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Geotechnical • Mechanical • Electrical
Fire • Hydraulics • Lifts • Green ESD
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STRUCTURAL CALCULATIONS AND DETAILS ADDENDUM (SR1A-01)

Builder / Agent:	KEY LARGO WATERS PTY LTD	**Job Number:**	1903075
Owner:	DARRAGH SEXTON & EMMA CAVAGGION	**Date:**	14/06/2019
Project:	PROPOSED 4 LEVEL APARTMENT BUILDING	**Order No.**	
Project Location:	11-13 WEST STREET, HINDMARSH		
Original Report Date:	30/04/2019		
Previous Addendum Dates:	N/A		

This Addendum is an integral part of the original Structural Calculations and Details giving specific recommendations for the above mentioned building / structure. The Addendum must be read in conjunction with the original report, previous Addenda and all listed attachments. This report is valid for a period of 24 months based on current standards, regulations, etc.

ATTACHMENTS: SC23, CC6-CC16, CB5-CB102, CS76-CS80, CW1-CW20, RS8-RS10, SS1-SS3, ST1-ST2

RECOMMENDED SITE INSPECTIONS:

1. After excavation for the footing beams and piers, prior to placement of the damp proof membrane.
2. After preparation of the reinforcement prior to pouring of any concrete.
3. As otherwise required by the engineer, or requested by the client/contractor.

NOTE: 1. These inspections will incur additional fees.
2. We require 24 hours notice when booking inspections.

ADDITIONAL NOTES / REQUIREMENTS:

1. Refer to A1 Drawings (Rev.B) for all Structural Details.
2. Footing sizes and details to be confirmed after demolition of existing structures and completion of geotechnical investigation.

REASON FOR ADDENDUM:

1. Reply to structural queries from the Certifier

For and on behalf of
TMK Consulting Engineers

ANDREW MARTIN
Senior Associate / Team Leader

REF: **1903075** DATE: 14/06/2019

PROPOSED 4 LEVEL APARTMENT BUILDING 11-13 WEST STREET, HINDMARSH

Please find our replies in RED:

1. Fire check to columns

Please refer to our supplementary calculation attached.

2. Slab design
    a. FRL check
    b. Bottom reinforcement (fire reo) requirement?

a. & b. Refer to our supplementary notes attached. Fire reo added. Plans revised.

3. Band beam design
    a. Provide Long Term Deflection check to all band beams. ETABS results showing min Longitudinal & Shear reo req but please supply detail calculations to each beam
    b. CB4 & CB5 are a concern regarding long term deflections (refer West & E1 Elevations). Especially CB4, Single span – don't think it can pass the long term deflection check

a. & b. Refer to our supplementary calculations attached. Some beams had been widen, reo revised. Please refer to our updated plans and beam details.

    c. Clarification of beam depth to CB5 -nominated Balcony 80mm set-down on Drawing

No sofit setdown. Beam depth varies along the beam as a result of set-downs at balcony and wet areas. Please refer to our updated plans and beam details.

4. Deltacore Planks
    a. Fire rating

Please refer to our supplementary note re. FR check for Deltacore.

    b. Calc page 51 -Deltacore Span Table typical topping slab is 60mm, please check for 80mm topping as specified on drawing

Please refer to our supplementary note. the Deltacore has the LL capacity of 10kPa, this will cover the extra toping without affecting the overall capacity of the member.

    c. Drawing S201 Section B, clarify capacity of Deltacore planks to carry/support cantilever balcony slab (hogging)

Please refer to our supplementary note. Deltacore has been modified by breaking out and allowing the continuity of reo from balcony slab.

5. Concrete Stair design calculation

Supplementary calculation attached.

6. Precast panel design
    a. Wall design calculations
    b. FRL
    c. Shear dowels check for EQ case

a. b. & c. Supplementary calculations attached. Minor changes made to precast walls, refer to updated plans and wall dowel details.

    d. Clarify dowel adequacy in shear from Wall to Slab (EQ case) along East/West Elevation

The precast walls facing East and West (shown in East & West elevations) are not designed for load-bearing (laterally and horizontally). Provisional dowel applied. However, we do increase dowel size for 1st floor wall in our structural plans.

7. Detail steel design calculations
    a. RB5/TB1/S1/all floor beams

Supplementary calculations attached (RS and SS pages). For RB5, please refer to our initial CR1.

8. Confirm the 180kPa as safe bearing pressure mentioned in the calcs.

180kPa as safe bearing pressure to be confirmed with a soil test report which only can be done after the demolition of existing structure at site.

9. Other items: SB1 & SC1 has been designed for 15% capacity reduction in the event of FIRE. Refer to the steel column calculation in this report (page SS2-SS3). FRL added to dwg steel schedules.

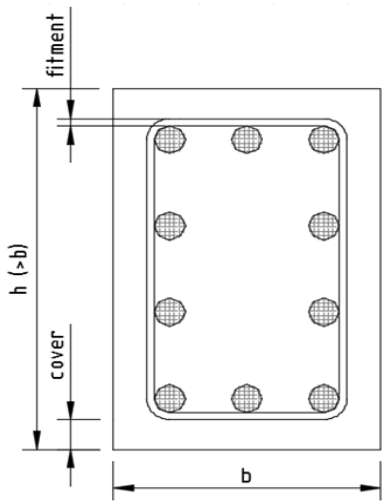
COLUMN

Ref.: 1903075
Date: 9/05/2019
Design: ENG
Page: CC1

FIRE RESISTANCE FOR BRACED SHORT RECTANGULAR COLUMN TO AS 3600:2018

I. Column Properties

Braced Column? (**Y** or **N**)			**Y**		Checked OK
Column exposed on **ONE** side? (**Y** or **N**)			**N**		
Column Height	H	=	**2250**	mm	
Width	b	=	**300**	mm	
Depth	h	=	**900**	mm	
Cover		=	**25**	mm	
Fitment Diameter		=	**12**	mm ∅	
Bar Diameter		=	**24**	mm ∅	



No. of Bars along b (**min 3 bars**)		=	**3**	bars	Checked OK (>= 3)
No. of Bars along h (**min 3 bars**)		=	**6**	bars	Checked OK (>= 3)
Effective Length Factor	k	=	**1.00**		
Concrete Grade	f'_c	=	**40**	MPa	
Steel Yield Strength	f_{sy}	=	**500**	MPa	
a_s (axis distance)		=	49	mm	
D_c = MIN(b,h)		=	300	mm	
D (cross-section depth in bending)		=	300	mm	
L_e = k * h (**max 3m high**)		=	2250	mm	Checked OK (< 3m)
A_s		=	6333	mm^2	
% A_s (**max 4%**)		=	2.35	%	Checked OK (<= 4%)
A_g		=	270000	mm^2	
A_c		=	263667	mm^2	

Design eccentricity	e =	**0.05**	x b	=	15	mm	Cheched OK (>= 5%)
Check e/b < 0.15		e/b		=	0.05		Cheched OK (< 0.15)

II. Column Load (under Fire Condition)

Fr. model/cals	N^*_f	=	**940**	kN
Fr. col. ult. capacity (RAPT...)	N_u	=	**3400**	kN
μ_{fi} = N^*_f / N_u		=	0.276471	Checked OK (<= 0.7)

III. FRP Check

FRP Required		=	**120**	min
D_c		=	**300**	mm
a_s		=	**49**	mm
μ_{fi}		=	**0.28**	
Min. FRP Achieved (Use Table 5.6.3)		=	**120**	min Checked OK
Overall Design is				OK

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RAPT - Version: 6.5.16.0
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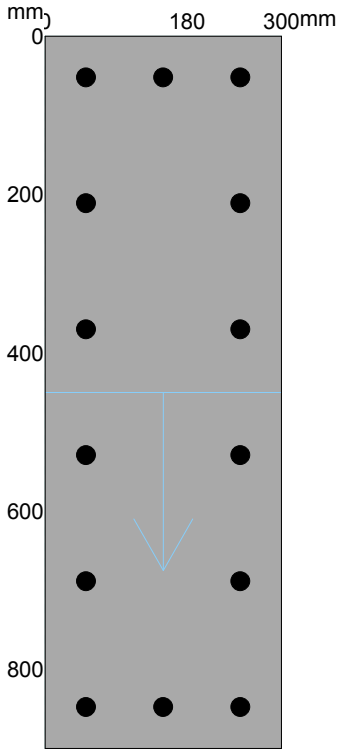


Input

General

Designer	A	
Project Name	A	
Project Number	A	
Description	A	
Design Code	List	Australia - AS3600-2009*SAVED*
Material	List	Australia - Australian Materials - 2009*SAVED*
Concrete Type	List	Standard Concrete - Brisbane/Sydney
Concrete Strength	List	40MPa
Rotation	#.#	0
Tension Curve	Y/N	N

Rectangle

	Solid/Void	X	Y	Width	Depth
#	List	mm	mm	mm	mm
1	Solid	0	0	300	900

Reinforcement Bar

	Reinforcement Bar Type	Reinforcement Bar Size	Number of bundled bars	X	Y	Distance	Tendon Force
#	List	List	List	mm	mm	mm	kN
1	N, Deformed, 500MPa	24, 24mm, 452mm2	1	52	52	10000	0
2				150	52	10000	0
3				150	848	10000	0
4				248	848	10000	0
5				52	211	10000	0

	Reinforcement Bar Type	Reinforcement Bar Size	Number of bundled bars	X	Y	Distance	Tendon Force
#	List	List	List	mm	mm	mm	kN
6				52	370	10000	0
7				52	530	10000	0
8				52	689	10000	0
9				52	848	10000	0
10				248	52	10000	0
11				248	211	10000	0
12				248	370	10000	0
13				248	530	10000	0
14				248	689	10000	0

Design Data

Capacity Reduction Factor in Flexure - Tension	#.#	0.8
Capacity Reduction Factor in Flexure - Compression	#.#	0.6
Capacity Reduction Factor in Shear	#.#	0.7
Concrete Material Factor Flexure	#.#	1
Concrete Material Factor Shear	#.#	1
Reinforcement Material Factor	#.#	1
Maximum Depth of Neutral Axis for Ductility	#.#	0.4
Shear Enhancement near Support	Y/N	N
Time of Loading in Days	#.#	28
Concrete Strength at Time of Loading	MPa	40
Design Period in Years	#.#	30
Relative Humidity	%	50
Average Temperature	C.	20
Long Term Calculation Basis	List	Code Default
Concrete Strength Gain Rate	List	N

Design Points

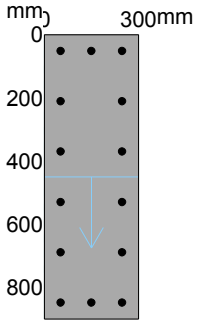
	Moment	Axial Force	Description
-1	kNm	kN	A
0	350	1260	

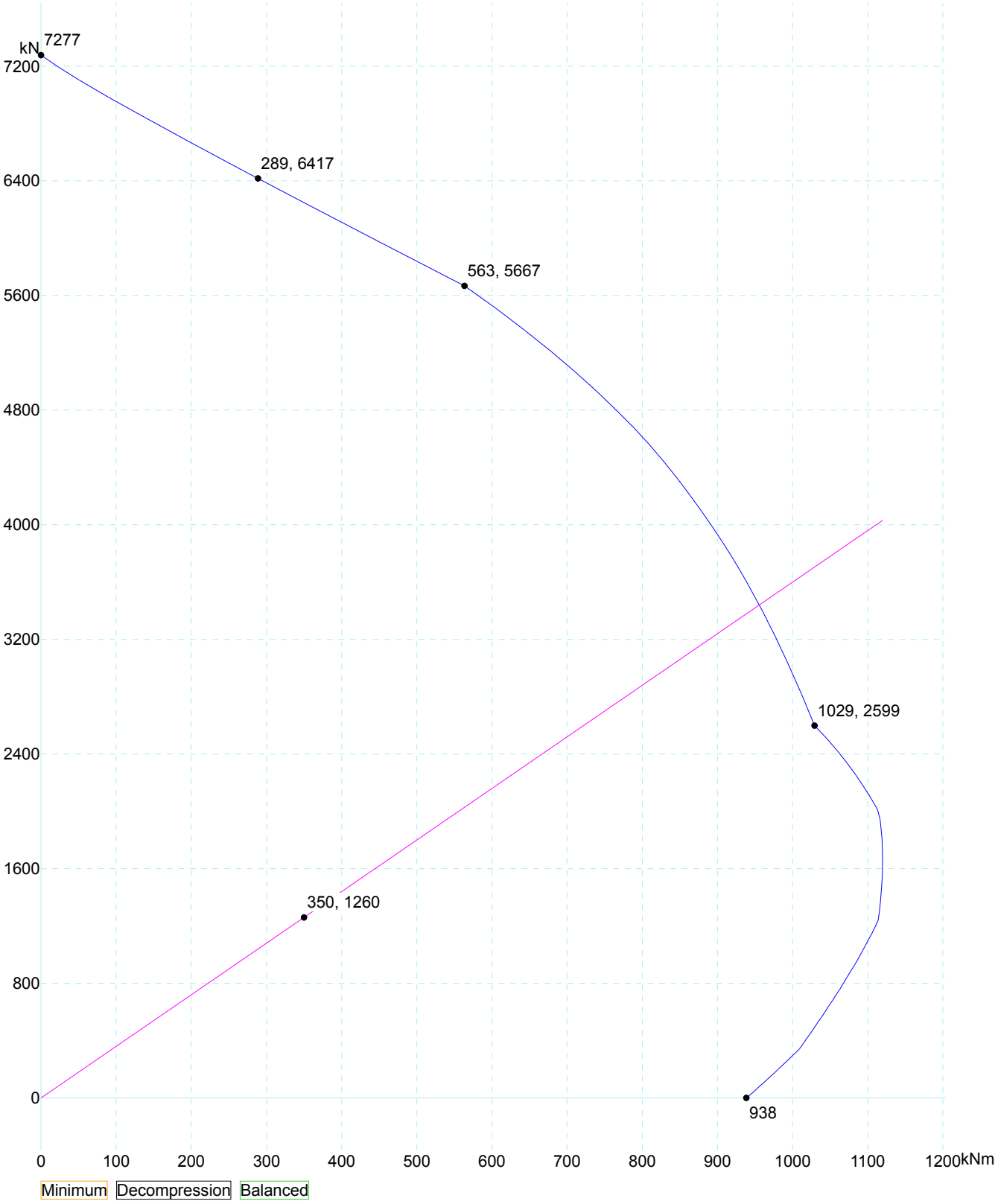
Slenderness

Length Unsupported	mm	2250
Column Framing	List	Braced
Effective Length Factor Braced	#.#	1
Moment Ratio for Creep	#.#	0.5
Smaller End Moment M1	kNm	19
Larger End Moment M2	kNm	350
Applied Axial Load	kN	1260

Slenderness Interaction Diagram

Rectangle 900mm Deep x 300mm
Reinforcement Bar, 14 N24
Reinforcement Ratio - 2.34%
Australia - AS3600-2009
Australia - Australian Materials - 2009
Concrete Type - 40MPa
Composite Elements 0.00 degrees clockwise. - Top Face in Compression
Length Unsupported = 2250mm
Effective Length Factor Braced = 1.00
Smaller End Moment = 19kNm
Larger End Moment = 350kNm
Minimum Moment = 57kNm
Slenderness - Column is STOCKY according to Code limits. No moment magnification required.
Maximum Moment = 1110kNm





CC-11

Errors and Warnings

Input

No errors or warnings were found.

Output

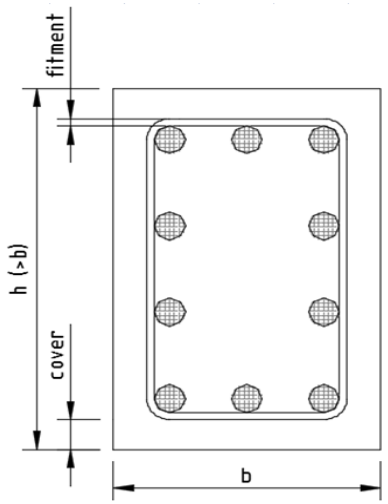
No errors or warnings were found.

Ref.: 1903075
Date: 9/05/2019
Design: ENG
Page: CC2

FIRE RESISTANCE FOR BRACED SHORT RECTANGULAR COLUMN TO AS 3600

I. Column Properties

Braced Column? (**Y** or **N**)			Y		Checked OK
Column exposed on **ONE** side? (**Y** or **N**)			N		
Column Height	H	=	2250	mm	
Width	b	=	300	mm	
Depth	h	=	700	mm	
Cover		=	25	mm	
Fitment Diameter		=	12	mm ∅	
Bar Diameter		=	24	mm ∅	



No. of Bars along b (**min 3 bars**)		=	3	bars	Checked OK (>= 3)
No. of Bars along h (**min 3 bars**)		=	5	bars	Checked OK (>= 3)
Effective Length Factor	k	=	1.00		
Concrete Grade	f'_c	=	40	MPa	
Steel Yield Strength	f_{sy}	=	500	MPa	
a_s (axis distance)		=	49	mm	
D_c = MIN(b,h)		=	300	mm	
D (cross-section depth in bending)		=	300	mm	
L_e = k * h (**max 3m high**)		=	2250	mm	Checked OK (< 3m)
A_s		=	5429	mm^2	
% A_s (**max 4%**)		=	2.59	%	Checked OK (<= 4%)
A_g		=	210000	mm^2	
A_c		=	204571	mm^2	

Design eccentricity	e =	0.05	x b	=	15	mm	Cheched OK (>= 5%)
Check e/b < 0.15		e/b		=	0.05		Cheched OK (< 0.15)

II. Column Load (under Fire Condition)

Fr. model/cals	N^*_f	=	447	kN
Fr. col. ult. capacity (RAPT...)	N_u	=	1200	kN
μ_{fi} = N^*_f / N_u		=	0.3725	Checked OK (<= 0.7)

III. FRP Check

FRP Required		=	120	min
D_c		=	**300**	mm
a_s		=	**49**	mm
μ_{fi}		=	**0.37**	
Min. FRP Achieved (Use Table 5.6.3)		=	120	min Checked OK
Overall Design is				OK

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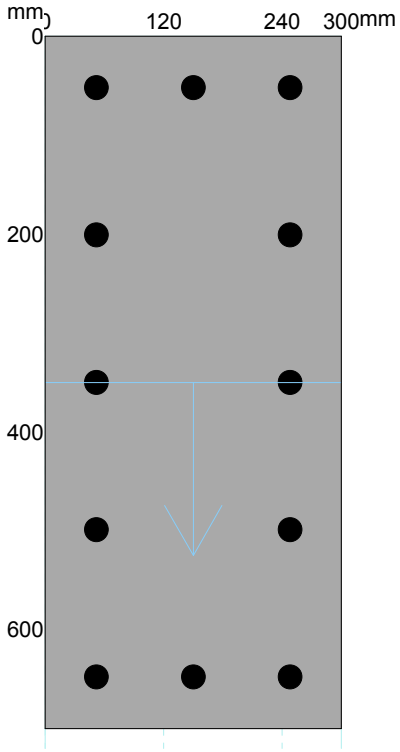


Input

General

Designer	A	
Project Name	A	
Project Number	A	
Description	A	
Design Code	List	Australia - AS3600-2009*SAVED*
Material	List	Australia - Australian Materials - 2009*SAVED*
Concrete Type	List	Standard Concrete - Brisbane/Sydney
Concrete Strength	List	40MPa
Rotation	#.#	0
Tension Curve	Y/N	N

Rectangle

	Solid/Void	X	Y	Width	Depth
#	List	mm	mm	mm	mm
1	Solid	0	0	300	700

Reinforcement Bar

	Reinforcement Bar Type	Reinforcement Bar Size	Number of bundled bars	X	Y	Distance	Tendon Force
#	List	List	List	mm	mm	mm	kN
1	N, Deformed, 500MPa	24, 24mm, 452mm2	1	52	52	10000	0
2				150	52	10000	0
3				150	648	10000	0
4				248	648	10000	0
5				52	201	10000	0

	Reinforcement Bar Type	Reinforcement Bar Size	Number of bundled bars	X	Y	Distance	Tendon Force
#	List	List	List	mm	mm	mm	kN
6				52	350	10000	0
7				52	499	10000	0
8				52	648	10000	0
9				248	52	10000	0
10				248	201	10000	0
11				248	350	10000	0
12				248	499	10000	0

Design Data

Capacity Reduction Factor in Flexure - Tension	#.#	0.8
Capacity Reduction Factor in Flexure - Compression	#.#	0.6
Capacity Reduction Factor in Shear	#.#	0.7
Concrete Material Factor Flexure	#.#	1
Concrete Material Factor Shear	#.#	1
Reinforcement Material Factor	#.#	1
Maximum Depth of Neutral Axis for Ductility	#.#	0.4
Shear Enhancement near Support	Y/N	N
Time of Loading in Days	#.#	28
Concrete Strength at Time of Loading	MPa	40
Design Period in Years	#.#	30
Relative Humidity	%	50
Average Temperature	C.	20
Long Term Calculation Basis	List	Code Default
Concrete Strength Gain Rate	List	N

