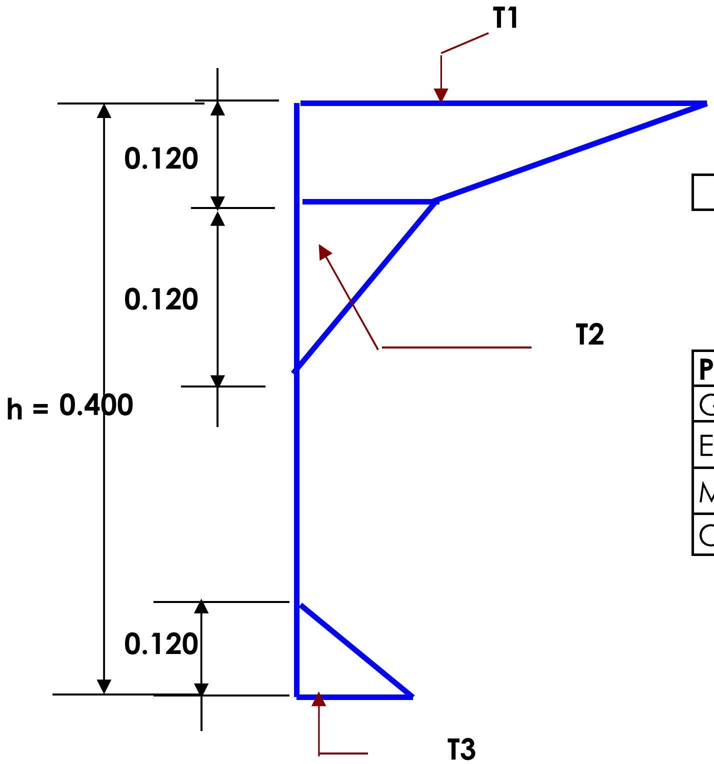
The top slab is designed for the effects of uniform temperature rise across the deck depth.

Variation of uniform tepperature	50
Temp Rise	35
Temp Fall	-15

2.7.1 CALCULATIONS FOR TEMPERATURE GRADIENT

TEMPERATURE RISE CASE

The top slab is designed for the effects of the distribution of the temperature across the deck depth as given in the sketch below.

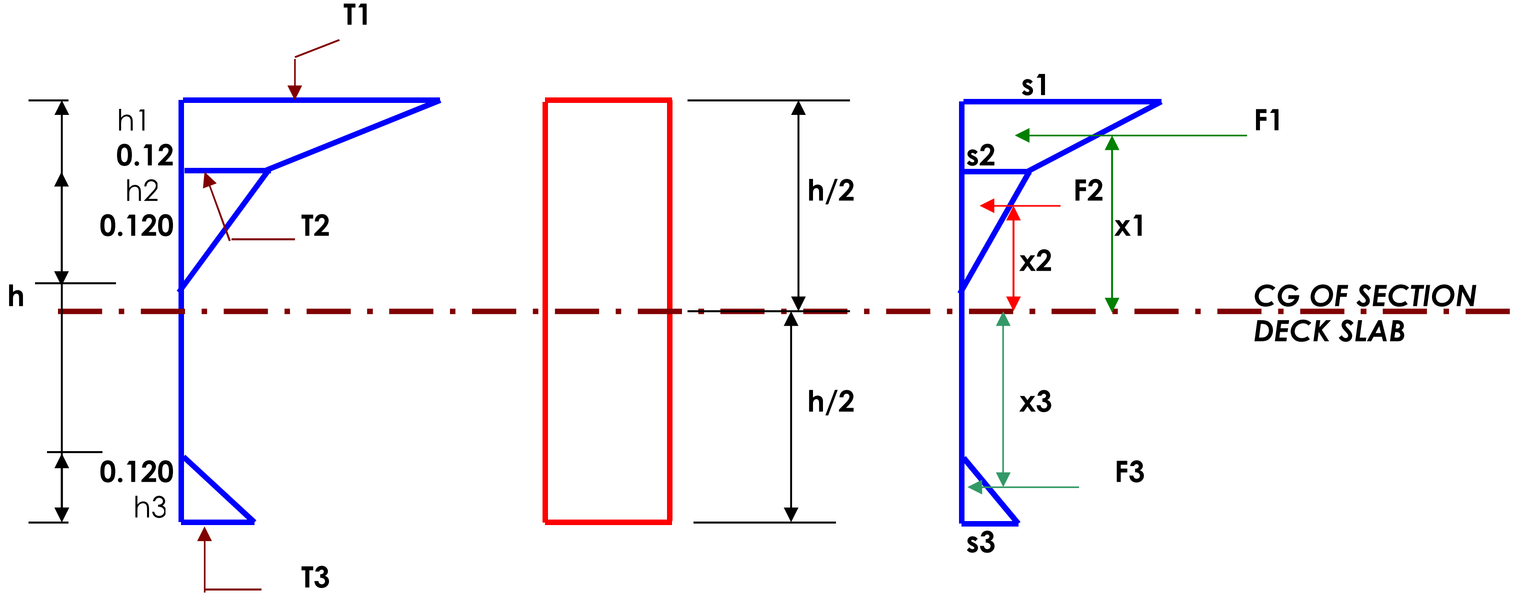


h =	Depth of Superstructure =	0.400	m

Parameters:			
Grade of Concrete	M =	35	
Elasticity for Concrete	E_i =	3.231E+06	T / m^2
Modified Elasticity for Concrete	$E_c = E_i$	3.231E+06	T / m^3
Coefficient of Thermal Expansi	a =	0.0000117	/ °C

OUTPUT		
Stress	s =	E a t
Force	F =	F1 + F2 + F3
Moment	M =	F1x1 + F2x2 -F3x3

Generalised Temperature & corresponding Force Diagram



TEMPERATURE RISE CASE

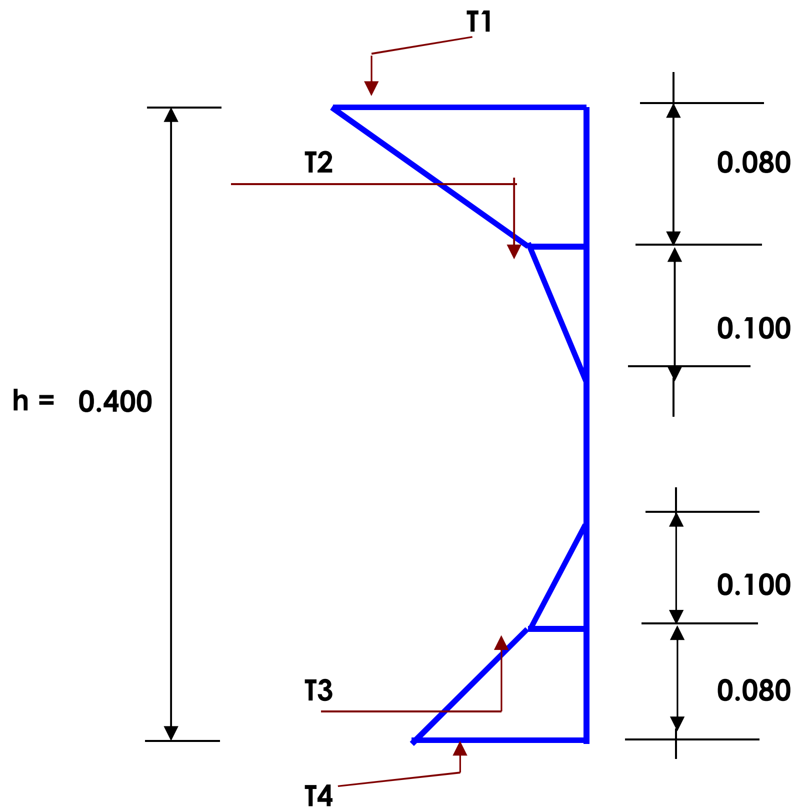
Member Description	h	h1	h2	h3	T1	T2	T3
	(m)	(m)	(m)	(m)	°C	°C	°C
Top slab	0.4	0.120	0.120	0.120	17.80	4.00	2.10

Member Descripti	s 1	s 2	s 3	F1	F2	F3	F
	T / m2	T / m2	T / m2	T	T	T	T
Top slab	672.9	151.2	79.38	49.44	9.07	4.76	**63.28**

Member Description	CG of Section from TOP	CG of Section from BOTTOM	CG of TOP BLOCK from TOP	CG of MID BLOCK from TOP	CG of BOTTOM BLOCK from BOTTOM	x1	x2	x3	M
						m	m	m	T - m
Top slab	0.2000	0.2000	0.0473	0.1600	0.0400	0.1527	0.0400	0.1600	**7.15**

2.7.2 TEMPERATURE FALL CASE

The top slab is designed for the effects of the distribution of the temperature across the deck depth as given in the sketch below.

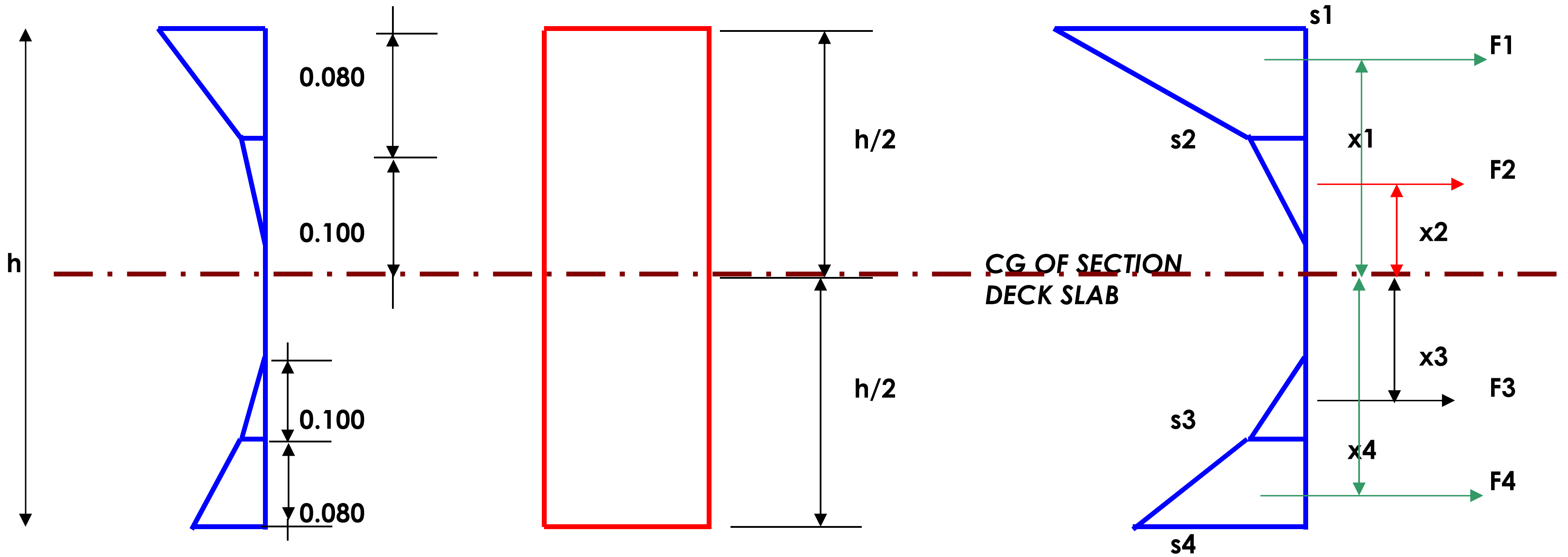


h =	Depth of Superstructure =	0.400	m

Parameters:			
Grade of Concrete	M =	35	
Elasticity for Concrete	E_i =	3.231E+06	T / m^2
Modified Elasticity for Concrete	$E_c = E_i$	3.231E+06	T / m^3
Coefficient of Thermal Expansion	a =	1.2E-05	/ °C