Design Points

	Moment	Axial Force	Description
-1	kNm	kN	A
0	350	590	

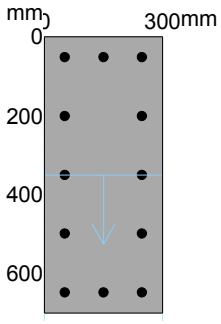
Slenderness

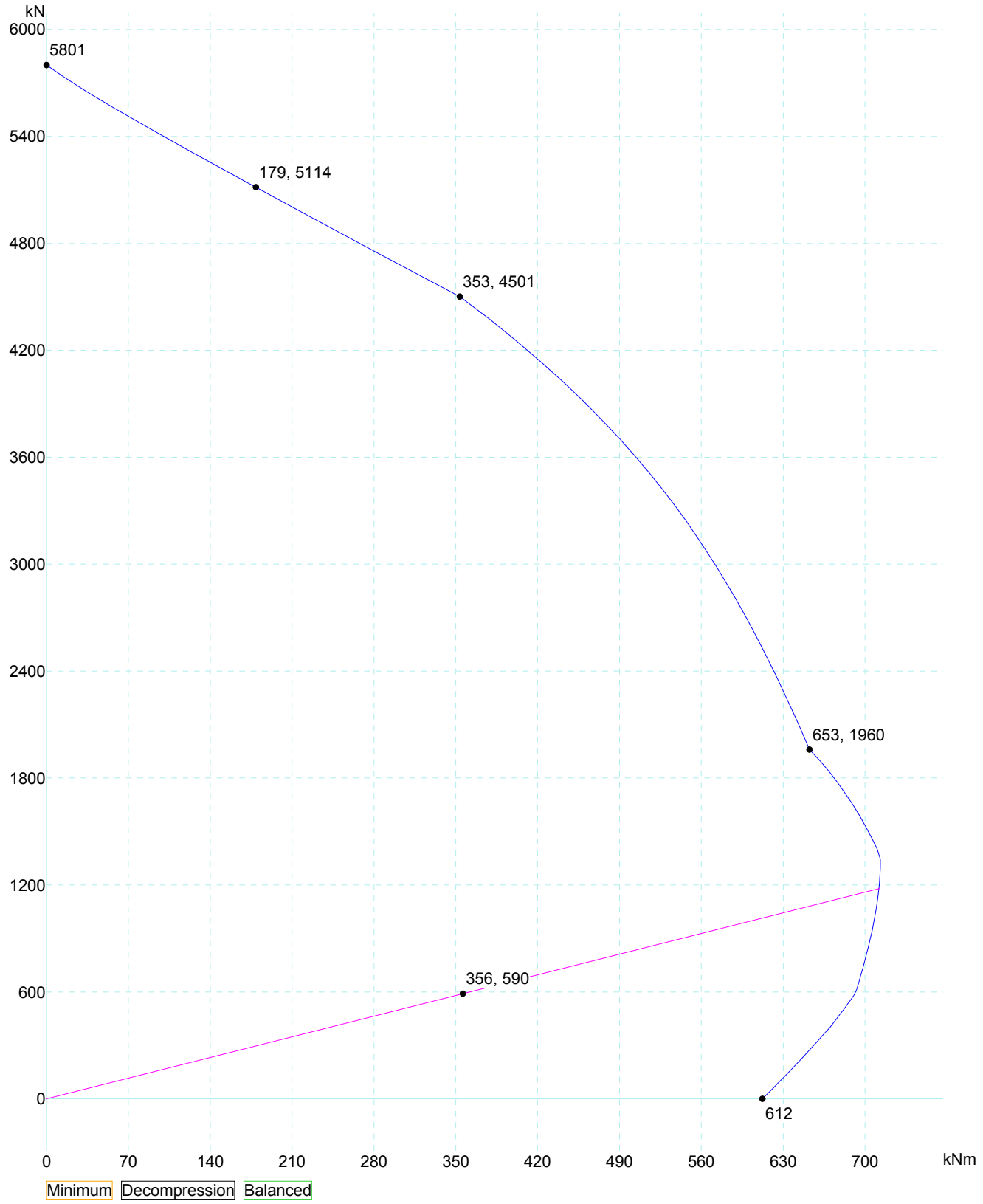
Length Unsupported	mm	2250
Column Framing	List	Braced
Effective Length Factor Braced	#.#	1
Moment Ratio for Creep	#.#	0.5
Smaller End Moment M1	kNm	45
Larger End Moment M2	kNm	356
Applied Axial Load	kN	590

GG15

Slenderness Interaction Diagram

Rectangle 700mm Deep x 300mm
Reinforcement Bar, 12 N24
Reinforcement Ratio - 2.58%
Australia - AS3600-2009
Australia - Australian Materials - 2009
Concrete Type - 40MPa
Composite Elements 0.00 degrees clockwise. - Top Face in Compression
Length Unsupported = 2250mm
Effective Length Factor Braced = 1.00
Smaller End Moment = 45kNm
Larger End Moment = 356kNm
Minimum Moment = 21kNm
Slenderness - Column is STOCKY according to Code limits. No moment magnification required.
Maximum Moment = 689kNm





Errors and Warnings

Input

No errors or warnings were found.

Output

No errors or warnings were found.

BAND BEAM

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RAPT - Version: 6.5.16.0
Reinforced And Post-Tensioned Concrete Analysis & Design Package

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Input

General

Design Code	List	Australia - AS3600*SAVED*
Material	List	Australia - Australian Materials*SAVED*
Reinforcement Type	List	Reinforced
Member Type	List	Beam
Panel Type	List	Internal
Strip Type	List	One way - Nominal Width
Column Stiffness	List	Equivalent Column
Concrete Type	List	Standard Concrete - Brisbane/Sydney
Concrete - Spanning Members	List	40MPa
Concrete - Columns	List	40MPa
Top Reinforcement Cover	mm	32
Bottom Reinforcement Cover	mm	32
Top Reinforcement Axis Depth Limit	mm	30
Bottom Reinforcement Axis Depth Limit	mm	30
Concrete Unit Weight	kn/m3	25
Self Weight Definition	List	Program Calculated
Pattern Live Load	Y/N	Y
Earthquake Design	List	None
Moment Redistribution	%	0
Design Surface Levels	List	Extreme Surfaces

Span

Span	Span Length	Slab Depth	Panel Width Left	Panel Width Right
	mm	mm	mm	mm
LE	0			
1	4200	250	3000	3000
2	7300	230	3000	3000
3	3000	230	3000	3000
RE	0			

Columns

Column	Column Grid Reference	Support Type	Transverse Column spacing	Transverse prestress (P/A)
	A	List	mm	MPa
1	1	Knife-Edge	3000	
2	2	Knife-Edge	3000	
3	3	Knife-Edge	3000	
4	4	Knife-Edge	3000	

Beams

Beam Number	Beam Depth	Beam Width at Slab	Beam Width	Effective Flange Width
	mm	mm	mm	mm
1	600	1200	1200	1914
2	600	1200	1200	2222
3	520	1200	1200	1710

Load Cases

Load Case	Load Type	Load Definition	Live Load Deflection Case	Description
	List	List	Y/N	A
1	Self Weight	Applied Loads		
2	Initial Dead Load	Applied Loads		
3	Extra Dead Load	Applied Loads		
4	Live Load	Applied Loads	Y	

1. Self Weight - Line

Load	Left End Reference Column	Left end of load from reference column	Load at left end	Right End reference column	Right end of load from reference column	Load at right end	Description
	#	mm	kN/m	#	mm	kN/m	A
1	1	0	29.25	2	0	29.25	
2	2	0	28.35	3	0	28.35	
3	3	0	25.95	4	0	25.95	

2. Initial Dead Load - Panel

Load	Left End reference column	Left end of load from reference column	Load at left end	Right End reference column	Right end of load from reference column	Load at right end	Description
	#	mm	kN/m2	#	mm	kN/m2	A
1	1	0	1	4	0	1	

3. Extra Dead Load - Point

Load	Reference column	Distance to Load from reference column	Load	Load Length	Description
	#	mm	kN	mm	A
1	2	3000	476	800	
2	3	1000	156	0	

4. Live Load - Panel

Load	Left End reference column	Left end of load from reference column	Load at left end	Right End reference column	Right end of load from reference column	Load at right end	Live Load reduction	Description
	#	mm	kN/m2	#	mm	kN/m2	#.#	A
1	1	0	2	4	0	2	1	

4. Live Load - Point

Load	Reference column	Distance to Load from reference column	Load	Load Length	Live Load reduction	Description
	#	mm	kN	mm	#.#	A
1	2	3000	174	800	1	
2	3	1000	35	0	1	

Load Combinations : Ultimate

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Live Load	1.2	1.2	1.2	1.5
2	Live Load	0.9	0.9	0.9	1.5
3	Dead Load	1.35	1.35	1.35	0

Load Combinations : Short Term Service

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Live Load	1	1	1	0.7

Load Combinations : Permanent Service

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Live Load	1	1	1	0.4

Load Combinations : Deflection

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Short Term - Deflection	1	1	1	0.7
2	Permanent - Deflection	1	1	1	0.4
3	Initial - Deflection	1	1	0	0

Load Combinations : Transfer Prestress

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Transfer	1	0	0	0

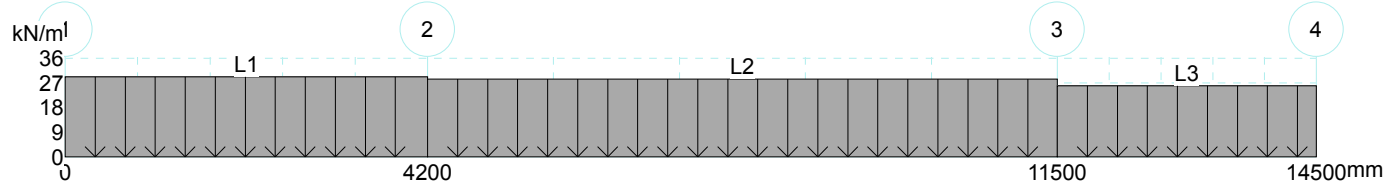
Load Combinations : Pre Existing

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Pre Existing	1	0	0	0

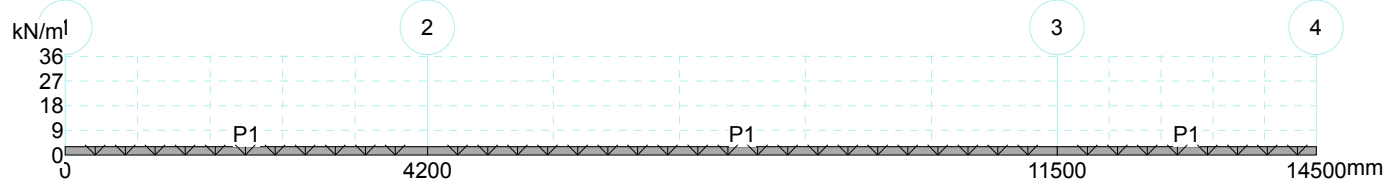
Load Combinations : Construction

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Construction	1	0	0	0

Load Case 1 : 1. Self Weight

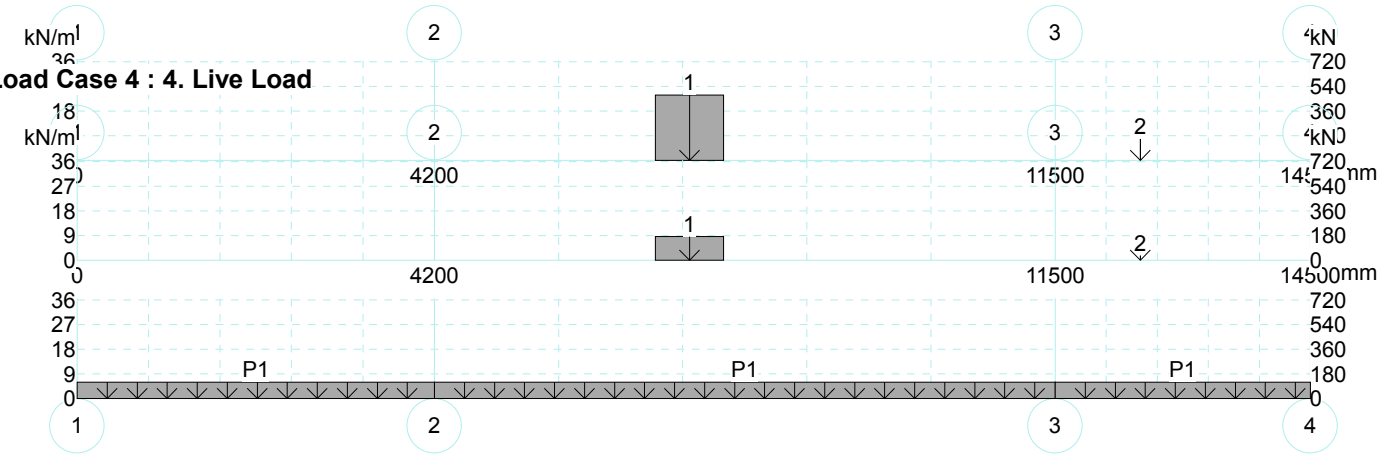


Load Case 2 : 2. Initial Dead Load



Load Case 3 : 3. Extra Dead Load

Load Case 4 : 4. Live Load



Reinforcement

Reinforcement Use	Reinforcement Type	Preferred Bar Size	Number of Legs
	List	List	#
Flexural Bar	N 500MPa		
Flexural Mesh	F 450MPa		
Shear Option 1	N 500MPa	10	2
Shear Option 2	N 500MPa	12	2
Shear Option 3	N 500MPa	16	2
Punching Shear	N 500MPa	10	1

Reinforcement

	Maximum Bar Spacing	Minimum Bar Spacing	Minimum Continuous Reinforcement	Minimum Span Reinforcement into End Support	Minimum Span Reinforcement into Internal Support	Infill Bars	Stagger Bars
	mm	mm	#.#	#.#	#.#	Y/N	Y/N
Support Reinforcement	300	60	0			N	N
Span Reinforcement	300	60		0	0	N	N

Design Zones : Top

Layer Number	Steel type	Left End Reference Column	Distance to left end of bar	Bar stagger length at left end	Top Cover at left end	Right End Reference Column	Distance to right end of bar	Bar stagger length at right end	Top Cover at Right end	Maximum Bar Size	Minimum Bar Size	Preferred bar size
	List	#	mm	mm	mm	#	mm	mm	mm	List	List	List
1	Bar	1	0	0	32	4	0	0	32	36	16	28

Layer Number	Minimum Number of Bars	Maximum Spacing of Bars	Minimum Steel area as %	% in Flange
	#	mm	%	%
1	0	0	0	0

Design Zones : Bottom

Layer Number	Steel type	Left End Reference Column	Distance to left end of bar	Bar stagger length at left end	Bottom Cover at left end	Right End Reference Column	Distance to right end of bar	Bar stagger length at right end	Bottom Cover at Right End	Maximum Bar Size	Minimum Bar Size	Preferred bar size
	List	#	mm	mm	mm	#	mm	mm	mm	List	List	List
1	Bar	1	0	0	32	4	0	0	32	36	16	28

Layer Number	Minimum Number of Bars	Maximum Spacing of Bars	Minimum Steel area as %	% in Flange
	#	mm	%	%
1	0	0	0	0

User Defined : Top

Layer Number	Steel type	Left End Reference Column	Distance to left end of bar	Bar stagger length at left end	Top Cover at left end	% Development of Left End of Bar in Tension	% Development of Left End of Bar in Compression	Right End Reference Column	Distance to right end of bar	Bar stagger length at right end	Top Cover at Right end
	List	#	mm	mm	mm	%	%	#	mm	mm	mm
1	N 500MPa	1	0	0	60	100	100	4	0	0	60

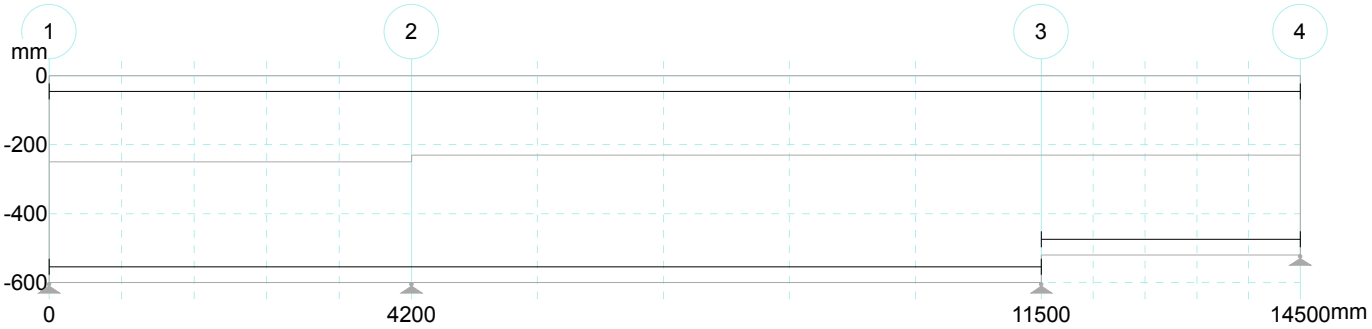
Layer Number	% Development of Right End of Bar in Tension	% Development of Right End of Bar in Compression	Bar Size	Number of Bars	Spacing of Bars	% in Flange	Layer attached after the PreExisting Load Case
	%	%	List	#	mm	%	Y/N
1	100	100	28	10	0	0	N

User Defined : Bottom

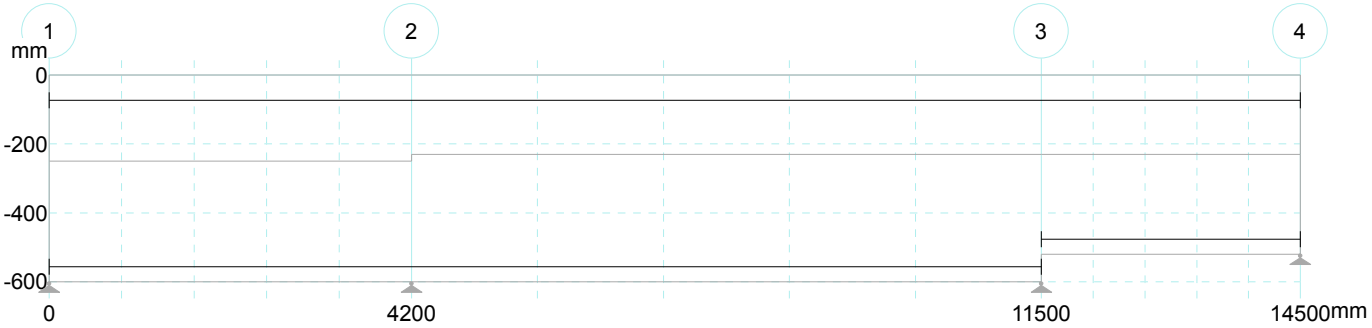
Layer Number	Steel type	Left End Reference Column	Distance to left end of bar	Bar stagger length at left end	Bottom Cover at Left end	% Development of Left End of Bar in Tension	% Development of Left End of Bar in Compression	Right End Reference Column	Distance to right end of bar	Bar stagger length at right end	Bottom Cover at Right End
	List	#	mm	mm	mm	%	%	#	mm	mm	mm
1	N 500MPa	1	0	0	30	100	100	2	7300	0	30
2	N 500MPa	3	0	0	30	100	0	4	0	0	30

Layer Number	% Development of Right End of Bar in Tension	% Development of Right End of Bar in Compression	Bar Size	Number of Bars	Spacing of Bars	% in Flange	Layer attached after the PreExisting Load Case
	%	%	List	#	mm	%	Y/N
1	100	100	28	10	0	0	N
2	100	0	28	10	0	0	N

Reinforcement Design Zones



Reinforcement Design Zones User Defined



Design Data

Capacity Reduction factor (phi) for Flexure	#.#	0.8
Capacity Reduction factor (phi) for Shear	#.#	0.7
Material Factor for Concrete in Flexure	#.#	1
Material Factor for Concrete in Shear	#.#	1
Material Factor for Reinforcement	#.#	1
Maximum Ratio of Neutral Axis Depth for Ductility	#.#	0.4
Ductility Limit - Strain	#.#	0
Ductility Check at Left End Column	Y/N	Y
Ductility Check at Right End Column	Y/N	Y
Minimum Reinforcement Strength Limit - #.## x M*	#.#	0
Flexural Critical Section - Consider Transverse Beams	Y/N	Y
Flexural Critical Section - Distance from centre of Support	#.#	-1

Beam Left Sideface Cover (Internal)	mm	25
Beam Right Sideface cover	mm	40
Prestress Minimum Reinforcement Basis	List	Program Default
Shear Enhancement at Supports	Y/N	N
Ast Value in Shear Calculations	List	Calculated
Limit Reinforcement Strain	Y/N	N
Include Strain Hardening of Reinforcement	Y/N	
Beam Shear Critical Section Location	List	Code Critical Section

Maximum Service Stress Change - Prestressed Sections	MPa	150
Maximum Service Stress Change - Reinforced Sections	MPa	0
Relative Humidity	%	50
Average Temperature	C.	20
Prestress Losses Calculations based on	List	Program Default
Crack Width Calculations	List	Code default
AS3600 Shrinkage and Temperature Reinforcement	List	Moderate
Degree of Restraint in Primary Direction	%	0
Degree of Restraint in Secondary Direction	%	0
Concrete Strength Gain Rate	List	N

Concrete Tensile Strength for Deflection Calculations- #.## x (Fc)n	#.#	-1
Maximum Value of Ieff/Igross for Deflection Calculations	#.#	0.6
Total Deflection Warning Limit - Maximum Span/Deflection	#.#	500
Total Deflection Warning Limit - Maximum Deflection	mm	30
Incremental Deflection Warning Limit - Maximum Span/Deflection	#.#	500
Incremental Deflection Warning Limit - Maximum Deflection	mm	30
Initial Time for Shrinkage	List	Full Shrinkage
Time of Loading in days	#.#	10
Age Adjustment Factor	#.#	0.76
Concrete Strength at Time of Loading	MPa	33.8
Loaded Period in years	#.#	30
Tension stiffening Approach	List	Modified Concrete Tensile Modulus Method

Live Load Pattern Factor	#.#	1
Pattern Live Load for Ultimate Strength	Y/N	Y
Pattern Live Load for Crack Control	Y/N	Y
Pattern Live Load For Deflections	Y/N	Y
Pattern Live Load for Deflection Permanent Load Combination	Y/N	N

Material Properties

Concrete : Standard Concrete - Brisbane/Sydney : Concrete Strength Basis - Cylinder

Description	A	40MPa
Characteristic Compressive Strength	MPa	40
Mean Compressive Strength	MPa	45.9
Lower Characteristic Tensile Strength	MPa	3.79
Upper Characteristic Tensile Strength	MPa	6.83
Concrete Density	kg/m3	2447
Design Concrete Modulus	MPa	32919.2
Mean Concrete Modulus	MPa	35263.5
Basic Shrinkage Strain	mm/mm	850
Shrinkage Multiplier	#.#	1
Basic Creep Factor	#.#	2.5
Creep Multiplier	#.#	1
Concrete Strain at Peak Stress	#.#	0.002
Squash Load Factor	#.#	0.85
Concrete Strain Limit	#.#	0.004
Strength Gain Rate	List	Normal

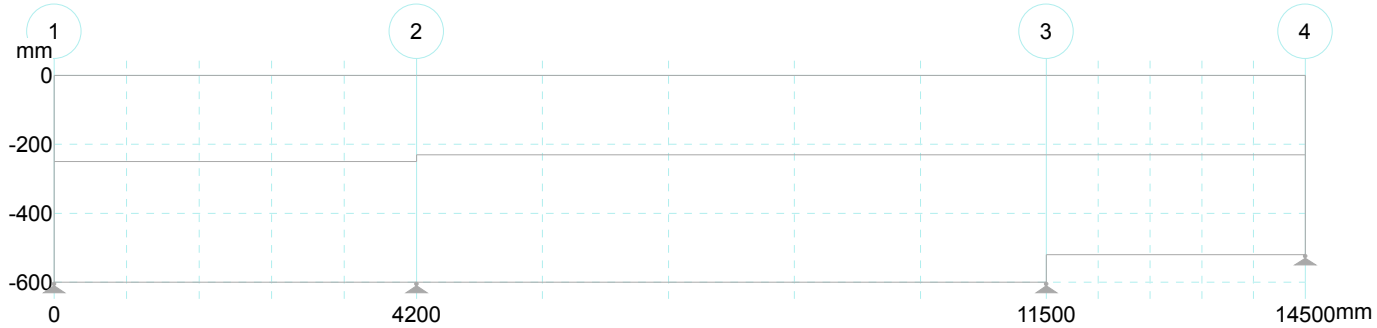
Reinforcement Bar

Designation	Type	Yield Stress	Elastic Modulus	Ductility	Peak Strain	Peak Stress	Design Strain Limit	Material Factor Flexure	Material Factor Shear	Material Capacity Reduction Factor - Flexure	Material Capacity Reduction Factor - Shear	Include as Flexural Reinforcement for Shear
N	Deformed	500	2e5	N	0.05	540	90	-1	-1	-1	-1	Y

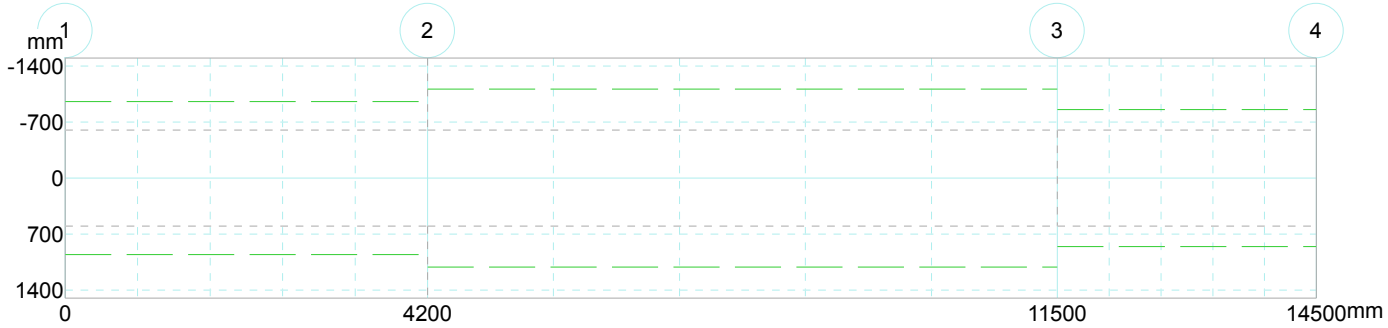
Description

Nominal Bar Size	Bar Diameter	Bar Area	Bar Inertia	Bar Weight	Stock Length
A	mm	mm2	mm4	kg/m	mm
10	10	78.5	491.07	0.62	12000
12	12	113	1018.29	0.89	12000
16	16	201	3218.29	1.58	12000
20	20	314	7857.14	2.47	12000
24	24	452	16292.6	3.55	12000
28	28	616	30184	4.83	12000
32	32	804	51492.6	6.31	12000
36	36	1020	82481.1	7.99	12000
40	40	1260	1.257e5	9.86	12000

Elevation view



Plan view



Warnings

Input

No errors or warnings were found.

Output

No errors or warnings were found.

Bending Moments

Load Cases

Column Actions

Col No. 1		Self Weight	Initial Dead Load	Extra Dead Load	Live Load
Moment Above	kNm	-0	-0	-0	-0
Moment Below	kNm	-0	-0	-0	-0
Reaction	kN	34.31	3.46	-76.95	-21.62
Elastic Rotation	#.#	0	0	-2.38e-4	0
Elastic Axial Shortening	mm	0	0	0	0

Col No. 2		Self Weight	Initial Dead Load	Extra Dead Load	Live Load
Moment Above	kNm	-0	-0	-0	-0
Moment Below	kNm	-0	-0	-0	-0
Reaction	kN	195.38	20.41	362.23	174.64
Elastic Rotation	#.#	0	0	4.77e-4	1.93e-4
Elastic Axial Shortening	mm	0	0	0	0

Col No. 3		Self Weight	Initial Dead Load	Extra Dead Load	Live Load
Moment Above	kNm	-0	-0	-0	-0
Moment Below	kNm	-0	-0	-0	-0
Reaction	kN	168.81	18.34	390.54	161.89
Elastic Rotation	#.#	-1.02e-4	0	-3.42e-4	-1.58e-4
Elastic Axial Shortening	mm	0	0	0	0

Col No. 4		Self Weight	Initial Dead Load	Extra Dead Load	Live Load
Moment Above	kNm	-0	-0	-0	-0
Moment Below	kNm	-0	-0	-0	-0
Reaction	kN	9.15	1.3	-43.82	-18.91
Elastic Rotation	#.#	0	0	1.27e-4	0
Elastic Axial Shortening	mm	0	0	0	0

Load Combinations

Column Actions

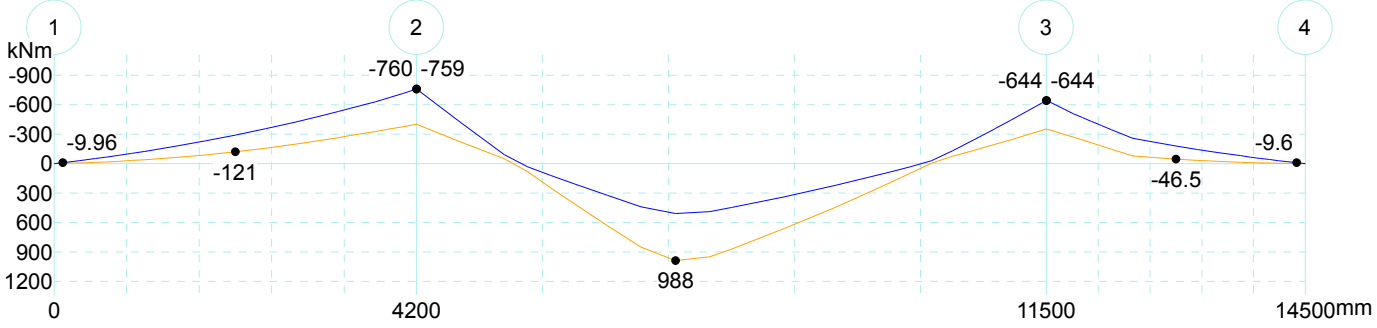
Col No. 1		Characteristic Service	Characteristic Service (Reversal)	Service	Service (Reversal)	Ultimate Flexure	Ultimate Flexure (Reversal)	Ultimate Shear	Ultimate Shear (Reversal)
Moment Above	kNm	0	0	0	0	0	0	0	0
Moment Below	kNm	0	0	0	0	0	0	0	0
Reaction	kN	-60.8	-60.8	-54.31	-54.31	-79.44	-79.44	-97.69	-17.81
Elastic Rotation	#.#	-3.13e-4	-3.13e-4	-2.87e-4	-2.87e-4	-4.01e-4	-4.01e-4	-4.29e-4	-1.79e-4
Elastic Axial Shortening	mm	0	0	0	0	0	0	0	0

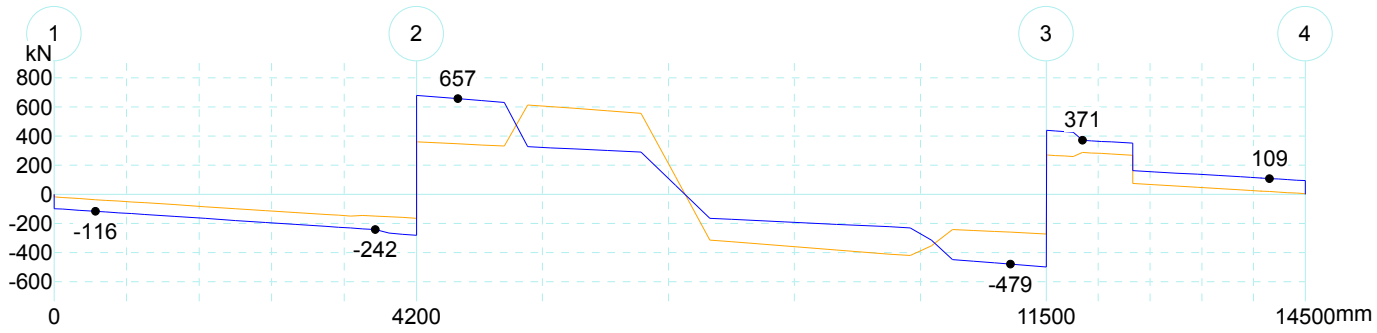
Col No. 2		Characteristic Service	Characteristic Service (Reversal)	Service	Service (Reversal)	Ultimate Flexure	Ultimate Flexure (Reversal)	Ultimate Shear	Ultimate Shear (Reversal)
Moment Above	kNm	0	0	0	0	0	0	0	0
Moment Below	kNm	0	0	0	0	0	0	0	0
Reaction	kN	752.65	752.65	700.26	700.26	955.57	955.57	524.61	960.11
Elastic Rotation	#.#	7.5e-4	7.5e-4	6.92e-4	6.92e-4	9.58e-4	9.58e-4	4.87e-4	9.66e-4
Elastic Axial Shortening	mm	0	0	0	0	0	0	0	0

Col No. 3		Characteristic Service	Characteristic Service (Reversal)	Service	Service (Reversal)	Ultimate Flexure	Ultimate Flexure (Reversal)	Ultimate Shear	Ultimate Shear (Reversal)
Moment Above	kNm	0	0	0	0	0	0	0	0
Moment Below	kNm	0	0	0	0	0	0	0	0
Reaction	kN	739.58	739.58	691.01	691.01	936.06	936.06	540.72	938.34
Elastic Rotation	#.#	-6.12e-4	-6.12e-4	-5.65e-4	-5.65e-4	-7.82e-4	-7.82e-4	-3.91e-4	-7.86e-4
Elastic Axial Shortening	mm	0	0	0	0	0	0	0	0

Col No. 4		Characteristic Service	Characteristic Service (Reversal)	Service	Service (Reversal)	Ultimate Flexure	Ultimate Flexure (Reversal)	Ultimate Shear	Ultimate Shear (Reversal)
Moment Above	kNm	0	0	0	0	0	0	0	0
Moment Below	kNm	0	0	0	0	0	0	0	0
Reaction	kN	-52.28	-52.28	-46.61	-46.61	-68.41	-68.41	-94.24	-4.68
Elastic Rotation	#.#	2.19e-4	2.19e-4	2e-4	2e-4	2.81e-4	2.81e-4	3.25e-4	0
Elastic Axial Shortening	mm	0	0	0	0	0	0	0	0

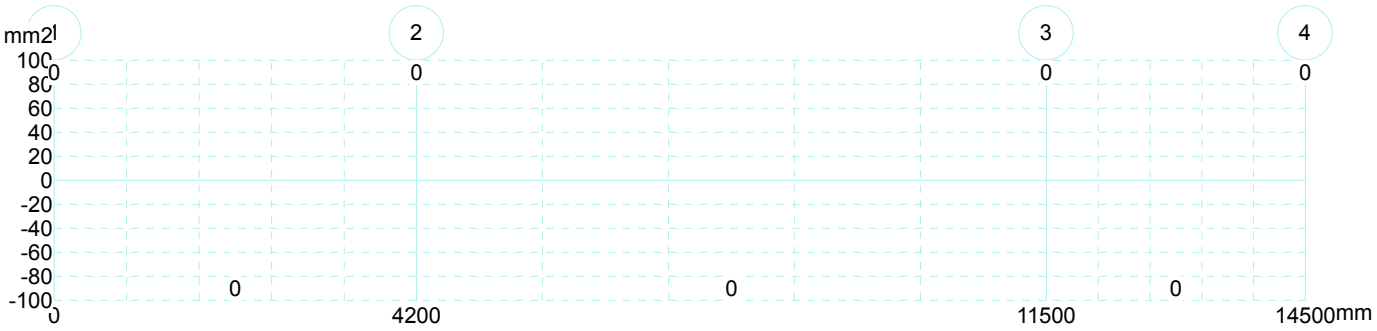
Ultimate Flexure



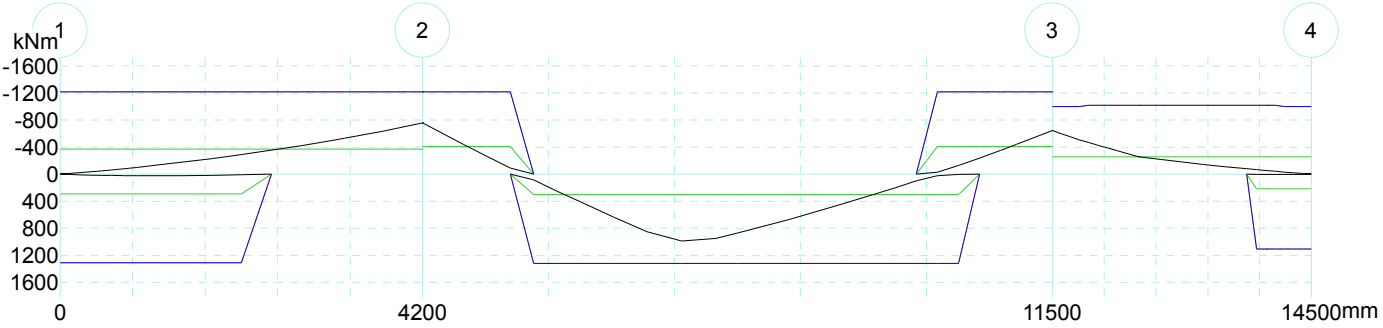


Shear Shear 1 Shear 2

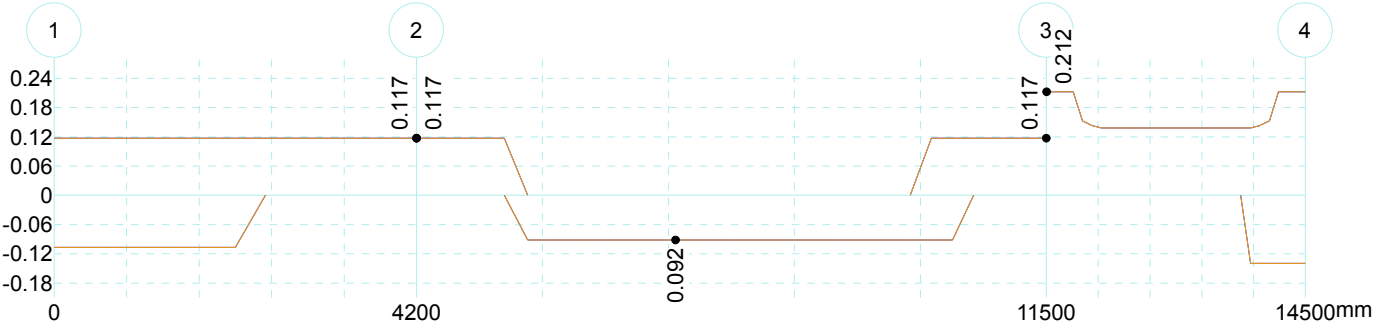
Flexural Design
Ultimate



Reinforcement Top Total Bottom Total Top Ultimate Bottom Ultimate Min Top Min Bot



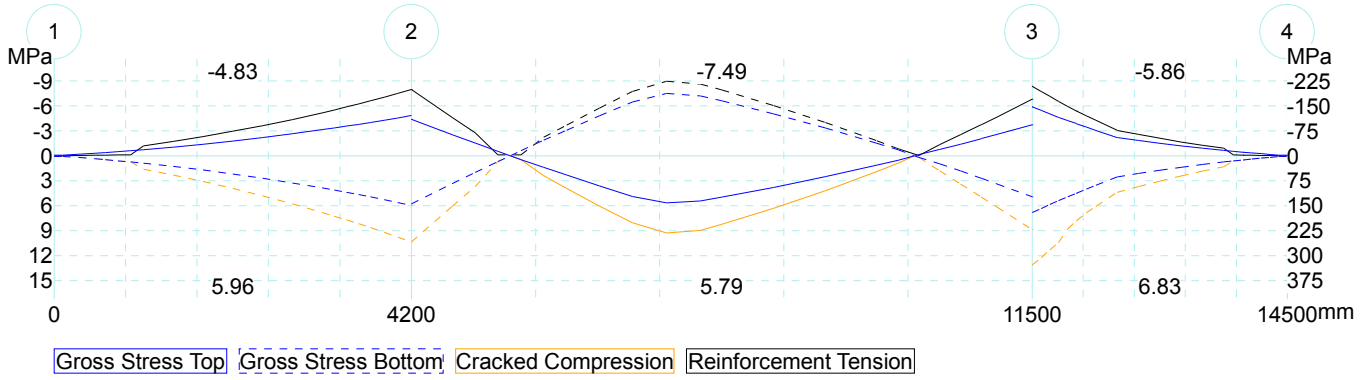
Capacity Minimum Ultimate Design Initial Final