OUTPUT		
Stress	s =	E a t
Force	F =	F1 + F2 + F3 + F4
Moment	M =	F1x1 + F2x2 - F3x3 - F4x4

Generalised Temperature & corresponding Force Diagram



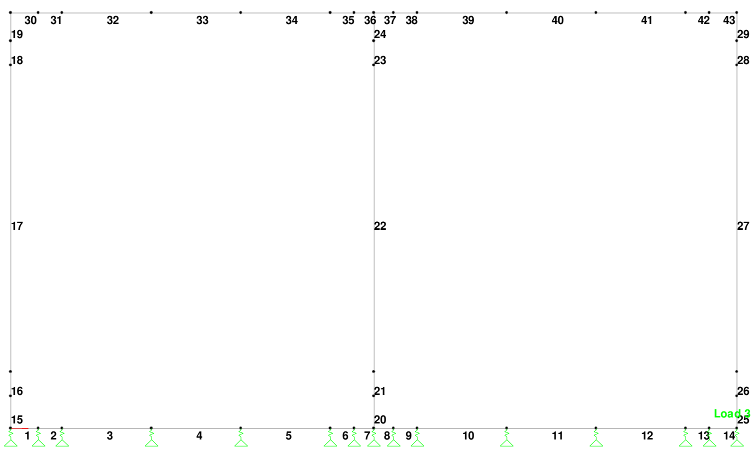
TEMPERATURE FALL CASE

Member Description	h	h1	h2	h3	h4	T1	T2	T3	T4
	(m)	(m)	(m)	(m)	(m)	°C	°C	°C	°C
Top slab	0.400	0.080	0.100	0.100	0.080	10.60	0.70	0.80	6.60

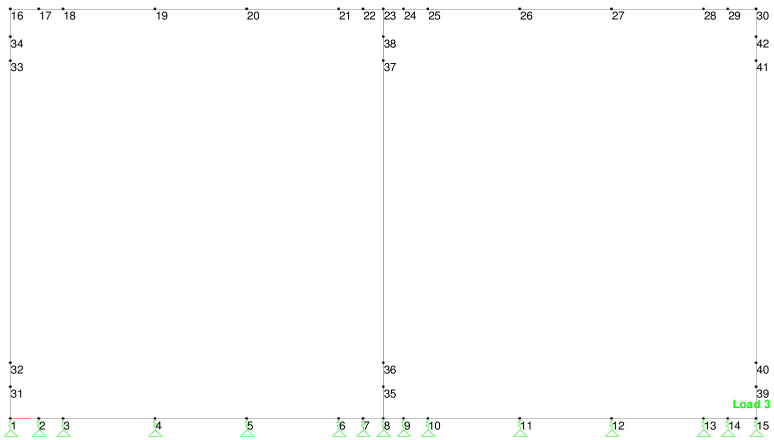
Member Description	**s 1**	**s 2**	**s 3**	**s 4**	**F1**	**F2**	**F3**	**F4**	**F**
	T / m2	T / m2	T / m2	T / m3	T	T	T	T	T
Top slab	400.7	26.5	30.2	249.5	17.09	1.32	1.51	11.19	**31.11**

Member Description	CG of Section from TOP	CG of Section from BOTTOM	CG of TOP BLOCK from TOP	CG of MID BLOCK from TOP	CG of MID BLOCK from BOTTOM	CG of BOTTOM BLOCK from BOTTOM	**x1**	**x2**	**x3**	**x4**	**M**
							m	m	m	m	T - m
Top slab	0.200	0.200	0.028	0.113	0.113	0.050	0.172	0.087	0.087	0.150	**1.244**

3.0 Design of Box Section (ULS):



BEAM NO



JOINT NO

Check for Flexture

Section to be checked	32 33 34 39 40 41		30 31 35 36 37 38 42 43		18 19 28 29		17 27		15 16 25 26		1 2 6 7 8 9 13 14		3 4 5 10 11 12		23 24	22	20 21
	TOP	**BOTTOM**	**TOP**	**BOTTOM**	**OUTSIDE**	**INSIDE**	**OUTSIDE**	**INSIDE**	**OUTSIDE**	**INSIDE**	**TOP**	**BOTTOM**	**TOP**	**BOTTOM**	**INTER WALL TOP**	**INTER WALL MID**	**INTER WALL BOTT**
Design Moment(KNm)	**100**	**149**	**334**	**99**	**175**	**83**	**166**	**76**	**164**	**82**	**78**	**308**	**177**	**222**	**7**	**7**	**7**
Width of section (m)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Depth of section (m)	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.450	0.450	0.450	0.450	0.300	0.300	0.300
Grade of Concrete	M35	M35	M35	M35	M35	M35	M35	M35	M35	M35	M35	M35	M35	M35	M35	M35	M35
Grade of Steel	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500
"E" value for concrete **(As per Eq. A2-5 (page-236) of IRC:112-2011)**	32308	32308	32308	32308	32308	32308	32308	32308	32308	32308	32308	32308	32308	32308	32308	32308	32308
"E" value for Steel **(As per Cl 6.3.5 of IRC:112-2011)**	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000