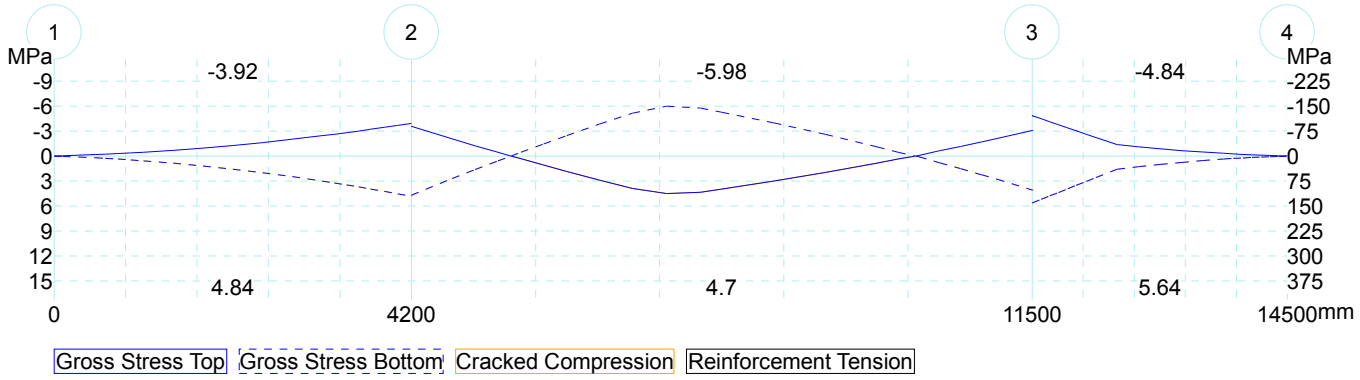
Neutral Axis Depth Initial Final

Service

Maximum Moment Condition

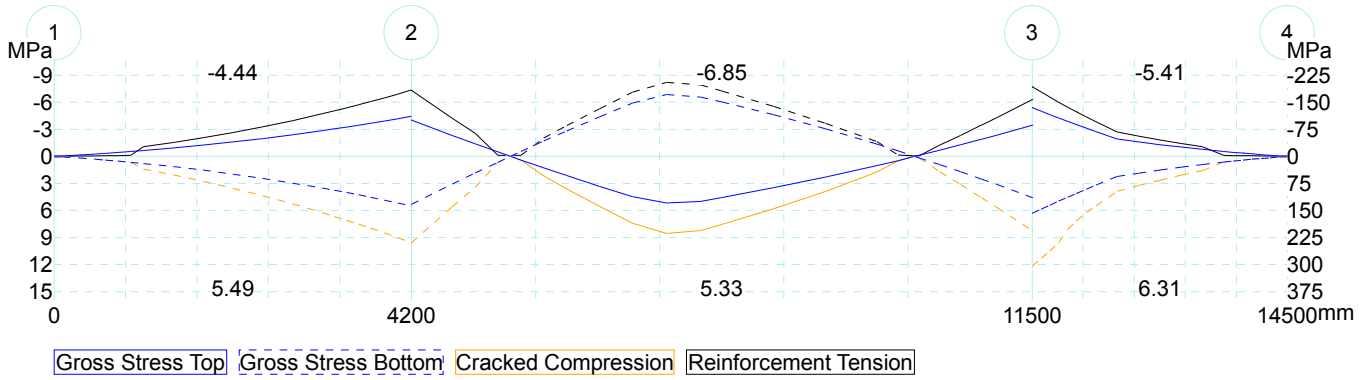


Reversal Moment Condition

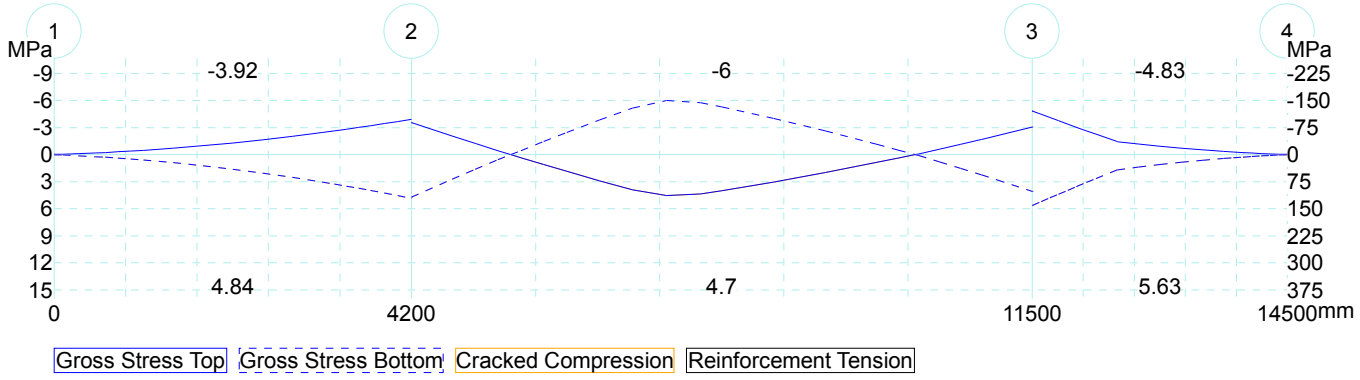


Permanent

Maximum Moment Condition



Reversal Moment Condition



Shear Design

Beam

Span 1

Locat	V*	Mv*	Mdec	d	Ast	bv	phi Vuc	phi Vut	phi Vu	Phi Vumax	phi VuMin	phi Vus	Theta	Asv/s
mm	kN	kNm	kNm	mm	mm2	mm	kN	kN	kN	kN	kN	kN	#.#	mm2/mm
100	-101.56	-9.96	0	526	0	1200	0	0	0	3534.72	0	0	0	0
480	-116.26	-51.35	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	0	30	0
599	-121.22	-64.43	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	0	30	0
601	-121.3	-64.67	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	0	30	0
750	-127.07	-83.18	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	0	30	0
899	-132.83	-102.54	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	0	30	0
1050	-139.74	-120.43	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	0	30	0
1400	-153.47	-168.11	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	0	30	0
1750	-168.59	-224.6	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	0	30	0
2100	-184.55	-282.37	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	0	30	0
2450	-199.55	-345.74	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	0	30	0
2800	-215.13	-415.37	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	0	30	0
3150	-231.82	-493.58	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	0	30	0
3294	-238.07	-525.43	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	0	30	0
3436	-244.85	-559.72	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	0	30	0
3578	-251.62	-594.96	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	0	30	0
3720	-258.21	-630.48	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	0	30	0
4199	-281.05	-759.63	0	526	0	1200	0	0	0	3534.72	0	0	0	0

Spacing of Sets				Minimum Legs	Shear Comments
2 legs N10	2 legs N12	2 legs N16	Min legs N10		
mm	mm	mm	mm	#	A
0	0	0	0	0	
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	

Span 2

Locat	V*	Mv*	Mdec	d	Ast	bv	phi Vuc	phi Vut	phi Vu	Phi Vumax	phi VuMin	phi Vus	Theta	Asv/s
mm	kN	kNm	kNm	mm	mm2	mm	kN	kN	kN	kN	kN	kN	#.#	mm2/mm
1	678.96	-759.24	0	526	0	1200	0	0	0	3534.72	0	0	0	0
480	656.63	-439.36	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	275.13	30.0379	0.86
749	644.09	-264.42	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	262.59	30	0.84
1018	631.88	-94.38	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	250.38	30	0.84
1287	619.34	73.91	0	556	0	1200	384.81	99999	384.81	3736.32	667.93	234.53	30	0.84
1556	606.79	238.82	0	556	0	1200	384.81	99999	384.81	3736.32	667.93	221.99	30	0.84
1825	595.43	395.77	0	556	0	1200	384.81	99999	384.81	3736.32	667.93	210.62	30	0.84
2212	577.39	622.71	0	556	0	1200	384.81	99999	384.81	3736.32	667.93	192.58	30	0.84
2600	559.3	843.22	0	556	0	1200	384.81	99999	384.81	3736.32	667.93	174.49	30	0.84
3000	141.69	930.58	0	556	0	1200	384.81	99999	384.81	3736.32	667.93	0	30	0
3400	-323.87	929.99	0	556	0	1200	384.81	99999	384.81	3736.32	667.93	0	30	0
3650	-335.53	847.56	0	556	0	1200	384.81	99999	384.81	3736.32	667.93	0	30	0
4259	-360.37	644.77	0	556	0	1200	384.81	99999	384.81	3736.32	667.93	0	30	0
4867	-386.38	424.83	0	556	0	1200	384.81	99999	384.81	3736.32	667.93	1.58	30	0.84
5475	-414.73	181.29	0	556	0	1200	384.81	99999	384.81	3736.32	667.93	29.92	30	0.84
5723	-425.04	82.09	0	556	0	1200	384.81	99999	384.81	3736.32	667.93	40.24	30	0.84
5967	-436.42	-23.01	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	54.93	30	0.84
6211	-447.79	-130.88	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	66.3	30	0.84
6455	-458.81	-239.84	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	77.32	30	0.84
6699	-470.19	-353.18	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	88.69	30	0.84

Locat	V*	Mv*	Mdec	d	Ast	bv	phi Vuc	phi Vut	phi Vu	Phi Vumax	phi VuMin	phi Vus	Theta	Asv/s
mm	kN	kNm	kNm	mm	mm2	mm	kN	kN	kN	kN	kN	kN	#.#	mm2/mm
6701	-470.28	-354.12	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	88.79	30	0.84
6884	-478.81	-440.96	0	526	0	1200	381.49	99999	381.49	3534.72	649.34	97.32	30	0.84
7299	-498.16	-643.68	0	526	0	1200	0	0	0	3534.72	0	0	0	0

Spacing of Sets				Minimum Legs	Shear Comments
2 legs N10	2 legs N12	2 legs N16	Min legs N10		
mm	mm	mm	mm	#	A
0	0	0	0	0	
182	262	300	273	3	
187	269	450	280	3	Minimum Steel
187	269	450	280	3	Minimum Steel
187	269	450	280	3	Minimum Steel
187	269	450	280	3	Minimum Steel
187	269	450	280	3	Minimum Steel
187	269	450	280	3	Minimum Steel
187	269	450	280	3	Minimum Steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
187	269	450	280	3	Minimum Steel
187	269	450	280	3	Minimum Steel
187	269	450	280	3	Minimum Steel
187	269	450	280	3	Minimum Steel
187	269	450	280	3	Minimum Steel
187	269	450	280	3	Minimum Steel
187	269	450	280	3	Minimum Steel
187	269	450	280	3	Minimum Steel
187	269	450	280	3	Minimum Steel
0	0	0	0	0	

Span 3

Locat	V*	Mv*	Mdec	d	Ast	bv	phi Vuc	phi Vut	phi Vu	Phi Vumax	phi VuMin	phi Vus	Theta	Asv/s
mm	kN	kNm	kNm	mm	mm2	mm	kN	kN	kN	kN	kN	kN	#.#	mm2/mm
1	440.09	-643.74	0	446	0	1200	0	0	0	2997.12	0	0	0	0
416	422.07	-465.19	0	446	0	1200	367.22	99999	367.22	2997.12	594.33	54.85	30	0.84
519	417.56	-421.95	0	446	0	1200	367.22	99999	367.22	2997.12	594.33	50.35	30	0.84
521	417.47	-421.12	0	446	0	1200	367.22	99999	367.22	2997.12	594.33	50.26	30	0.84
635	412.49	-373.81	0	446	0	1200	367.22	99999	367.22	2997.12	594.33	45.27	30	0.84
750	407.88	-327.61	0	446	0	1200	367.22	99999	367.22	2997.12	594.33	40.66	30	0.84
999	396.99	-227.41	0	446	0	1200	367.22	99999	367.22	2997.12	594.33	29.77	30	0.84
1001	170.27	-252.97	0	446	0	1200	367.22	99999	367.22	2997.12	594.33	0	30	0
1250	160.15	-213.29	0	446	0	1200	367.22	99999	367.22	2997.12	594.33	0	30	0
1500	150.4	-176.4	0	446	0	1200	367.22	99999	367.22	2997.12	594.33	0	30	0
1750	139.97	-142.13	0	446	0	1200	367.22	99999	367.22	2997.12	594.33	0	30	0
2000	130.16	-108.29	0	446	0	1200	367.22	99999	367.22	2997.12	594.33	0	30	0
2250	121.33	-78.69	0	446	0	1200	367.22	99999	367.22	2997.12	594.33	0	30	0
2365	116.56	-66.38	0	446	0	1200	367.22	99999	367.22	2997.12	594.33	0	30	0
2479	112.6	-53.32	0	446	0	1200	367.22	99999	367.22	2997.12	594.33	0	30	0
2481	112.53	-53.09	0	446	0	1200	367.22	99999	367.22	2997.12	594.33	0	30	0
2584	108.95	-41.69	0	446	0	1200	367.22	99999	367.22	2997.12	594.33	0	30	0
2900	97.72	-9.6	0	446	0	1200	0	0	0	2997.12	0	0	0	0

Spacing of Sets				Minimum Legs	Shear Comments
2 legs N10	2 legs N12	2 legs N16	Min legs N10		
mm	mm	mm	mm	#	A
0	0	0	0	0	
187	269	390	374	4	Minimum Steel
187	269	390	374	4	Minimum Steel
187	269	390	374	4	Minimum Steel
187	269	390	374	4	Minimum Steel
187	269	390	374	4	Minimum Steel
187	269	390	374	4	Minimum Steel

Spacing of Sets				Minimum Legs	Shear Comments
2 legs N10	2 legs N12	2 legs N16	Min legs N10		
mm	mm	mm	mm	#	A
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	

Punching

Column Head Critical Section

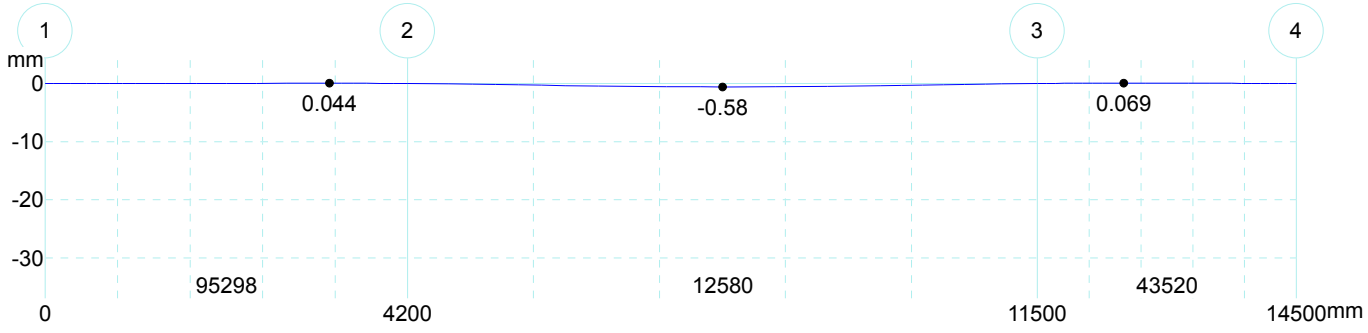
Column No.	Bh	a	at	u	d	fcv	P/A	Asw/s min	V*	Mv*	phi Vuo	phi Vu	phi VuMin	phi Vumax	side beam	Moment Transfer	Asw/s reqd
A	#.#	mm	mm	mm	mm	MPa	MPa	mm2/mm	kN	kNm	kN	kN	kN	kN	A	A	mm2/mm
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0

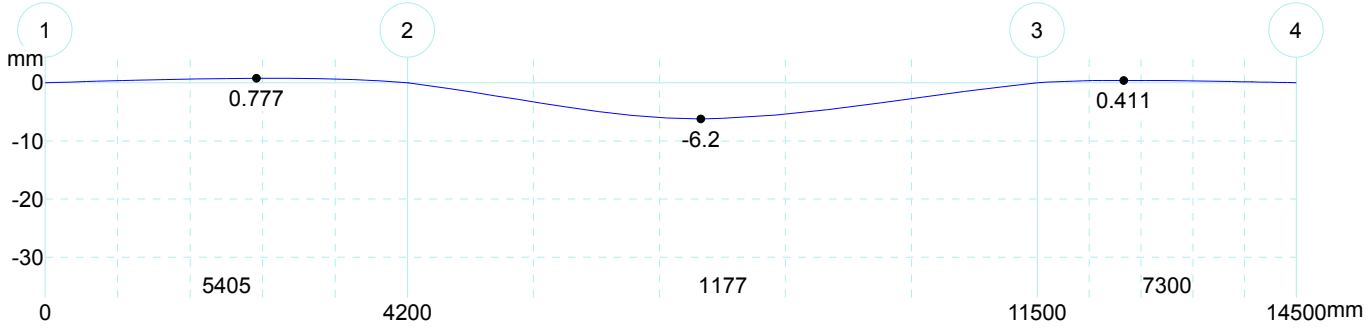
result
A
Check Not Carried Out!
Check Not Carried Out!
Check Not Carried Out!
Check Not Carried Out!

Deflections

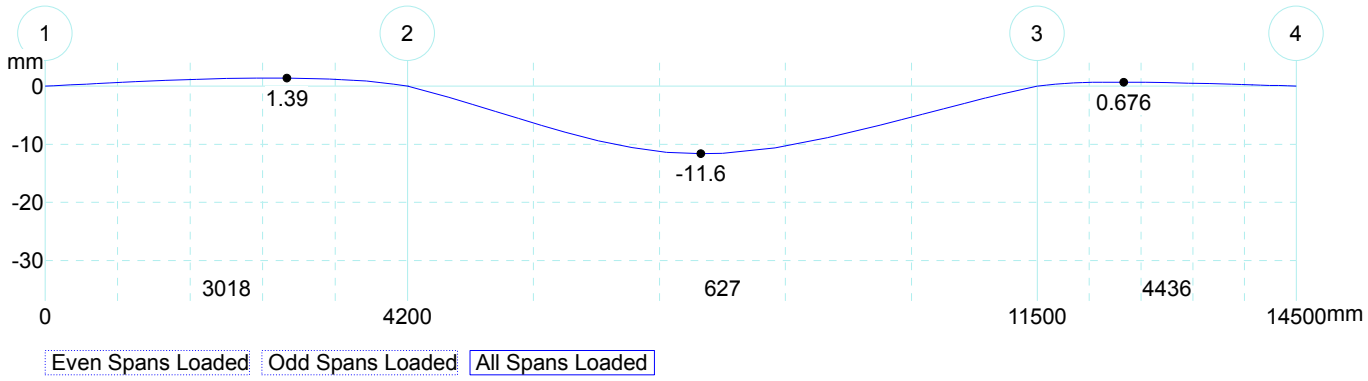
All Spans Loaded

Transfer



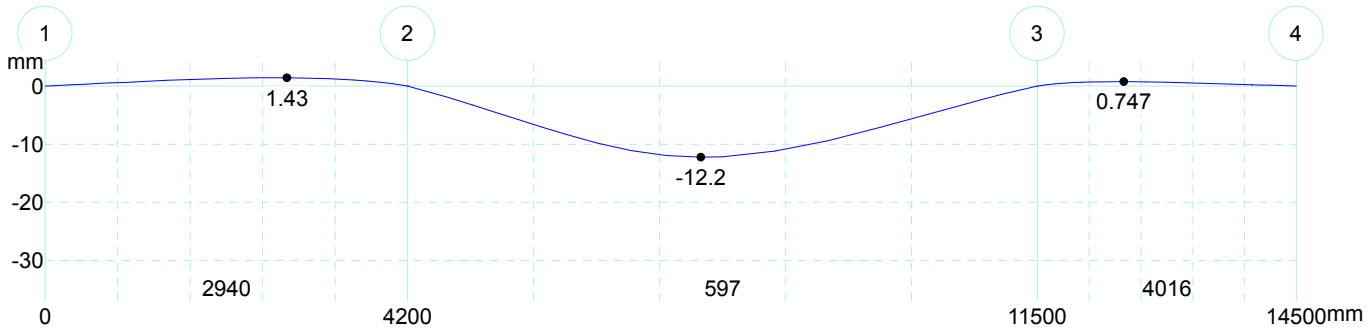


Incremental



Even Spans Loaded | Odd Spans Loaded | All Spans Loaded

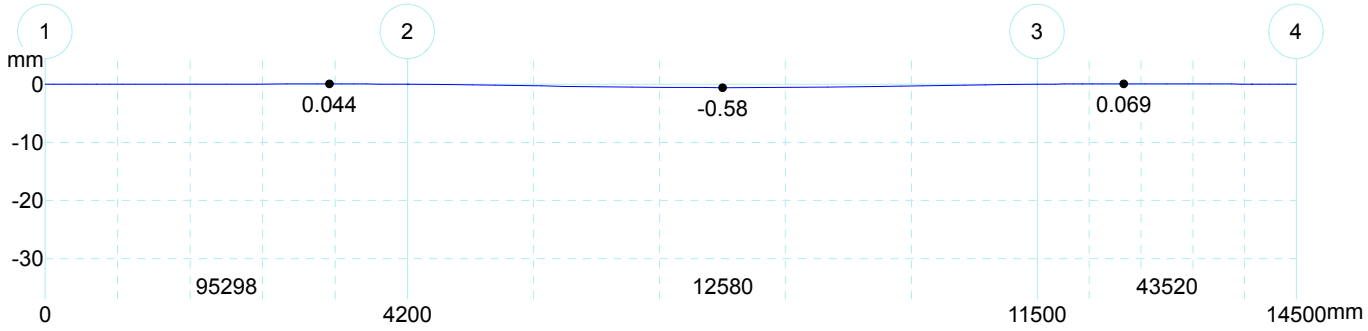
Total Long Term



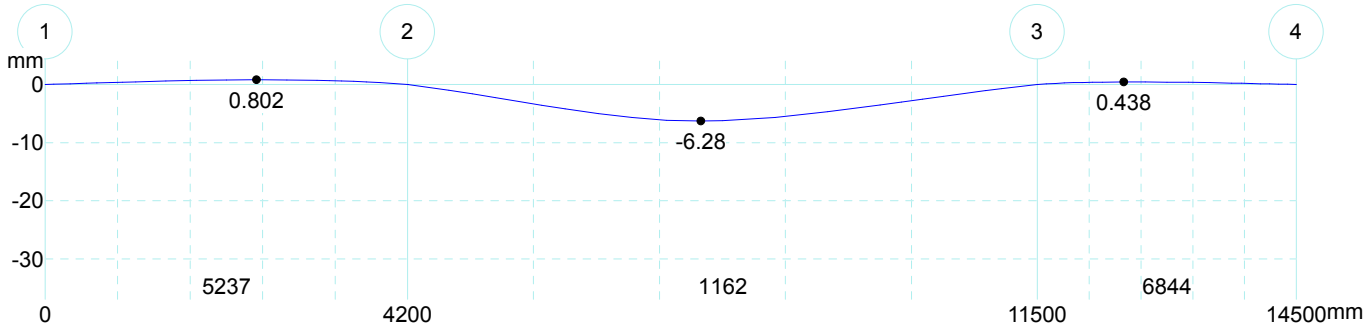
Even Spans Loaded | Odd Spans Loaded | All Spans Loaded