Section to be checked	32 33 34 39 40 41		30 31 35 36 37 38 42 43		18 19 28 29		17 27		15 16 25 26		1 2 6 7 8 9 13 14		3 4 5 10 11 12		23 24	22	20 21
	TOP	**BOTTOM**	**TOP**	**BOTTOM**	**OUTSIDE**	**INSIDE**	**OUTSIDE**	**INSIDE**	**OUTSIDE**	**INSIDE**	**TOP**	**BOTTOM**	**TOP**	**BOTTOM**	**INTER WALL TOP**	**INTER WALL MID**	**INTER WALL BOTT**
Design compressive streangth of Concrete(Mpa) **(As per Eq 6.22 (Page 49) of IRC:112-2011)**	15.56	15.56	15.56	15.56	15.56	15.56	15.56	15.56	15.56	15.56	15.56	15.56	15.56	15.56	15.56	15.56	15.56
Design Peak Strength of Steel(Mpa) **(As per fig-6.2 (Page-30) of IRC:112-2011)**	434.78	434.78	434.78	434.78	434.78	434.78	434.78	434.78	434.78	434.78	434.78	434.78	434.78	434.78	434.78	434.78	434.78
Concrete failure strain **(As per Table -6.5 of IRC:112-2011)**	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035
Concrete limiting strain **(As per Table -6.5 of**	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Yield strain of steel	0.00217	0.00217	0.00217	0.00217	0.00217	0.00217	0.00217	0.00217	0.00217	0.00217	0.00217	0.00217	0.00217	0.00217	0.00217	0.00217	0.00217
Limiting strain of steel	0.00417	0.00417	0.00417	0.00417	0.00417	0.00417	0.00417	0.00417	0.00417	0.00417	0.00417	0.00417	0.00417	0.00417	0.00417	0.00417	0.00417
R=M/bd^2	0.852	1.273	2.858	0.848	1.766	0.710	1.673	0.649	1.651	0.700	0.508	2.309	1.153	1.667	0.113	0.113	0.113
Pt=	0.00202	0.00306	0.00734	0.00201	0.00433	0.00167	0.00408	0.00152	0.00403	0.00165	0.00119	0.00579	0.00276	0.00407	0.00026	0.00026	0.00026
Ast required (mm2)	**690**	**1046**	**2510**	**686**	**1363**	**572**	**1287**	**522**	**1268**	**564**	**466**	**2112**	**1082**	**1486**	**63**	**63**	**63**
Provide Reinforcement(mm2)	16 dia	16 dia	16 dia	16 dia	20 dia	16 dia	20 dia	16 dia	20 dia	16 dia	16 dia	20 dia	16 dia	20 dia	16 dia	16 dia	16 dia
	200 mm	200 mm	200 mm	200 mm	200 mm	200 mm	200 mm	200 mm	200 mm	200 mm	200 mm	200 mm	200 mm	200 mm	200 mm	200 mm	200 mm
	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&
	0 dia	16 dia	20 dia	0 dia	16 dia	0 dia	0 dia	0 dia	16 dia	0 dia	0 dia	16 dia	16 dia	0 dia	16 dia	0 dia	16 dia
	200 mm	200 mm	200 mm	200 mm	200 mm	200 mm	200 mm	200 mm	200 mm	200 mm	200 mm	200 mm	200 mm	200 mm	200 mm	200 mm	200 mm
Total Reinforcement(mm2) provided	**1005**	**2011**	**2576**	**1005**	**2576**	**1005**	**1571**	**1005**	**2576**	**1005**	**1005**	**2576**	**2011**	**1571**	**2011**	**1005**	**2011**
Clear Cover (mm)	50	50	50	50	75	50	75	50	75	50	50	75	50	75	50	50	50
Effective depth d (mm)	342	342	342	342	315	342	315	342	315	342	392	365	392	365	242	242	242
Actual Neutral Axis Depth Nu (mm)	34.5	69.0	88.4	34.5	88.4	34.5	53.9	34.5	88.4	34.5	34.5	88.4	69.0	53.9	69.0	34.5	69.0
So strain	0.03120	0.01385	0.01004	0.03120	0.00897	0.03120	0.01695	0.03120	0.00897	0.03120	0.03627	0.01095	0.01639	0.02020	0.00878	0.02105	0.00878
So strsss	434.8	434.8	434.8	434.8	434.8	434.8	434.8	434.8	434.8	434.8	434.8	434.8	434.8	434.8	434.8	434.8	434.8
Balanced Neu axis depth Nbal (mm)	156.0	156.0	156.0	156.0	143.7	156.0	143.7	156.0	143.7	156.0	178.8	166.5	178.8	166.5	110.4	110.4	110.4