Even Spans Loaded

Transfer

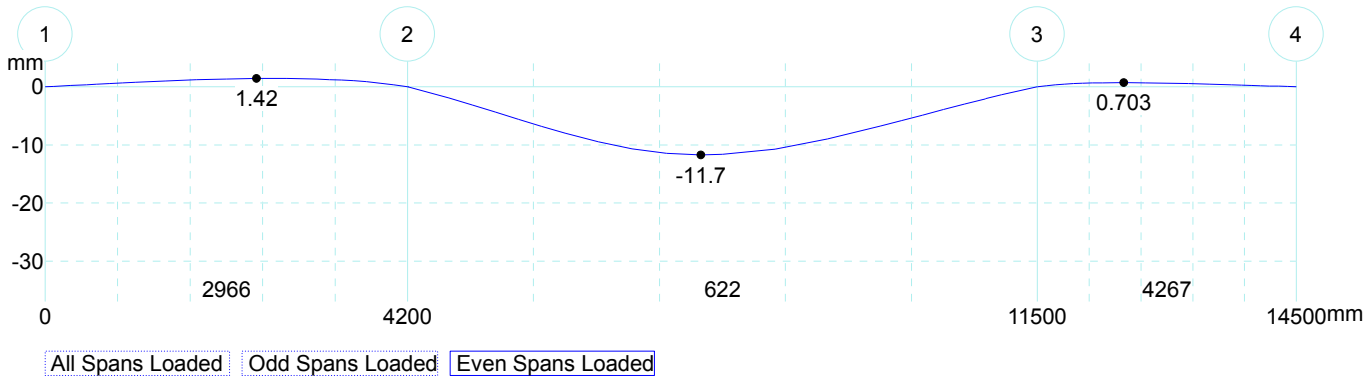


Short Term



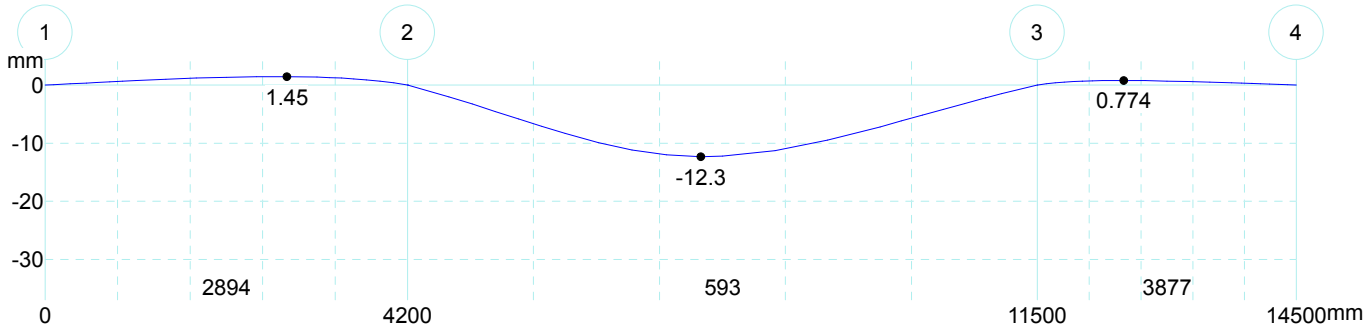
All Spans Loaded | Odd Spans Loaded | Even Spans Loaded

Incremental



All Spans Loaded | Odd Spans Loaded | Even Spans Loaded

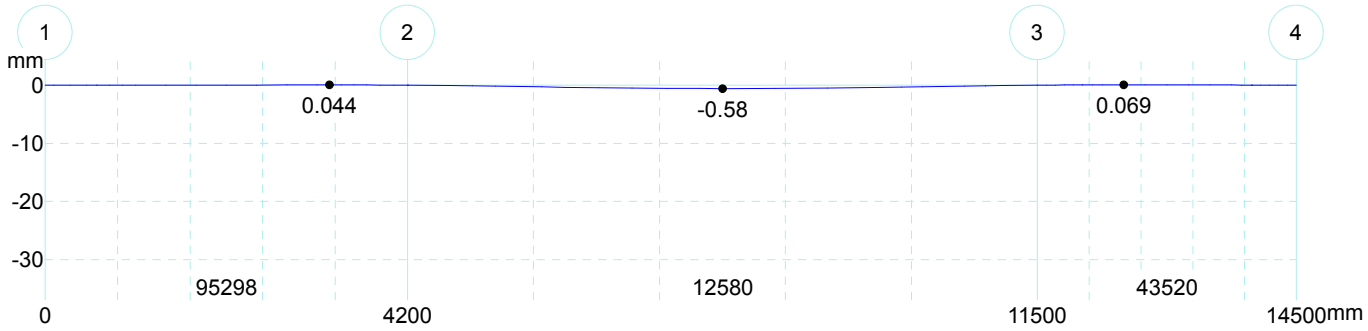
Total Long Term



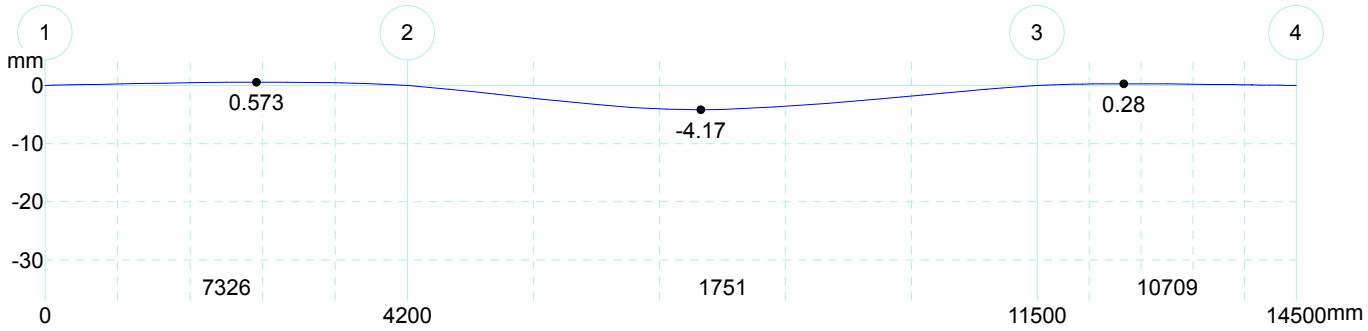
All Spans Loaded | Odd Spans Loaded | Even Spans Loaded

Odd Spans Loaded

Transfer

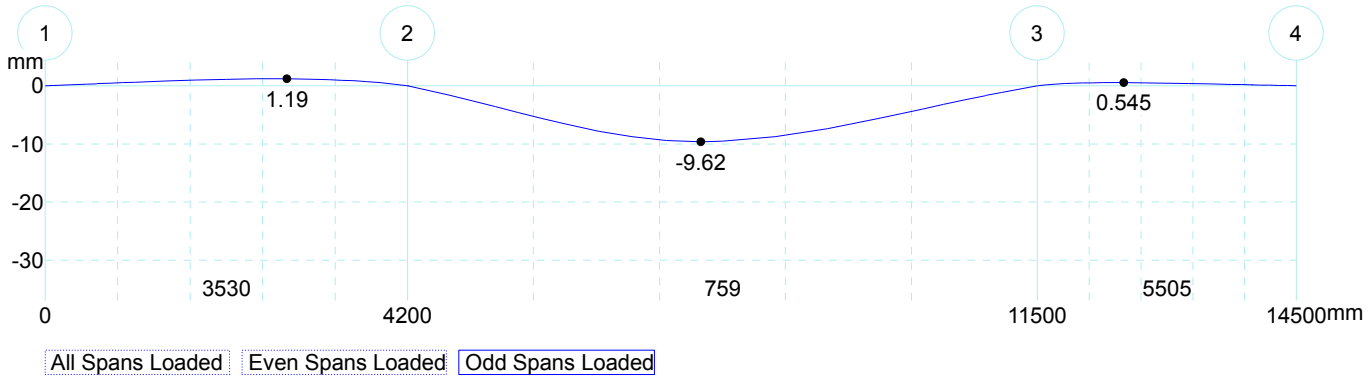


Short Term



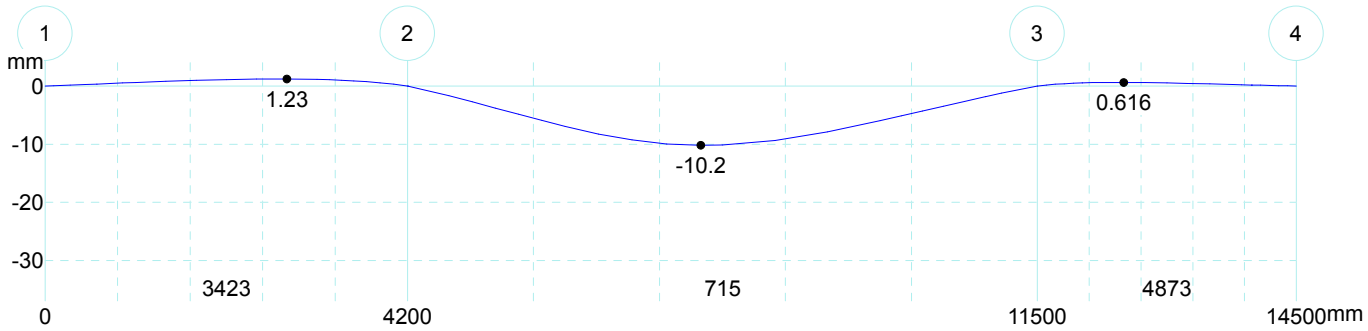
All Spans Loaded | Even Spans Loaded | Odd Spans Loaded

Incremental



All Spans Loaded | Even Spans Loaded | Odd Spans Loaded

Total Long Term



All Spans Loaded | Even Spans Loaded | Odd Spans Loaded

Detailed Reinforcement

Span 1

	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
100	40	300	0	46	1914	No Steel Added	0	0	0	554	1200	No Steel Added
290	40	300	0	46	1914	No Steel Added	0	0	0	554	1200	No Steel Added
480	40	300	0	46	1914	No Steel Added	0	0	0	554	1200	No Steel Added
599	40	300	0	46	1914	No Steel Added	0	0	0	554	1200	No Steel Added
601	40	300	0	46	1914	No Steel Added	0	0	0	554	1200	No Steel Added
750	40	300	0	46	1914	No Steel Added	0	0	0	554	1200	No Steel Added
899	40	300	0	46	1914	No Steel Added	0	0	0	554	1200	No Steel Added
1050	40	300	0	46	1914	No Steel Added	0	0	0	554	1200	No Steel Added
1400	40	300	0	46	1914	No Steel Added	0	0	0	554	1200	No Steel Added
1750	40	300	0	46	1914	No Steel Added	0	0	0	554	1200	No Steel Added
2100	40	300	0	46	1914	No Steel Added	0	0	0	554	1200	No Steel Added
2450	40	300	0	46	1914	No Steel Added	0	0	0	554	1200	No Steel Added
2800	40	300	0	46	1914	No Steel Added	0	0	0	554	1200	No Steel Added
3150	36	300	0	46	1914	No Steel Added	0	0	0	554	1200	No Steel Added
3294	36	300	0	46	1914	No Steel Added	0	0	0	554	1200	No Steel Added
3436	32	300	0	46	1914	No Steel Added	0	0	0	554	1200	No Steel Added
3578	32	300	0	46	1914	No Steel Added	0	0	0	554	1200	No Steel Added
3720	28	294	0	46	1914	No Steel Added	0	0	0	554	1200	No Steel Added
3881	28	280	0	46	1914	No Steel Added	0	0	0	554	1200	No Steel Added
4040	24	266	0	46	1914	No Steel Added	0	0	0	554	1200	No Steel Added
4199	24	251	0	46	1914	No Steel Added	0	0	0	554	1200	No Steel Added

Shear Reinforcement				
	Spacing of Sets			
Area	2 legs N10	2 legs N12	2 legs N16	Shear Comments
mm2/mm	mm	mm	mm	A
0	0	0	0	
0	0	0	0	
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel

Shear Reinforcement				
	Spacing of Sets			
Area	2 legs N10	2 legs N12	2 legs N16	Shear Comments
mm2/mm	mm	mm	mm	A
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	
0	0	0	0	
0	0	0	0	

Design Comments:-
- - Column Grid 1 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Column Grid 2 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 1 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

Span 2

	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
1	24	251	0	46	2222	No Steel Added	0	0	0	554	1200	No Steel Added
480	40	300	0	46	2222	No Steel Added	0	0	0	554	1200	No Steel Added
749	40	300	0	46	2222	No Steel Added	0	0	0	554	1200	No Steel Added
1018	40	300	0	46	2222	No Steel Added	0	0	0	554	1200	No Steel Added
1287	0	0	0	46	2222	No Steel Added	40	300	0	554	1200	No Steel Added
1556	0	0	0	46	2222	No Steel Added	40	300	0	554	1200	No Steel Added
1825	0	0	0	46	2222	No Steel Added	40	300	0	554	1200	No Steel Added
2212	0	0	0	46	2222	No Steel Added	32	300	0	554	1200	No Steel Added
2600	0	0	0	46	2222	No Steel Added	24	258	0	554	1200	No Steel Added
3000	0	0	0	46	2222	No Steel Added	20	220	0	554	1200	No Steel Added
3400	0	0	0	46	2222	No Steel Added	20	230	0	554	1200	No Steel Added
3650	0	0	0	46	2222	No Steel Added	24	253	0	554	1200	No Steel Added
4259	0	0	0	46	2222	No Steel Added	32	300	0	554	1200	No Steel Added
4867	0	0	0	46	2222	No Steel Added	40	300	0	554	1200	No Steel Added
5475	0	0	0	46	2222	No Steel Added	40	300	0	554	1200	No Steel Added
5723	0	0	0	46	2222	No Steel Added	40	300	0	554	1200	No Steel Added
5967	40	300	0	46	2222	No Steel Added	0	0	0	554	1200	No Steel Added
6211	40	300	0	46	2222	No Steel Added	0	0	0	554	1200	No Steel Added
6455	40	300	0	46	2222	No Steel Added	0	0	0	554	1200	No Steel Added
6699	40	300	0	46	2222	No Steel Added	0	0	0	554	1200	No Steel Added
6701	40	300	0	46	2222	No Steel Added	0	0	0	554	1200	No Steel Added
6884	40	300	0	46	2222	No Steel Added	0	0	0	554	1200	No Steel Added
7299	28	288	0	46	2222	No Steel Added	0	0	0	554	1200	No Steel Added

Shear Reinforcement				
	Spacing of Sets			
Area	2 legs N10	2 legs N12	2 legs N16	Shear Comments
mm2/mm	mm	mm	mm	A
0	0	0	0	
0.86	182	262	300	
0.84	187	269	450	Minimum Steel
0.84	187	269	450	Minimum Steel
0.84	187	269	450	Minimum Steel
0.84	187	269	450	Minimum Steel
0.84	187	269	450	Minimum Steel
0.84	187	269	450	Minimum Steel
0.84	187	269	450	Minimum Steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0.84	187	269	450	Minimum Steel

Shear Reinforcement				
	Spacing of Sets			
Area	2 legs N10	2 legs N12	2 legs N16	Shear Comments
mm2/mm	mm	mm	mm	A
0.84	187	269	450	Minimum Steel
0.84	187	269	450	Minimum Steel
0.84	187	269	450	Minimum Steel
0.84	187	269	450	Minimum Steel
0.84	187	269	450	Minimum Steel
0.84	187	269	450	Minimum Steel
0.84	187	269	450	Minimum Steel
0.84	187	269	450	Minimum Steel
0	0	0	0	

Design Comments:-
- - Column Grid 2 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Column Grid 3 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 2 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

Span 3

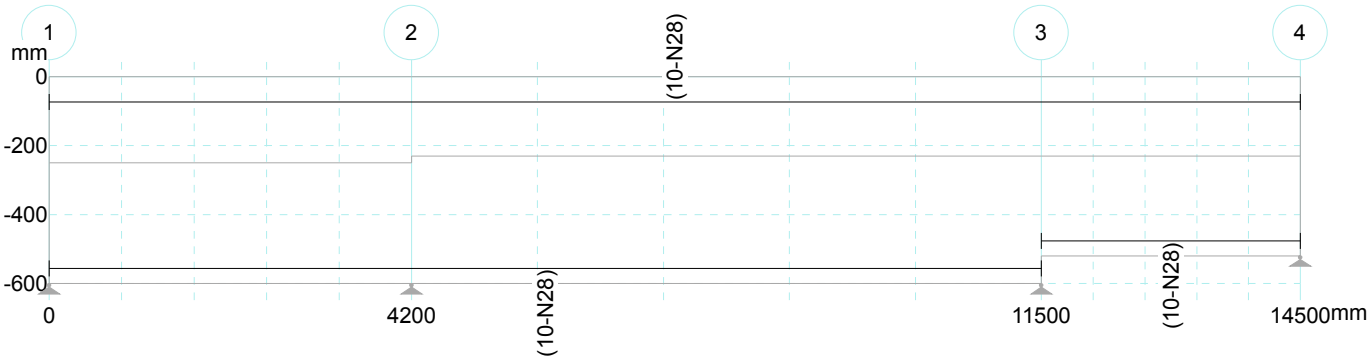
	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
1	24	240	0	46	1710	No Steel Added	0	0	0	474	1200	No Steel Added
104	24	258	0	46	1710	No Steel Added	0	0	0	474	1200	No Steel Added
207	28	277	0	46	1710	No Steel Added	0	0	0	474	1200	No Steel Added
310	28	295	0	46	1710	No Steel Added	0	0	0	474	1200	No Steel Added
416	32	300	0	46	1710	No Steel Added	0	0	0	474	1200	No Steel Added
519	36	300	0	46	1710	No Steel Added	0	0	0	474	1200	No Steel Added
521	36	300	0	46	1710	No Steel Added	0	0	0	474	1200	No Steel Added
635	40	300	0	46	1710	No Steel Added	0	0	0	474	1200	No Steel Added
750	40	300	0	46	1710	No Steel Added	0	0	0	474	1200	No Steel Added
999	40	300	0	46	1710	No Steel Added	0	0	0	474	1200	No Steel Added
1001	40	300	0	46	1710	No Steel Added	0	0	0	474	1200	No Steel Added
1250	40	300	0	46	1710	No Steel Added	0	0	0	474	1200	No Steel Added
1500	40	300	0	46	1710	No Steel Added	0	0	0	474	1200	No Steel Added
1750	40	300	0	46	1710	No Steel Added	0	0	0	474	1200	No Steel Added
2000	40	300	0	46	1710	No Steel Added	0	0	0	474	1200	No Steel Added
2250	40	300	0	46	1710	No Steel Added	0	0	0	474	1200	No Steel Added
2365	40	300	0	46	1710	No Steel Added	0	0	0	474	1200	No Steel Added
2479	40	300	0	46	1710	No Steel Added	0	0	0	474	1200	No Steel Added
2481	40	300	0	46	1710	No Steel Added	0	0	0	474	1200	No Steel Added
2584	40	300	0	46	1710	No Steel Added	0	0	0	474	1200	No Steel Added
2690	40	300	0	46	1710	No Steel Added	0	0	0	474	1200	No Steel Added
2795	40	300	0	46	1710	No Steel Added	0	0	0	474	1200	No Steel Added
2900	40	300	0	46	1710	No Steel Added	0	0	0	474	1200	No Steel Added