Section to be checked	32 33 34 39 40 41		30 31 35 36 37 38 42 43		18 19 28 29		17 27		15 16 25 26		1 2 6 7 8 9 13 14		3 4 5 10 11 12		23 24	22	20 21
	TOP	**BOTTOM**	**TOP**	**BOTTOM**	**OUTSIDE**	**INSIDE**	**OUTSIDE**	**INSIDE**	**OUTSIDE**	**INSIDE**	**TOP**	**BOTTOM**	**TOP**	**BOTTOM**	**INTER WALL TOP**	**INTER WALL MID**	**INTER WALL BOTT**
Total Ultimate compressive force (KN)	437.1	874.2	1120.0	437.1	1120.0	437.1	683.0	437.1	1120.0	437.1	437.1	1120.0	874.2	683.0	874.2	437.1	874.2
Total Ultimate Tensile force (KN)	437.1	874.2	1120.0	437.1	1120.0	437.1	683.0	437.1	1120.0	437.1	437.1	1120.0	874.2	683.0	874.2	437.1	874.2
So, Difference in force (KN)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CG of compressive force (mm)	14.4	28.7	36.8	14.4	36.8	14.4	22.4	14.4	36.8	14.4	14.4	36.8	28.7	22.4	28.7	14.4	28.7
UNDER / OVER REINFORCED CHECK	**U.R.SEC, OK**	**U.R.SEC, OK**	**U.R.SEC, OK**	**U.R.SEC, OK**	**U.R.SEC, OK**	**U.R.SEC , OK**	**U.R.SEC, OK**	**U.R.SE C, OK**	**U.R.SEC, OK**	**U.R.SE C, OK**	**U.R.SE C, OK**	**U.R.SEC, OK**	**U.R.SE C, OK**	**U.R.SEC, OK**	**U.R.SEC , OK**	**U.R.SE C, OK**	**U.R.SE C, OK**
So Moment of resistance (in terms of compressive streangth of concrete) (KNm)	143.2	273.9	341.9	143.2	311.6	143.2	199.8	143.2	311.6	143.2	165.1	367.6	317.6	234.0	186.5	99.5	186.5
So Moment of resistance (in terms of	143.2	273.9	341.9	143.2	311.6	143.2	199.8	143.2	311.6	143.2	165.1	367.6	317.6	234.0	186.5	99.5	186.5
	OK	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**

Check for Shear (As per CL 10.3.2 of IRC:112-2011)

Section to be checked	Top slab	Side Wall	Bottom slab	INTER WALL
Shear force at **d** distance from support (KN)	230.5	31.1	257.2	9.1
Enhancement factor (**As per Cl 10.3.2 (5) of**	1	1	1	1
Design shear force (KN)	**230.5**	**31.1**	**257.2**	**9.1**
Width of section (m)	1.00	1.00	1.00	1.00
Effective Depth of section (m)	342	315	365	242
K = 1+SQRT(200/d) (**As per Eq 10.2 of IRC:112-2011)**	1.765	1.797	1.740	1.909
Governing k	1.76	1.80	1.74	1.91
Asl (mm2)	2576	2576	2576	2011
ρ1 = Asl / (bw x d) **(As per Eq 10.5 of IRC:112-2011)**	0.00753	0.00818	0.00706	0.00831
Ned = axial compression	0	0	0	0
σcp =	0.00	0.00	0.00	0.00
So Vrdc (KN) (**As per Eq 10.1 of IRC:112-2011)**	198.08	190.87	204.04	156.61
vmin (**As per Eq 10.1 of IRC:112-2011)**	0.430	0.442	0.421	0.484
Vrdcmin =	147.0	139.1	153.7	117.1
So governing shear resistance Vrdcgovern=	**198**	**191**	**204**	**157**
	<	>	<	>
	230.5	31.1	257.2	9.1

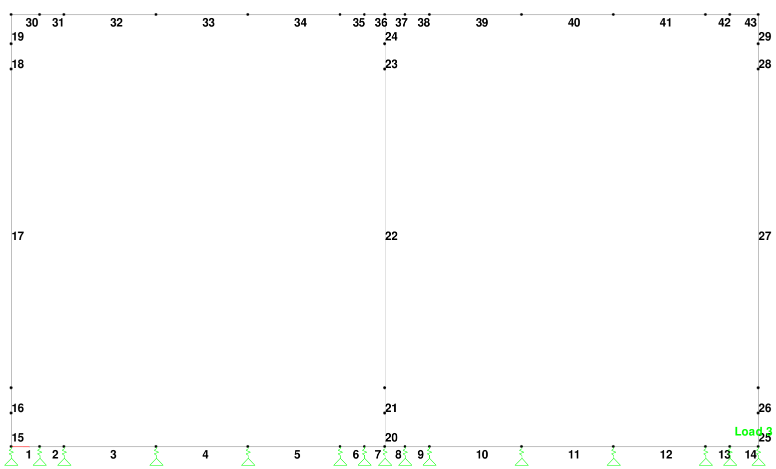
Distribution Reinforcement :

Maximum required main reinforcement a				**2510**	mm2
So,distribution reinforcement re	0.2 tieme			**502**	mm2
Let provic	12 dia	175 mm	=	**759**	mm2
				OK	
Maximum required main reinforcement a				**1363**	mm2
So,distribution reinforcement re	0.2 tieme			**273**	mm2
Let provic	12 dia	175 mm	=	**759**	mm2
				OK	
Maximum required main reinforcement a				**2112**	mm2
So,distribution reinforcement re	0.2 tieme			**422**	mm2
Let provic	12 dia	175 mm	=	**759**	mm2
				OK	

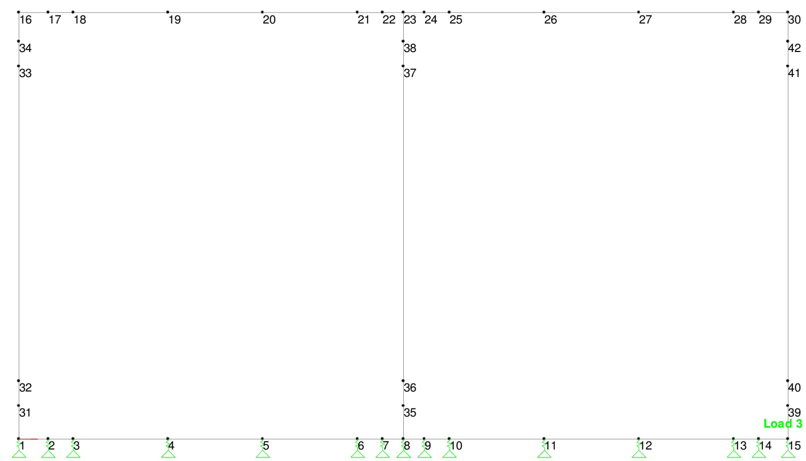
Section to be checked	32 33 34 39 40 41		30 31 35 36 37 38 42 43		18 19 28 29		17 27		15 16 25 26		1 2 6 7 8 9 13 14		3 4 5 10 11 12		23 24	22	20 21
	TOP	**BOTTOM**	**TOP**	**BOTTOM**	**OUTSIDE**	**INSIDE**	**OUTSIDE**	**INSIDE**	**OUTSIDE**	**INSIDE**	**TOP**	**BOTTOM**	**TOP**	**BOTTOM**	**INTER WALL TOP**	**INTER WALL MID**	**INTER WALL BOTT**
			Shear Reinforce reqd	**OK**	**Shear Reinforc e reqd**	**OK**											

LET , θ (Degree)=	11.03	11.03	11.03
αcw =	1	1	1
bw (mm)=	1000	1000	1000
z =	0.9	0.9	0.9
v1=	0.6	0.6	0.6
fcd=	15.56	15.56	15.56
SO Vrdmax =	1577.06	1577.06	1577.06
Shear Reinforcement	2 Legged	2 Legged	2 Legged
	10 mm dia	10 mm dia	10 mm dia
	200 mm	200 mm	200 mm
Asw (mm2) =	157.080	157.080	157.080
z=	0.9	0.9	0.9
fywd=	434.8	434.8	434.8
Vrds =	1577.06	1577.06	1577.06
Difference in force	0.00	0.00	0.00
So shear capacity =	1577.1	1577.1	1577.1
Design shear force =	230.456	31.141	257.196
	OK	**OK**	**OK**

4.1 Design of Box Section (SLS):



BEAM NO



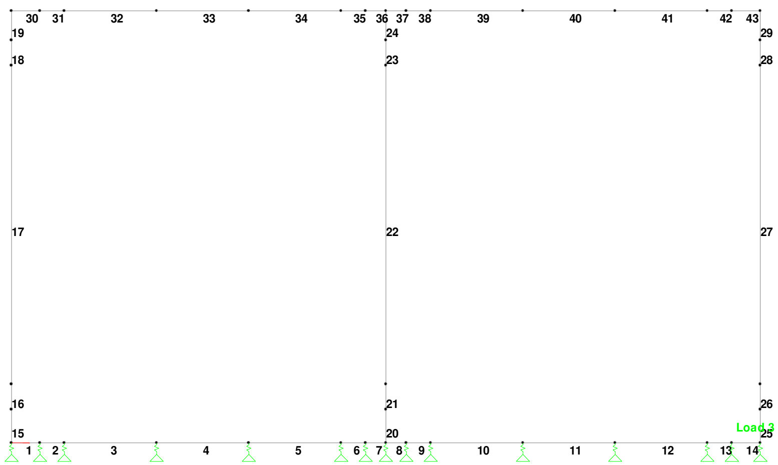
JOINT NO

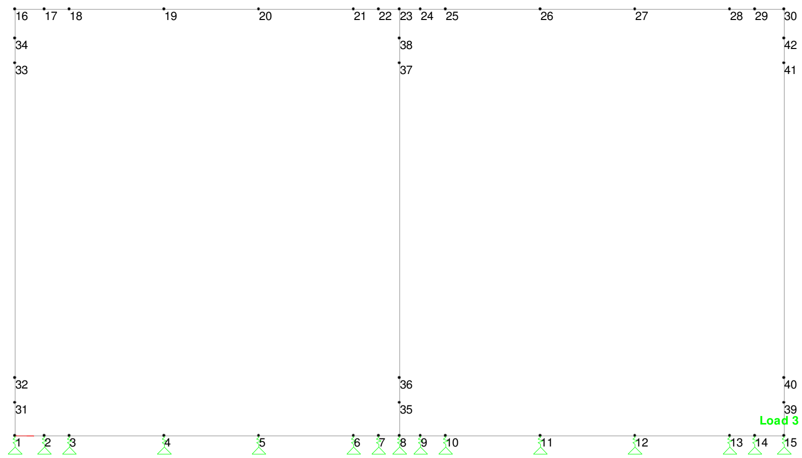
Crack Width check:

Section to be checked	32 33 34 39 40 41		0 31 35 36 37 38 42 4		18 19 28 29		17 27		15 16 25 26		1 2 6 7 8 9 13 14		3 4 5 10 11 12		23 24	22	20 21
	TOP	**BOTTOM**	**TOP**	**BOTTOM**	**OUTSIDE**	**INSIDE**	**OUTSIDE**	**INSIDE**	**OUTSIDE**	**INSIDE**	**TOP**	**BOTTOM**	**TOP**	**BOTTOM**	**INTER WALL TOP**	**INTER WALL MID**	**INTER WALL BOTT**
Design Moment(KNm)	**23**	**27**	**60**	**0**	**25**	**0**	**0**	**0**	**45**	**0**	**0**	**54**	**38**	**18**	**0.022**	**0.107**	**0.117**
Width of section (m)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Depth of section (m)	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.450	0.450	0.450	0.450	0.300	0.300	0.300
Grade of Concrete	M35	M35	M35	M35	M35	M35	M35	M35	M35	M35	M35	M35	M35	M35	M35	M35	M35
Grade of Steel	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500
(As per Eq. A2-5 (page-236) of IRC:112-2011)	32308	32308	32308	32308	32308	32308	32308	32308	32308	32308	32308	32308	32308	32308	32308	32308	32308
"E" value for Steel **(As per Cl 6.3.5 of IRC:112-2011)**	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
Clear Cover (mm)	50	50	50	50	75	50	75	50	75	50	50	75	50	75	50	50	50
Effective depth d (mm)	342	342	342	342	315	342	315	342	315	342	392	365	392	365	242	242	242
Modular ratio in tension :	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
per Table -6.5 of IRC:112-2011)	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035
per Table -6.5 of IRC:112-2011)	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8