Shear Reinforcement				
	Spacing of Sets			
Area	2 legs N10	2 legs N12	2 legs N16	Shear Comments
mm2/mm	mm	mm	mm	A
0	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	
0.84	187	269	390	Minimum Steel
0.84	187	269	390	Minimum Steel
0.84	187	269	390	Minimum Steel
0.84	187	269	390	Minimum Steel
0.84	187	269	390	Minimum Steel
0.84	187	269	390	Minimum Steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel

Shear Reinforcement				
	Spacing of Sets			
Area	2 legs N10	2 legs N12	2 legs N16	Shear Comments
mm2/mm	mm	mm	mm	A
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	
0	0	0	0	
0	0	0	0	

Design Comments:-
- - Column Grid 3 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 3 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

Reinforcement Layout



- - Column Grid 1 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Column Grid 2 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 1 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

- - Column Grid 2 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Column Grid 3 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 2 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

- - Column Grid 3 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 3 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

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RAPT - Version: 6.5.16.0
Reinforced And Post-Tensioned Concrete Analysis & Design Package

Licensee
TMK Consulting Engineers
Level 6
100 Pirie Street
Adelaide SA 5000
11169065160718WPN3

Input

General

Design Code	List	Australia - AS3600*SAVED*
Material	List	Australia - Australian Materials*SAVED*
Reinforcement Type	List	Reinforced
Member Type	List	Beam
Panel Type	List	Internal
Strip Type	List	One way - Nominal Width
Column Stiffness	List	Equivalent Column
Concrete Type	List	Standard Concrete - Brisbane/Sydney
Concrete - Spanning Members	List	40MPa
Concrete - Columns	List	40MPa
Top Reinforcement Cover	mm	32
Bottom Reinforcement Cover	mm	32
Top Reinforcement Axis Depth Limit	mm	30
Bottom Reinforcement Axis Depth Limit	mm	30
Concrete Unit Weight	kn/m3	25
Self Weight Definition	List	Program Calculated
Pattern Live Load	Y/N	Y
Earthquake Design	List	None
Moment Redistribution	%	0
Design Surface Levels	List	Extreme Surfaces

Span

Span	Span Length	Slab Depth	Panel Width Left	Panel Width Right
	mm	mm	mm	mm
LE	0			
1	5100	230	5750	5750
2	7800	230	5750	5750
3	6700	200	5750	5750
4	5100	200	5750	5750
5	3400	200	5750	5750
RE	0			

Columns

Column	Column Grid Reference	Support Type	Transverse Column spacing	Transverse prestress (P/A)
	A	List	mm	MPa
1	1	Knife-Edge	5750	
2	2	Knife-Edge	5750	
3	3	Knife-Edge	5750	
4	4	Knife-Edge	5750	
5	5	Knife-Edge	5750	
6	6	Knife-Edge	5750	

Beams

Beam Number	Beam Depth	Beam Width at Slab	Beam Width	Effective Flange Width
	mm	mm	mm	mm
1	600	800	800	1667
2	570	800	800	1892
3	600	800	800	1738
4	600	800	800	1514
5	520	800	800	1378

Load Cases

Load Case	Load Type	Load Definition	Live Load Deflection Case	Description
	List	List	Y/N	A
1	Self Weight	Applied Loads		
2	Initial Dead Load	Applied Loads		
3	Extra Dead Load	Applied Loads		
4	Live Load	Applied Loads	Y	

1. Self Weight - Line

Load	Left End Reference Column	Left end of load from reference column	Load at left end	Right End reference column	Right end of load from reference column	Load at right end	Description
	#	mm	kN/m	#	mm	kN/m	A
1	1	0	40.46	2	0	40.46	
2	2	0	39.86	3	0	39.86	
3	3	0	36.75	4	0	36.75	
4	4	0	36.75	5	0	36.75	
5	5	0	35.15	6	0	35.15	

2. Initial Dead Load - Panel

Load	Left End reference column	Left end of load from reference column	Load at left end	Right End reference column	Right end of load from reference column	Load at right end	Description
	#	mm	kN/m2	#	mm	kN/m2	A
1	1	0	1	6	0	1	

3. Extra Dead Load - Point

Load	Reference column	Distance to Load from reference column	Load	Load Length	Description
	#	mm	kN	mm	A
1	1	1000	226	2000	
2	2	0	232	0	
3	2	4000	263	0	
4	3	3900	287	0	
5	4	1000	283	0	
6	5	1700	250	3400	

4. Live Load - Panel

Load	Left End reference column	Left end of load from reference column	Load at left end	Right End reference column	Right end of load from reference column	Load at right end	Live Load reduction	Description
	#	mm	kN/m2	#	mm	kN/m2	#.#	A
1	1	0	1.5	6	0	1.5	1	

4. Live Load - Point

Load	Reference column	Distance to Load from reference column	Load	Load Length	Live Load reduction	Description
	#	mm	kN	mm	#.#	A
1	1	1000	55	2000	1	
2	2	0	44	0	1	
3	2	4000	23	0	1	
4	3	5300	21	0	1	
5	4	1300	38	0	1	
6	5	1700	70	3400	1	

Load Combinations : Ultimate

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Live Load	1.2	1.2	1.2	1.5
2	Live Load	0.9	0.9	0.9	1.5
3	Dead Load	1.35	1.35	1.35	0

Load Combinations : Short Term Service

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Live Load	1	1	1	0.7

Load Combinations : Permanent Service

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Live Load	1	1	1	0.4

Load Combinations : Deflection

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Short Term - Deflection	1	1	1	0.7
2	Permanent - Deflection	1	1	1	0.4
3	Initial - Deflection	1	1	0	0

Load Combinations : Transfer Prestress

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Transfer	1	0	0	0

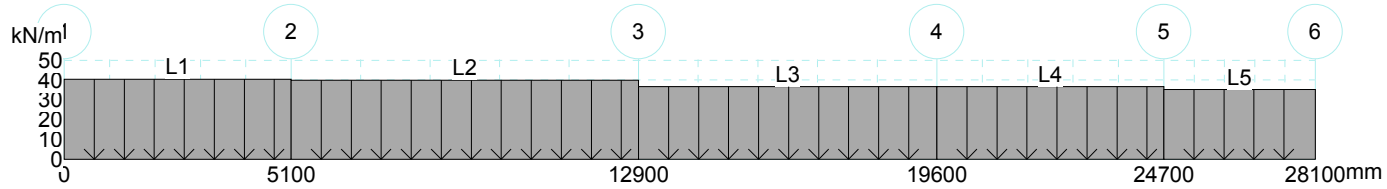
Load Combinations : Pre Existing

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Pre Existing	1	0	0	0

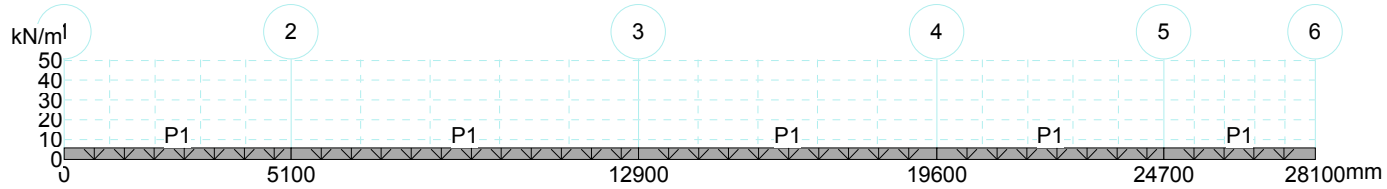
Load Combinations : Construction

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Construction	1	0	0	0

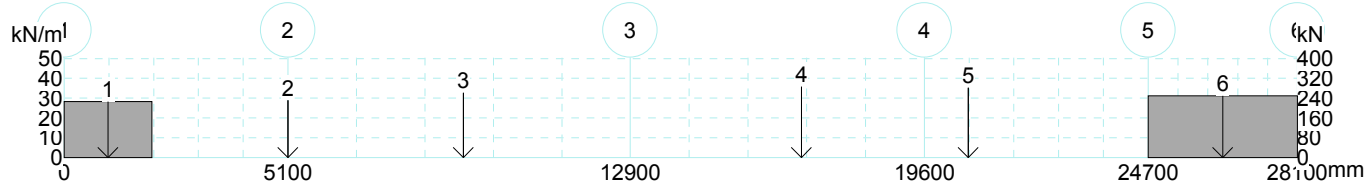
Load Case 1 : 1. Self Weight



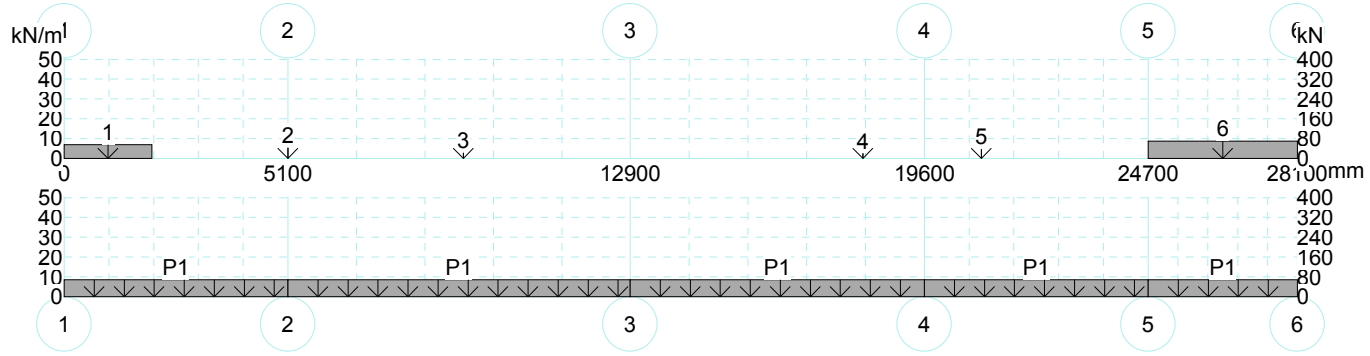
Load Case 2 : 2. Initial Dead Load



Load Case 3 : 3. Extra Dead Load



Load Case 4 : 4. Live Load



Reinforcement

Reinforcement Use	Reinforcement Type	Preferred Bar Size	Number of Legs
	List	List	#
Flexural Bar	N 500MPa		
Flexural Mesh	F 450MPa		
Shear Option 1	N 500MPa	10	2
Shear Option 2	N 500MPa	12	2
Shear Option 3	N 500MPa	16	2
Punching Shear	N 500MPa	10	1

Reinforcement

	Maximum Bar Spacing	Minimum Bar Spacing	Minimum Continuous Reinforcement	Minimum Span Reinforcement into End Support	Minimum Span Reinforcement into Internal Support	Infill Bars	Stagger Bars
	mm	mm	#.#	#.#	#.#	Y/N	Y/N
Support Reinforcement	300	60	0			N	N
Span Reinforcement	300	60		0	0	N	N

Design Zones : Top

Layer Number	Steel type	Left End Reference Column	Distance to left end of bar	Bar stagger length at left end	Top Cover at left end	Right End Reference Column	Distance to right end of bar	Bar stagger length at right end	Top Cover at Right end	Maximum Bar Size	Minimum Bar Size	Preferred bar size
	List	#	mm	mm	mm	#	mm	mm	mm	List	List	List
1	Bar	1	0	0	32	6	0	0	32	36	16	28

Layer Number	Minimum Number of Bars	Maximum Spacing of Bars	Minimum Steel area as %	% in Flange
	#	mm	%	%
1	0	0	0	0

Design Zones : Bottom

Layer Number	Steel type	Left End Reference Column	Distance to left end of bar	Bar stagger length at left end	Bottom Cover at left end	Right End Reference Column	Distance to right end of bar	Bar stagger length at right end	Bottom Cover at Right End	Maximum Bar Size	Minimum Bar Size	Preferred bar size
	List	#	mm	mm	mm	#	mm	mm	mm	List	List	List
1	Bar	1	0	0	32	6	0	0	32	36	16	28

Layer Number	Minimum Number of Bars	Maximum Spacing of Bars	Minimum Steel area as %	% in Flange
	#	mm	%	%
1	0	0	0	0

User Defined : Top

Layer Number	Steel type	Left End Reference Column	Distance to left end of bar	Bar stagger length at left end	Top Cover at left end	% Development of Left End of Bar in Tension	% Development of Left End of Bar in Compression	Right End Reference Column	Distance to right end of bar	Bar stagger length at right end	Top Cover at Right end
	List	#	mm	mm	mm	%	%	#	mm	mm	mm
1	N 500MPa	1	5100	0	60	100	0	3	6700	0	60
2	N 500MPa	1	0	0	60	100	0	2	0	0	60
3	N 500MPa	4	0	0	60	100	0	6	0	0	60

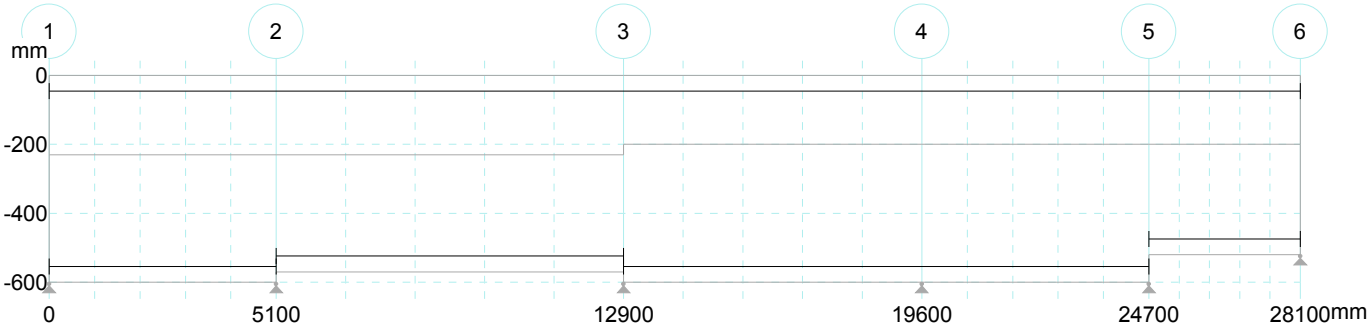
Layer Number	% Development of Right End of Bar in Tension	% Development of Right End of Bar in Compression	Bar Size	Number of Bars	Spacing of Bars	% in Flange	Layer attached after the PreExisting Load Case
	%	%	List	#	mm	%	Y/N
1	100	0	28	8	0	0	N
2	100	0	24	8	0	0	N
3	100	0	20	8	0	0	N

User Defined : Bottom

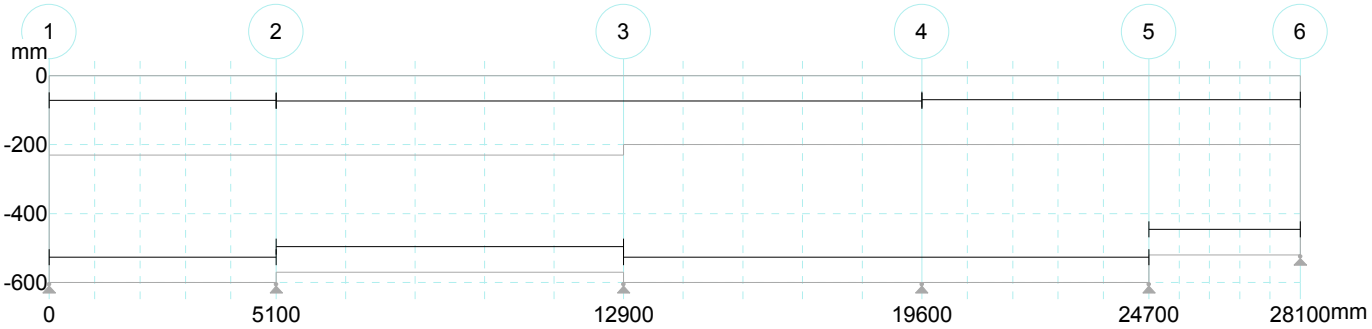
Layer Number	Steel type	Left End Reference Column	Distance to left end of bar	Bar stagger length at left end	Bottom Cover at Left end	% Development of Left End of Bar in Tension	% Development of Left End of Bar in Compression	Right End Reference Column	Distance to right end of bar	Bar stagger length at right end	Bottom Cover at Right End
	List	#	mm	mm	mm	%	%	#	mm	mm	mm
1	N 500MPa	1	0	0	60	100	100	2	0	0	60
2	N 500MPa	2	0	0	60	100	0	3	0	0	60
3	N 500MPa	3	0	0	60	100	0	5	0	0	60
4	N 500MPa	5	0	0	60	100	0	6	0	0	60

Layer Number	% Development of Right End of Bar in Tension	% Development of Right End of Bar in Compression	Bar Size	Number of Bars	Spacing of Bars	% in Flange	Layer attached after the PreExisting Load Case
	%	%	List	#	mm	%	Y/N
1	100	100	28	8	0	0	N
2	100	0	28	8	0	0	N
3	100	0	28	8	0	0	N
4	100	0	28	8	0	0	N

Reinforcement Design Zones



Reinforcement Design Zones User Defined



Design Data

Capacity Reduction factor (phi) for Flexure	#.#	0.8
Capacity Reduction factor (phi) for Shear	#.#	0.7
Material Factor for Concrete in Flexure	#.#	1
Material Factor for Concrete in Shear	#.#	1
Material Factor for Reinforcement	#.#	1
Maximum Ratio of Neutral Axis Depth for Ductility	#.#	0.4
Ductility Limit - Strain	#.#	0
Ductility Check at Left End Column	Y/N	Y
Ductility Check at Right End Column	Y/N	Y
Minimum Reinforcement Strength Limit - #.## x M*	#.#	0
Flexural Critical Section - Consider Transverse Beams	Y/N	Y
Flexural Critical Section - Distance from centre of Support	#.#	-1
Beam Left Sideface Cover (Internal)	mm	25
Beam Right Sideface cover	mm	40
Prestress Minimum Reinforcement Basis	List	Program Default
Shear Enhancement at Supports	Y/N	N
Ast Value in Shear Calculations	List	Calculated
Limit Reinforcement Strain	Y/N	N
Include Strain Hardening of Reinforcement	Y/N	
Beam Shear Critical Section Location	List	Code Critical Section

Maximum Service Stress Change - Prestressed Sections	MPa	150
Maximum Service Stress Change - Reinforced Sections	MPa	0
Relative Humidity	%	50
Average Temperature	C.	20
Prestress Losses Calculations based on	List	Program Default
Crack Width Calculations	List	Code default
AS3600 Shrinkage and Temperature Reinforcement	List	Moderate
Degree of Restraint in Primary Direction	%	0
Degree of Restraint in Secondary Direction	%	0
Concrete Strength Gain Rate	List	N

Concrete Tensile Strength for Deflection Calculations- #.## x (Fc)n	#.#	-1
Maximum Value of Ieff/Igross for Deflection Calculations	#.#	0.6
Total Deflection Warning Limit - Maximum Span/Deflection	#.#	500
Total Deflection Warning Limit - Maximum Deflection	mm	30
Incremental Deflection Warning Limit - Maximum Span/Deflection	#.#	500
Incremental Deflection Warning Limit - Maximum Deflection	mm	30
Initial Time for Shrinkage	List	Full Shrinkage
Time of Loading in days	#.#	10
Age Adjustment Factor	#.#	0.76
Concrete Strength at Time of Loading	MPa	33.8
Loaded Period in years	#.#	30
Tension stiffening Approach	List	Modified Concrete Tensile Modulus Method

Live Load Pattern Factor	#.#	1
Pattern Live Load for Ultimate Strength	Y/N	Y
Pattern Live Load for Crack Control	Y/N	Y
Pattern Live Load For Deflections	Y/N	Y
Pattern Live Load for Deflection Permanent Load Combination	Y/N	N

Material Properties

Concrete : Standard Concrete - Brisbane/Sydney : Concrete Strength Basis - Cylinder

Description	A	40MPa
Characteristic Compressive Strength	MPa	40
Mean Compressive Strength	MPa	45.9
Lower Characteristic Tensile Strength	MPa	3.79
Upper Characteristic Tensile Strength	MPa	6.83
Concrete Density	kg/m3	2447
Design Concrete Modulus	MPa	32919.2
Mean Concrete Modulus	MPa	35263.5
Basic Shrinkage Strain	mm/mm	850
Shrinkage Multiplier	#.#	1
Basic Creep Factor	#.#	2.5
Creep Multiplier	#.#	1
Concrete Strain at Peak Stress	#.#	0.002
Squash Load Factor	#.#	0.85
Concrete Strain Limit	#.#	0.004
Strength Gain Rate	List	Normal