Section to be checked	32 33 34 39 40 41		0 31 35 36 37 38 42 4		18 19 28 29		17 27		15 16 25 26		1 2 6 7 8 9 13 14		3 4 5 10 11 12		23 24	22	20 21
	TOP	**BOTTOM**	**TOP**	**BOTTOM**	**OUTSIDE**	**INSIDE**	**OUTSIDE**	**INSIDE**	**OUTSIDE**	**INSIDE**	**TOP**	**BOTTOM**	**TOP**	**BOTTOM**	**INTER WALL TOP**	**INTER WALL MID**	**INTER WALL BOTT**
Max stress in Steel:	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
Area of rein provided :	1005	2011	2576	1005	2576	1005	1571	1005	2576	1005	1005	2576	2011	1571	2011	1005	2011
Actual Neutral Axis Depth Nu:	**67**	**90**	**100**	**40**	**95**	**81**	**68**	**81**	**95**	**69**	**43**	**104**	**97**	**150**	**101**	**104**	**66**
Balanced neutral axis depth:	101	101	101	101	101	101	101	101	101	101	113	113	113	113	75	75	75
Actual tensile stress :	**71**	**43**	**76**	**0**	**34**	**0**	**0**	**0**	**62**	**0**	**0**	**63**	**52**	**37**	**0**	**1**	**0**
Maximum comp stress:	2.15	1.93	3.90	0.00	1.84	0.00	0.00	0.00	3.36	0.00	0.00	3.12	2.17	3.24	0.00	0.05	0.01
CG of compressive force:	22.19	30.01	33.30	13.41	31.73	27.09	22.80	27.09	31.73	23.05	14.23	34.59	32.45	50.00	33.61	34.83	22.13
Total Compressive Force :	71.58	86.96	194.90	0.00	87.40	0.00	0.00	0.00	159.96	0.00	0.00	162.10	105.54	242.83	0.24	2.55	0.42
Total Tensile Force :	71.58	86.96	194.90	0.00	87.40	0.00	0.00	0.00	159.96	0.00	0.00	162.10	105.54	58.32	0.11	0.52	0.53
Difference in force	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-184.51	-0.13	-2.03	0.12
Moment of resistance :	22.89	27.13	60.17	0.00	24.76	0.00	0.00	0.00	45.31	0.00	0.00	53.56	37.95	18.37	0.02	0.11	0.12
Applied Moment :	22.89	27.13	60.17	0.00	24.76	0.00	0.00	0.00	45.31	0.00	0.00	53.56	37.95	18.37	0.02	0.11	0.12
Difference in moment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
c = Clear cover to the longitudnal reinforcement	50	50	50	50	75	50	75	50	75	50	50	75	50	75	75	50	75
K1 =	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
K2 =	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
ϕ =	16	16	16	16	20	16	20	16	20	16	16	20	16	20	16	16	16
As =	1005	2011	2576	1005	2576	1005	1571	1005	2576	1005	1005	2576	2011	1571	2011	1005	2011
hceff =	145	145	145	145	200	145	200	145	200	145	145	212.5	145	212.5	145	145	145
Aceff =	145000	145000	145000	145000	200000	145000	200000	145000	200000	145000	145000	212500	145000	212500	145000	145000	145000
ρpeff =	0.00693	0.01387	0.01777	0.00693	0.01288	0.00693	0.00785	0.00693	0.01288	0.00693	0.00693	0.01212	0.01387	0.00739	0.01387	0.00693	0.01387
Srmax = Maximum crack spacing =3.4xC+(0.425xK1xK2XΦ/ρpeff) **(As per Eq 12.8 of IRC:112-2011)**	562.32	366.16	323.10	562.32	518.96	562.32	687.90	562.32	518.96	562.32	562.32	535.46	366.16	714.96	451.16	562.32	451.16
σsc =	71	43	76	0	34	0	0	0	62	0	0	63	52	37	0	1	0
Kt =	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
fcteff =	105.76	105.76	105.76	105.76	105.76	105.76	105.76	105.76	105.76	105.76	105.76	105.76	105.76	105.76	105.76	105.76	105.76
αe =	6.190	6.190	6.190	6.190	6.190	6.190	6.190	6.190	6.190	6.190	6.190	6.190	6.190	6.190	6.190	6.190	6.190
(εsm-εcm) =	-0.0394	-0.0205	-0.0161	-0.0398	-0.0220	-0.0398	-0.0353	-0.0398	-0.0219	-0.0398	-0.0398	-0.0231	-0.0204	-0.0372	-0.0207	-0.0398	-0.0207
(εsm-εcm)min =	0.00021	0.00013	0.00023	0.00000	0.00010	0.00000	0.00000	0.00000	0.00019	0.00000	0.00000	0.00019	0.00016	0.00011	0.00000	0.00000	0.00000
(εsm-εcm)governing =	0.00021	0.00013	0.00023	0.00000	0.00010	0.00000	0.00000	0.00000	0.00019	0.00000	0.00000	0.00019	0.00016	0.00011	0.00000	0.00000	0.00000
Crack Width Wk = S rmax * (εsm-εcm)governing **As per Eq 12.5 of IRC:112-2011**	0.1201	0.0475	0.0733	0.0000	0.0528	0.0000	0.0000	0.0000	0.0967	0.0000	0.0000	0.1011	0.0577	0.0796	0.0001	0.0009	0.0004
Limiting value of Crack width (**As per Tab-12.1 of IRC:112-2011)**	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
STATUS	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
	TOP SLAB				**SIDE WALL**						**BOTTOM SLAB**				**INNER WALL**		

4.2 Design of Box Section (SLS):





Stress Check

Section to be checked	32 33 34 39 40 41		30 31 35 36 37 38 42 43		18 19 28 29		17 27		15 16 25 26		1 2 6 7 8 9 13 14		3 4 5 10 11 12		23 24	22	20 21
	TOP	BOTTOM	TOP	BOTTOM	OUTSIDE	INSIDE	OUTSIDE	INSIDE	OUTSIDE	INSIDE	TOP	BOTTOM	TOP	BOTTOM	INTER WALL TOP	INTER WALL MID	INTER WALL BOTT
Design Moment(KNm)	**91**	**105**	**229**	**0**	**123**	**23**	**0**	**21**	**116**	**0**	**0**	**211**	**122**	**152**	**6.548**	**5.906**	**6.818**
Width of section (m)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Depth of section (m)	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.450	0.450	0.450	0.450	0.300	0.300	0.300
Grade of Concrete	M35	M35	M35	M35	M35	M35	M35	M35	M35	M35	M35	M35	M35	M35	M35	M35	M35
Grade of Steel	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500	Fe500
(As per Eq. A2-5 (page-236) of IRC:112-2011)	32308	32308	32308	32308	32308	32308	32308	32308	32308	32308	32308	32308	32308	32308	32308	32308	32308
"E" value for Steel **(As per Cl 6.3.5 of IRC:112-2011)**	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
Clear Cover (mm)	50	50	50	50	75	50	75	50	75	50	50	75	50	75	50	50	50
Effective depth d (mm)	342	342	342	342	315	342	315	342	315	342	392	365	392	365	242	242	242

Section to be checked	32 33 34 39 40 41		30 31 35 36 37 38 42 43		18 19 28 29		17 27		15 16 25 26		1 2 6 7 8 9 13 14		3 4 5 10 11 12		23 24	22	20 21
	TOP	**BOTTOM**	**TOP**	**BOTTOM**	**OUTSIDE**	**INSIDE**	**OUTSIDE**	**INSIDE**	**OUTSIDE**	**INSIDE**	**TOP**	**BOTTOM**	**TOP**	**BOTTOM**	**INTER WALL TOP**	**INTER WALL MID**	**INTER WALL BOTT**
Modular ratio in tension :	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Concrete failure strain **(As per Table -6.5 of IRC:112-2011)**	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035
Max stress in concrete: **(As per Table -6.5 of IRC:112-2011)**	**16.8**	**16.8**	**16.8**	**16.8**	**16.8**	**16.8**	**16.8**	**16.8**	**16.8**	**16.8**	**16.8**	**16.8**	**16.8**	**16.8**	**16.8**	**16.8**	**16.8**
Max stress in Steel:	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**
Area of reinforcement provided	1005	2011	2576	1005	2576	1005	1571	1005	2576	1005	1005	2576	2011	1571	2011	1005	2011
Actual Neutral Axis Depth Nu:	67	90	100	77	95	81	68	81	95	62	99	104	97	84	74	55	74
Balanced neutral axis depth:	101	101	101	101	101	101	101	101	101	101	113	113	113	113	75	75	75
Actual tensile stress :	**284**	**167**	**288**	**0**	**168**	**73**	**0**	**66**	**159**	**0**	**0**	**248**	**169**	**288**	**15**	**26**	**16**
Maximum compressive stress:	**8.58**	**7.44**	**14.87**	**0.00**	**9.10**	**2.86**	**0.00**	**2.57**	**8.61**	**0.00**	**0.00**	**12.33**	**7.00**	**10.76**	**0.82**	**0.96**	**0.85**
CG of compressive force:	22.19	30.01	33.30	25.55	31.73	27.09	22.80	27.09	31.73	20.70	33.04	34.59	32.45	28.01	24.53	18.29	24.53
Total Compressive Force :	285.50	335.01	742.60	0.00	433.04	116.37	0.00	104.42	409.66	0.00	0.00	639.65	340.64	451.95	30.11	26.40	31.35
Total Tensile Force :	285.50	335.01	742.60	0.00	433.04	73.87	0.00	66.28	409.66	0.00	0.00	639.65	340.64	451.95	30.11	26.40	31.35
Difference in force	0.00	0.00	0.00	0.00	0.00	-42.50	0.00	-38.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Moment of resistance :	91.31	104.52	229.24	0.00	122.67	23.26	0.00	20.87	116.05	0.00	0.00	211.35	122.48	152.30	6.55	5.91	6.82
Applied Moment :	91.31	104.52	229.24	0.00	122.67	23.26	0.00	20.87	116.05	0.00	0.00	211.35	122.48	152.30	6.55	5.91	6.82
Difference in moment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHECK FOR COMPRESSIVE STRESS	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
CHECK FOR TENSILE STRESS	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
	TOP SLAB				**SIDE WALL**						**BOTTOM SLAB**				**INNER WALL**		