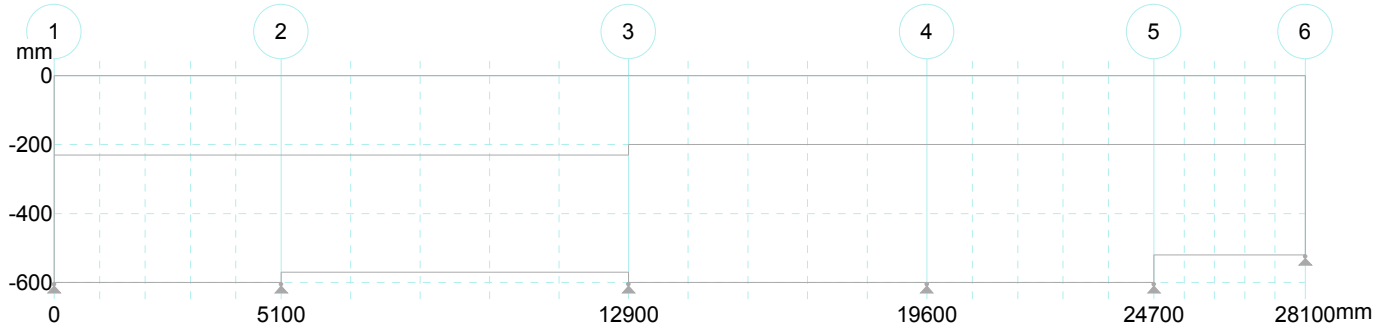
Reinforcement Bar

Designation	Type	Yield Stress	Elastic Modulus	Ductility	Peak Strain	Peak Stress	Design Strain Limit	Material Factor Flexure	Material Factor Shear	Material Capacity Reduction Factor - Flexure	Material Capacity Reduction Factor - Shear	Include as Flexural Reinforcement for Shear
N	Deformed	500	2e5	N	0.05	540	90	-1	-1	-1	-1	Y

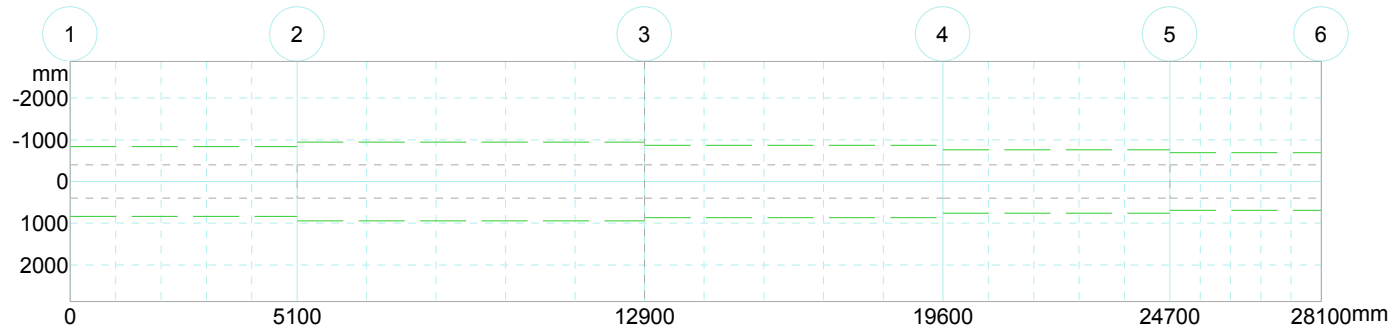
Description

Nominal Bar Size	Bar Diameter	Bar Area	Bar Inertia	Bar Weight	Stock Length
A	mm	mm2	mm4	kg/m	mm
10	10	78.5	491.07	0.62	12000
12	12	113	1018.29	0.89	12000
16	16	201	3218.29	1.58	12000
20	20	314	7857.14	2.47	12000
24	24	452	16292.6	3.55	12000
28	28	616	30184	4.83	12000
32	32	804	51492.6	6.31	12000
36	36	1020	82481.1	7.99	12000
40	40	1260	1.257e5	9.86	12000

Elevation view



Plan view



Warnings

Input

No errors or warnings were found.

Output

No errors or warnings were found.

Bending Moments

Load Cases

Column Actions

Col No. 1		Self Weight	Initial Dead Load	Extra Dead Load	Live Load
Moment Above	kNm	-0	-0	-0	-0
Moment Below	kNm	-0	-0	-0	-0
Reaction	kN	67.81	9.63	143.31	53.59
Elastic Rotation	#.#	0	0	1.16e-4	0
Elastic Axial Shortening	mm	0	0	0	0

Col No. 2		Self Weight	Initial Dead Load	Extra Dead Load	Live Load
Moment Above	kNm	-0	-0	-0	-0
Moment Below	kNm	-0	-0	-0	-0
Reaction	kN	293.05	41.82	434.21	135.28
Elastic Rotation	#.#	1.17e-4	0	2.19e-4	0
Elastic Axial Shortening	mm	0	0	0	0

Col No. 3		Self Weight	Initial Dead Load	Extra Dead Load	Live Load
Moment Above	kNm	-0	-0	-0	-0
Moment Below	kNm	-0	-0	-0	-0
Reaction	kN	292.33	43.71	271.62	79.88
Elastic Rotation	#.#	-1.02e-4	0	-1.09e-4	0
Elastic Axial Shortening	mm	0	0	0	0

Col No. 4		Self Weight	Initial Dead Load	Extra Dead Load	Live Load
Moment Above	kNm	-0	-0	-0	-0
Moment Below	kNm	-0	-0	-0	-0
Reaction	kN	212.46	33.57	413.37	94.58
Elastic Rotation	#.#	0	0	0	0
Elastic Axial Shortening	mm	0	0	0	0

Col No. 5		Self Weight	Initial Dead Load	Extra Dead Load	Live Load
Moment Above	kNm	-0	-0	-0	-0
Moment Below	kNm	-0	-0	-0	-0
Reaction	kN	162.49	25.82	174.18	91.1
Elastic Rotation	#.#	0	0	0	0
Elastic Axial Shortening	mm	0	0	0	0

Col No. 6		Self Weight	Initial Dead Load	Extra Dead Load	Live Load
Moment Above	kNm	-0	-0	-0	-0
Moment Below	kNm	-0	-0	-0	-0
Reaction	kN	42.31	7.02	104.32	38.93
Elastic Rotation	#.#	0	0	-1.89e-4	0
Elastic Axial Shortening	mm	0	0	0	0

Load Combinations

Column Actions

Col No. 1		Characteristic Service	Characteristic Service (Reversal)	Service	Service (Reversal)	Ultimate Flexure	Ultimate Flexure (Reversal)	Ultimate Shear	Ultimate Shear (Reversal)
Moment Above	kNm	0	0	0	0	0	0	0	0
Moment Below	kNm	0	0	0	0	0	0	0	0
Reaction	kN	274.34	274.34	258.26	258.26	345.29	345.29	184.4	358.62
Elastic Rotation	#.#	3.04e-4	3.04e-4	2.82e-4	2.82e-4	3.88e-4	3.88e-4	1.19e-4	4.69e-4
Elastic Axial Shortening	mm	0	0	0	0	0	0	0	0

Col No. 2		Characteristic Service	Characteristic Service (Reversal)	Service	Service (Reversal)	Ultimate Flexure	Ultimate Flexure (Reversal)	Ultimate Shear	Ultimate Shear (Reversal)
Moment Above	kNm	0	0	0	0	0	0	0	0
Moment Below	kNm	0	0	0	0	0	0	0	0
Reaction	kN	904.36	904.36	863.77	863.77	1125.81	1125.81	708.99	1132.51
Elastic Rotation	#.#	3.79e-4	3.79e-4	3.71e-4	3.71e-4	4.63e-4	4.63e-4	2.47e-4	4.85e-4
Elastic Axial Shortening	mm	0	0	0	0	0	0	0	0

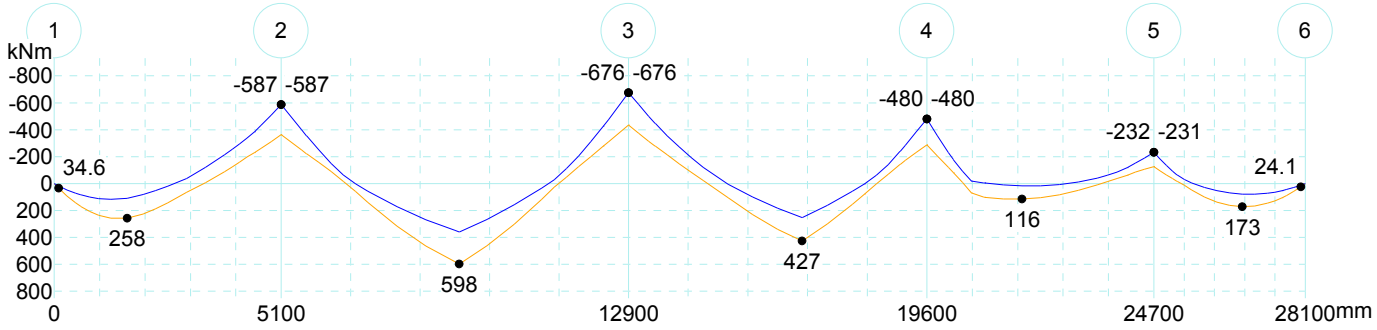
Col No. 3		Characteristic Service	Characteristic Service (Reversal)	Service	Service (Reversal)	Ultimate Flexure	Ultimate Flexure (Reversal)	Ultimate Shear	Ultimate Shear (Reversal)
Moment Above	kNm	0	0	0	0	0	0	0	0
Moment Below	kNm	0	0	0	0	0	0	0	0
Reaction	kN	687.54	687.54	663.58	663.58	849.01	849.01	561.24	863.47
Elastic Rotation	#.#	-2.68e-4	-2.68e-4	-2.55e-4	-2.55e-4	-3.35e-4	-3.35e-4	-1.28e-4	-3.36e-4
Elastic Axial Shortening	mm	0	0	0	0	0	0	0	0

Col No. 4		Characteristic Service	Characteristic Service (Reversal)	Service	Service (Reversal)	Ultimate Flexure	Ultimate Flexure (Reversal)	Ultimate Shear	Ultimate Shear (Reversal)
Moment Above	kNm	0	0	0	0	0	0	0	0
Moment Below	kNm	0	0	0	0	0	0	0	0
Reaction	kN	753.98	753.98	725.6	725.6	933.15	933.15	608.81	959.66
Elastic Rotation	#.#	-1.31e-4	-1.31e-4	-1.31e-4	-1.31e-4	-1.57e-4	-1.57e-4	0	-1.74e-4
Elastic Axial Shortening	mm	0	0	0	0	0	0	0	0

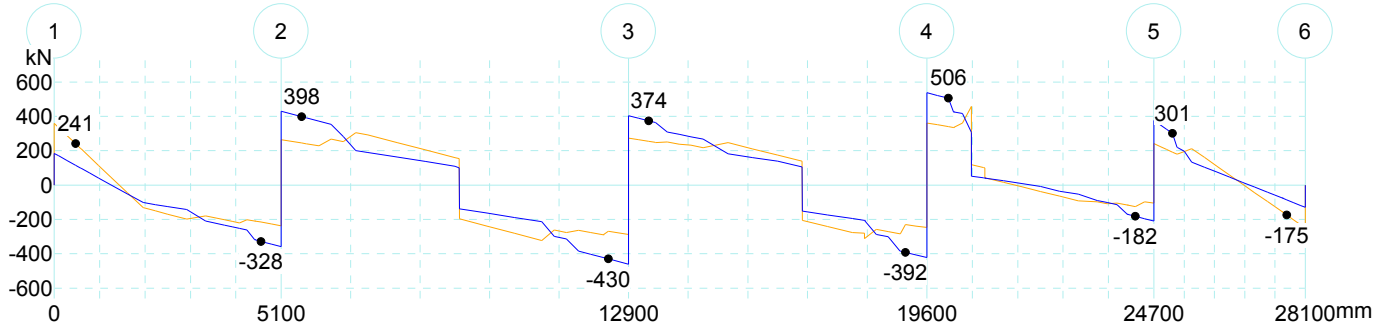
Col No. 5		Characteristic Service	Characteristic Service (Reversal)	Service	Service (Reversal)	Ultimate Flexure	Ultimate Flexure (Reversal)	Ultimate Shear	Ultimate Shear (Reversal)
Moment Above	kNm	0	0	0	0	0	0	0	0
Moment Below	kNm	0	0	0	0	0	0	0	0
Reaction	kN	453.59	453.59	426.26	426.26	571.64	571.64	346.96	584.91
Elastic Rotation	#.#	0	0	0	0	1.07e-4	1.07e-4	1.27e-4	0
Elastic Axial Shortening	mm	0	0	0	0	0	0	0	0

Col No. 6		Characteristic Service	Characteristic Service (Reversal)	Service	Service (Reversal)	Ultimate Flexure	Ultimate Flexure (Reversal)	Ultimate Shear	Ultimate Shear (Reversal)
Moment Above	kNm	0	0	0	0	0	0	0	0
Moment Below	kNm	0	0	0	0	0	0	0	0
Reaction	kN	192.58	192.58	180.9	180.9	242.77	242.77	129.37	250.23
Elastic Rotation	#.#	-3.19e-4	-3.19e-4	-3e-4	-3e-4	-4.02e-4	-4.02e-4	-1.89e-4	-4.36e-4
Elastic Axial Shortening	mm	0	0	0	0	0	0	0	0

Ultimate Flexure



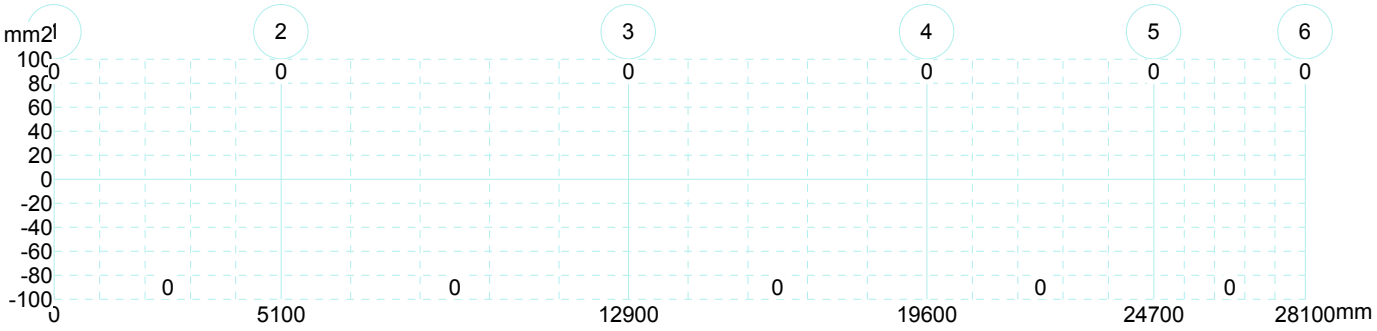
Moment Moment 1 Moment 2



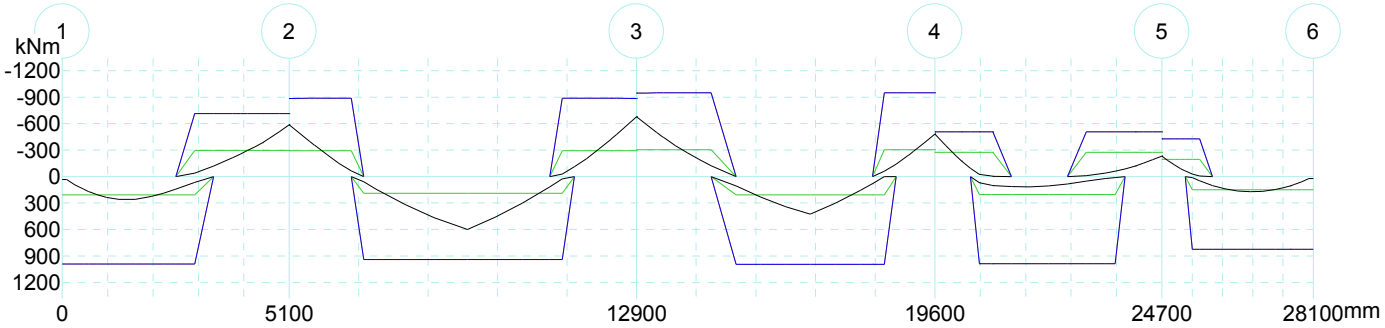
Shear Shear 1 Shear 2

Flexural Design

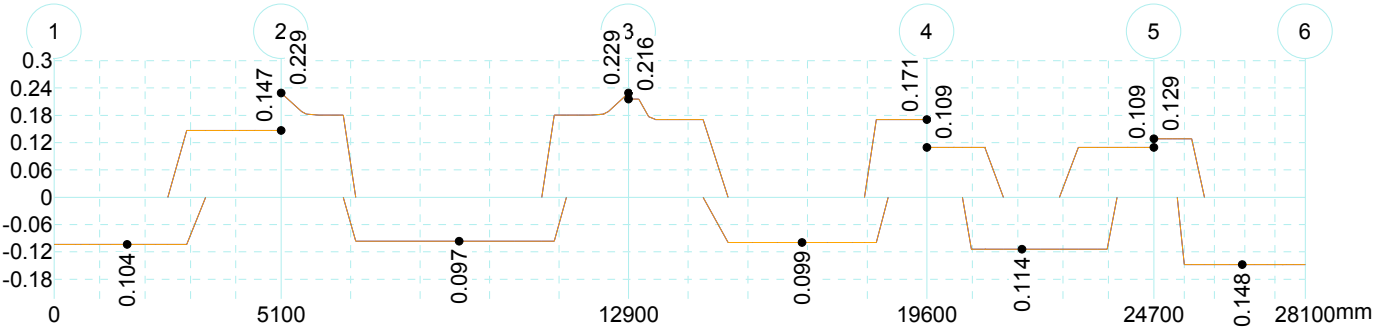
Ultimate



Reinforcement Top Total Bottom Total Top Ultimate Bottom Ultimate Min Top Min Bot



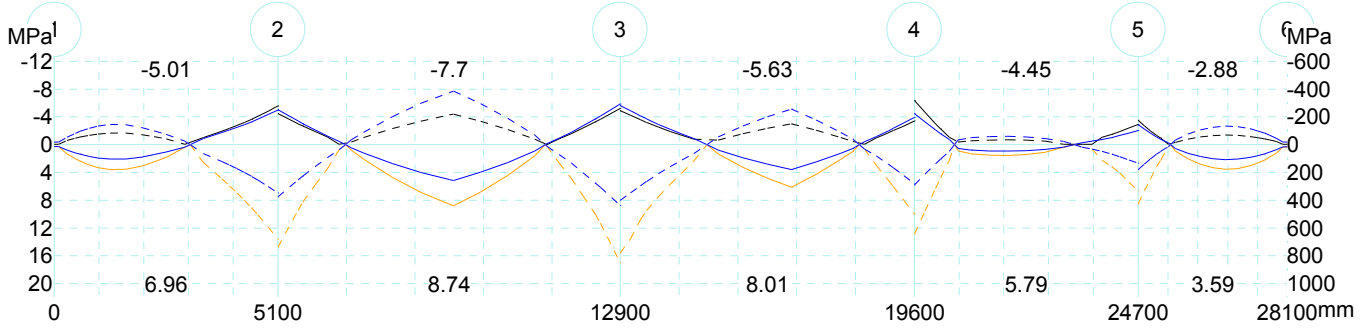
Capacity Minimum Ultimate Design Initial Final



Neutral Axis Depth Initial Final

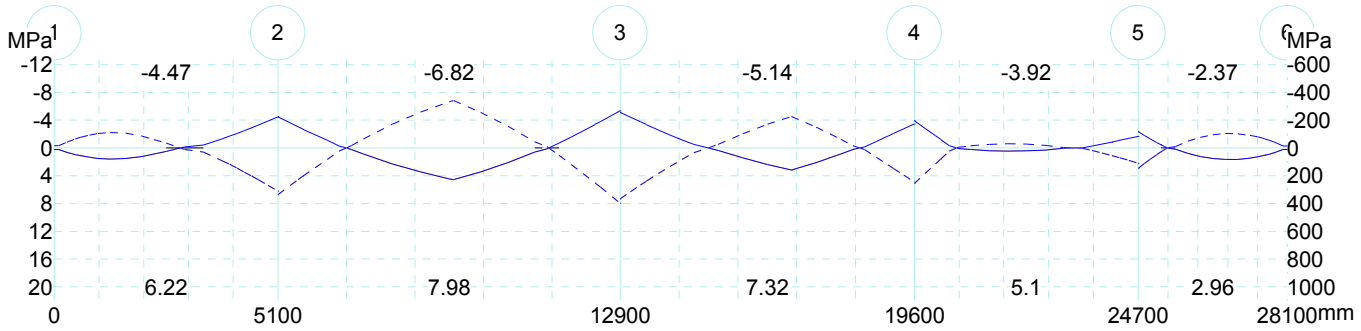
Service

Maximum Moment Condition



Gross Stress Top | Gross Stress Bottom | Cracked Compression | Reinforcement Tension

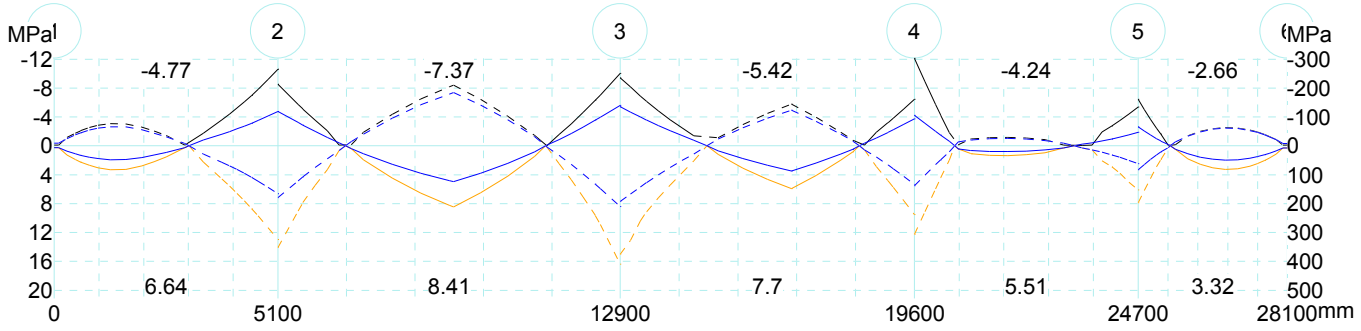
Reversal Moment Condition



Gross Stress Top | Gross Stress Bottom | Cracked Compression | Reinforcement Tension

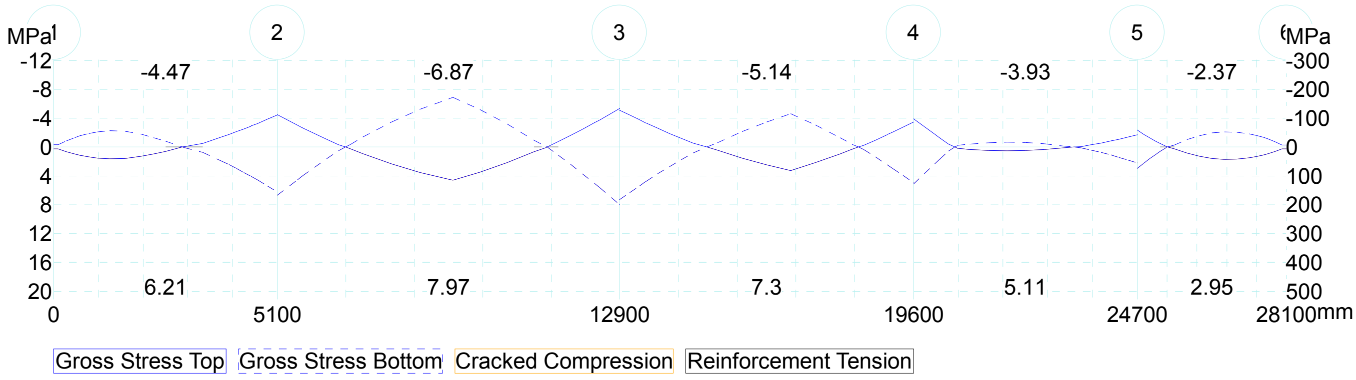
Permanent

Maximum Moment Condition



Gross Stress Top | Gross Stress Bottom | Cracked Compression | Reinforcement Tension

Reversal Moment Condition



Shear Design
Beam
Span 1

Locat	V*	Mv*	Mdec	d	Ast	bv	phi Vuc	phi Vut	phi Vu	Phi Vumax	phi VuMin	phi Vus	Theta	Asv/s
mm	kN	kNm	kNm	mm	mm2	mm	kN	kN	kN	kN	kN	kN	#.#	mm2/mm
100	335.36	34.76	0	526	0	800	0	0	0	2356.48	0	0	0	0
480	242.17	144.49	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0.56
599	213.5	162.16	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0.56
601	213.12	162.59	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0.56
800	166.29	200.5	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0.56
1000	117.24	228.85	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0
1275	57.55	228.67	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0
1637	-72.81	180.85	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0
2000	-154.94	171.32	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0.56
2275	-172.47	138.33	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0.56
2550	-191.27	88.31	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0.56
2975	-217.38	9.66	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0.56
3400	-244.48	-82.21	0	528	0	800	243.93	99999	243.93	2365.44	423.18	0.55	30	0.56
3825	-273.54	-192.29	0	528	0	800	243.93	99999	243.93	2365.44	423.18	29.61	30	0.56
3995	-284.08	-235.45	0	528	0	800	243.93	99999	243.93	2365.44	423.18	40.16	30	0.56
4163	-295.57	-284.14	0	528	0	800	243.93	99999	243.93	2365.44	423.18	51.65	30	0.56
4331	-307.06	-334.76	0	528	0	800	243.93	99999	243.93	2365.44	423.18	63.14	30	0.56
4499	-318.22	-385.83	0	528	0	800	243.93	99999	243.93	2365.44	423.18	74.3	30	0.56
4501	-318.36	-386.46	0	528	0	800	243.93	99999	243.93	2365.44	423.18	74.43	30	0.56
4644	-328.14	-432.69	0	528	0	800	243.93	99999	243.93	2365.44	423.18	84.21	30	0.56
5099	-359.26	-589.07	0	528	0	800	0	0	0	2365.44	0	0	0	0

Spacing of Sets				Minimum Legs	Shear Comments
2 legs N10	2 legs N12	2 legs N16	Min legs N10		
mm	mm	mm	mm	#	A
0	0	0	0	0	
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
0	0	0	0	0	

Span 2

Locat	V*	Mv*	Mdec	d	Ast	bv	phi Vuc	phi Vut	phi Vu	Phi Vumax	phi VuMin	phi Vus	Theta	Asv/s
mm	kN	kNm	kNm	mm	mm2	mm	kN	kN	kN	kN	kN	kN	#.#	mm2/mm
1	429.91	-589	0	496	0	800	0	0	0	2222.08	0	0	0	0
456	399.12	-400.4	0	496	0	800	267.15	99999	267.15	2222.08	435.53	131.97	30	0.56
569	391.47	-355.73	0	496	0	800	267.15	99999	267.15	2222.08	435.53	124.32	30	0.56
571	391.33	-354.95	0	496	0	800	267.15	99999	267.15	2222.08	435.53	124.19	30	0.56
846	372.72	-249.89	0	496	0	800	267.15	99999	267.15	2222.08	435.53	105.58	30	0.56
1121	354.62	-152.42	0	496	0	800	267.15	99999	267.15	2222.08	435.53	87.47	30	0.56
1396	336.01	-57.46	0	496	0	800	267.15	99999	267.15	2222.08	435.53	68.86	30	0.56
1671	317.4	32.39	0	496	0	800	267.15	99999	267.15	2222.08	435.53	50.25	30	0.56
1950	300.32	110.85	0	496	0	800	267.15	99999	267.15	2222.08	435.53	33.18	30	0.56
2600	256.34	291.76	0	496	0	800	267.15	99999	267.15	2222.08	435.53	0	30	0.56
3250	215.79	433.93	0	496	0	800	267.15	99999	267.15	2222.08	435.53	0	30	0.56
3900	177.1	546.91	0	496	0	800	267.15	99999	267.15	2222.08	435.53	0	30	0.56
3999	170.4	564.11	0	496	0	800	267.15	99999	267.15	2222.08	435.53	0	30	0.56
4001	-213.67	557.21	0	496	0	800	267.15	99999	267.15	2222.08	435.53	0	30	0.56
4618	-251.32	428.52	0	496	0	800	267.15	99999	267.15	2222.08	435.53	0	30	0.56
5234	-289.46	273.56	0	496	0	800	267.15	99999	267.15	2222.08	435.53	22.31	30	0.56
5850	-331.14	82.42	0	496	0	800	267.15	99999	267.15	2222.08	435.53	64	30	0.56
6129	-348.14	-4.42	0	496	0	800	267.15	99999	267.15	2222.08	435.53	81	30	0.56
6404	-366.75	-102.72	0	496	0	800	267.15	99999	267.15	2222.08	435.53	99.61	30	0.56
6679	-385.36	-206.14	0	496	0	800	267.15	99999	267.15	2222.08	435.53	118.22	30	0.56
6954	-403.44	-311.95	0	496	0	800	267.15	99999	267.15	2222.08	435.53	136.29	30	0.56
7229	-422.05	-425.45	0	496	0	800	267.15	99999	267.15	2222.08	435.53	154.9	30	0.56
7231	-422.19	-426.3	0	496	0	800	267.15	99999	267.15	2222.08	435.53	155.04	30	0.56
7344	-429.83	-474.44	0	496	0	800	267.15	99999	267.15	2222.08	435.53	162.69	30	0.56
7799	-460.62	-677.01	0	496	0	800	0	0	0	2222.08	0	0	0	0

Spacing of Sets				Minimum Legs	Shear Comments
2 legs N10	2 legs N12	2 legs N16	Min legs N10		
mm	mm	mm	mm	#	A
0	0	0	0	0	
280	404	428	421	3	Minimum Steel
280	404	428	421	3	Minimum Steel
280	404	428	421	3	Minimum Steel
280	404	428	421	3	Minimum Steel
280	404	428	421	3	Minimum Steel
280	404	428	421	3	Minimum Steel
280	404	428	421	3	Minimum Steel
280	404	428	421	3	Minimum Steel
280	404	428	421	3	Minimum Steel
280	404	428	421	3	Minimum Steel
280	404	428	421	3	Minimum Steel
280	404	428	421	3	Minimum Steel
280	404	428	421	3	Minimum Steel
280	404	428	421	3	Minimum Steel
280	404	428	421	3	Minimum Steel
280	404	428	421	3	Minimum Steel
280	404	428	421	3	Minimum Steel
280	404	428	421	3	Minimum Steel
280	404	428	421	3	Minimum Steel
280	404	428	421	3	Minimum Steel
280	404	428	421	3	Minimum Steel
280	404	428	421	3	Minimum Steel
280	404	428	421	3	Minimum Steel
0	0	0	0	0	

Span 3

Locat	V*	Mv*	Mdec	d	Ast	bv	phi Vuc	phi Vut	phi Vu	Phi Vumax	phi VuMin	phi Vus	Theta	Asv/s
mm	kN	kNm	kNm	mm	mm2	mm	kN	kN	kN	kN	kN	kN	#.#	mm2/mm
1	403.83	-677.07	0	526	0	800	0	0	0	2356.48	0	0	0	0
456	374.74	-499.95	0	526	0	800	270.26	99999	270.26	2356.48	448.83	104.48	30	0.56
599	365.6	-447.01	0	526	0	800	270.26	99999	270.26	2356.48	448.83	95.33	30	0.56
601	365.47	-446.28	0	526	0	800	270.26	99999	270.26	2356.48	448.83	95.2	30	0.56
869	348.88	-352.99	0	526	0	800	270.26	99999	270.26	2356.48	448.83	78.62	30	0.56
1137	331.74	-261.79	0	526	0	800	270.26	99999	270.26	2356.48	448.83	61.48	30	0.56

Locat	V*	Mv*	Mdec	d	Ast	bv	phi Vuc	phi Vut	phi Vu	Phi Vumax	phi VuMin	phi Vus	Theta	Asv/s
mm	kN	kNm	kNm	mm	mm2	mm	kN	kN	kN	kN	kN	kN	#.#	mm2/mm
1405	314.61	-175.18	0	526	0	800	270.26	99999	270.26	2356.48	448.83	44.34	30	0.56
1675	299.16	-99.05	0	526	0	800	270.26	99999	270.26	2356.48	448.83	28.9	30	0.56
2233	263.48	57.92	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0.56
2791	231.09	186.62	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0.56
3350	200.21	295.5	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0.56
3899	167.82	385.07	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0.56
3901	-226.48	417.76	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0.56
4463	-258.73	281.41	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0.56
5025	-292.19	102.39	0	526	0	800	270.26	99999	270.26	2356.48	448.83	21.93	30	0.56
5299	-308.18	26.15	0	526	0	800	270.26	99999	270.26	2356.48	448.83	37.92	30	0.56
5301	-334.78	46.07	0	526	0	800	270.26	99999	270.26	2356.48	448.83	64.52	30	0.56
5567	-351.79	-45.25	0	526	0	800	270.26	99999	270.26	2356.48	448.83	81.52	30	0.56
5833	-368.8	-141.09	0	526	0	800	270.26	99999	270.26	2356.48	448.83	98.53	30	0.56
6099	-385.37	-239.34	0	526	0	800	270.26	99999	270.26	2356.48	448.83	115.1	30	0.56
6101	-385.5	-240.11	0	526	0	800	270.26	99999	270.26	2356.48	448.83	115.23	30	0.56
6220	-393.1	-286.44	0	526	0	800	270.26	99999	270.26	2356.48	448.83	122.84	30	0.56
6699	-423.73	-482.07	0	526	0	800	0	0	0	2356.48	0	0	0	0

Spacing of Sets				Minimum Legs	Shear Comments
2 legs N10	2 legs N12	2 legs N16	Min legs N10		
mm	mm	mm	mm	#	A
0	0	0	0	0	
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
0	0	0	0	0	

Span 4

Locat	V*	Mv*	Mdec	d	Ast	bv	phi Vuc	phi Vut	phi Vu	Phi Vumax	phi VuMin	phi Vus	Theta	Asv/s
mm	kN	kNm	kNm	mm	mm2	mm	kN	kN	kN	kN	kN	kN	#.#	mm2/mm
1	537.38	-481.96	0	530	0	800	0	0	0	2374.4	0	0	0	0
480	506.75	-231.89	0	530	0	800	216.18	99999	216.18	2374.4	396.1	290.57	30.839	0.94
599	499.14	-172.04	0	530	0	800	216.18	99999	216.18	2374.4	396.1	282.97	30.7813	0.91
601	499.02	-171.04	0	530	0	800	216.18	99999	216.18	2374.4	396.1	282.84	30.7803	0.91
800	486.69	-74.31	0	530	0	800	216.18	99999	216.18	2374.4	396.1	270.51	30.6868	0.87
999	473.96	21.28	0	526	0	800	270.26	99999	270.26	2356.48	448.83	203.7	30.1976	0.64
1001	134.23	21.89	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0
1275	118.03	52.5	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0
1299	116.49	55.31	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0
1301	72.27	18.35	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0
1717	45.67	42.88	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0
2133	-31.48	95.93	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0
2550	-56.28	84.58	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0
2975	-79.94	62.59	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0
3400	-104.75	28.8	0	526	0	800	270.26	99999	270.26	2356.48	448.83	0	30	0
3825	-131.92	-21.49	0	530	0	800	216.18	99999	216.18	2374.4	396.1	0	30	0.56

Locat	V*	Mv*	Mdec	d	Ast	bv	phi Vuc	phi Vut	phi Vu	Phi Vumax	phi VuMin	phi Vus	Theta	Asv/s
mm	kN	kNm	kNm	mm	mm2	mm	kN	kN	kN	kN	kN	kN	#.#	mm2/mm
4051	-145.08	-48.9	0	530	0	800	216.18	99999	216.18	2374.4	396.1	0	30	0.56
4275	-159.4	-83	0	530	0	800	216.18	99999	216.18	2374.4	396.1	0	30	0.56
4499	-173.33	-118.94	0	530	0	800	216.18	99999	216.18	2374.4	396.1	0	30	0.56
4501	-173.46	-119.29	0	530	0	800	216.18	99999	216.18	2374.4	396.1	0	30	0.56
4684	-185.16	-152.1	0	530	0	800	216.18	99999	216.18	2374.4	396.1	0	30	0.56
5099	-211.69	-234.45	0	530	0	800	0	0	0	2374.4	0	0	0	0

Spacing of Sets				Minimum Legs	Shear Comments
2 legs N10	2 legs N12	2 legs N16	Min legs N10		
mm	mm	mm	mm	#	A
0	0	0	0	0	
168	242	300	252	3	
173	249	300	259	3	
173	249	300	259	3	
181	261	300	272	3	
244	300	300	300	3	
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
280	404	450	421	3	Minimum Steel
0	0	0	0	0	

Span 5

Locat	V*	Mv*	Mdec	d	Ast	bv	phi Vuc	phi Vut	phi Vu	Phi Vumax	phi VuMin	phi Vus	Theta	Asv/s
mm	kN	kNm	kNm	mm	mm2	mm	kN	kN	kN	kN	kN	kN	#.#	mm2/mm
1	376.77	-234.29	0	450	0	800	0	0	0	2016	0	0	0	0
416	301.81	-95.33	0	450	0	800	299.18	99999	299.18	2016	451.95	2.62	30	0.56
519	283.54	-65.16	0	450	0	800	299.18	99999	299.18	2016	451.95	0	30	0.56
521	283.18	-64.6	0	450	0	800	299.18	99999	299.18	2016	451.95	0	30	0.56
685	253.47	-20.59	0	450	0	800	299.18	99999	299.18	2016	451.95	0	30	0.56
850	225.69	13.41	0	446	0	800	260.15	99999	260.15	1998.08	411.56	0	30	0.56
1133	174.43	70.03	0	446	0	800	260.15	99999	260.15	1998.08	411.56	0	30	0.56
1416	127.15	104.23	0	446	0	800	260.15	99999	260.15	1998.08	411.56	0	30	0
1700	81.91	122.5	0	446	0	800	260.15	99999	260.15	1998.08	411.56	0	30	0
1984	32.97	126.59	0	446	0	800	260.15	99999	260.15	1998.08	411.56	0	30	0
2267	-54.24	149.59	0	446	0	800	260.15	99999	260.15	1998.08	411.56	0	30	0
2550	-104.47	138.41	0	446	0	800	260.15	99999	260.15	1998.08	411.56	0	30	0
2715	-129.95	127.55	0	446	0	800	260.15	99999	260.15	1998.08	411.56	0	30	0
2879	-159.65	103.81	0	446	0	800	260.15	99999	260.15	1998.08	411.56	0	30	0.56
2881	-160.02	103.49	0	446	0	800	260.15	99999	260.15	1998.08	411.56	0	30	0.56
2984	-178.28	86.05	0	446	0	800	260.15	99999	260.15	1998.08	411.56	0	30	0.56
3300	-234.43	24.35	0	446	0	800	0	0	0	1998.08	0	0	0	0

Spacing of Sets				Minimum Legs	Shear Comments
2 legs N10	2 legs N12	2 legs N16	Min legs N10		
mm	mm	mm	mm	#	A
0	0	0	0	0	
280	390	390	390	3	Minimum Steel
280	390	390	390	3	Minimum Steel
280	390	390	390	3	Minimum Steel
280	390	390	390	3	Minimum Steel
280	390	390	390	3	Minimum Steel

Spacing of Sets				Minimum Legs	Shear Comments
2 legs N10	2 legs N12	2 legs N16	Min legs N10		
mm	mm	mm	mm	#	A
280	390	390	390	3	Minimum Steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
280	390	390	390	3	Minimum Steel
280	390	390	390	3	Minimum Steel
280	390	390	390	3	Minimum Steel
0	0	0	0	0	

Punching

Column Head Critical Section

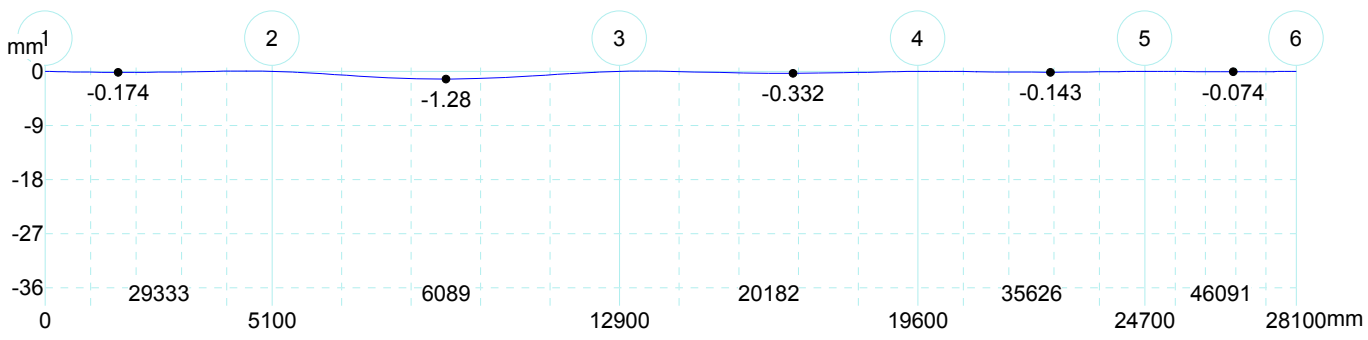
Column No.	Bh	a	at	u	d	fcv	P/A	Asw/s min	V*	Mv*	phi Vuo	phi Vu	phi VuMin	phi Vumax	side beam	Moment Transfer	Asw/s reqd
A	#.#	mm	mm	mm	mm	MPa	MPa	mm2/mm	kN	kNm	kN	kN	kN	kN	A	A	mm2/mm
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0

result
A
Check Not Carried Out!
Check Not Carried Out!
Check Not Carried Out!
Check Not Carried Out!
Check Not Carried Out!
Check Not Carried Out!

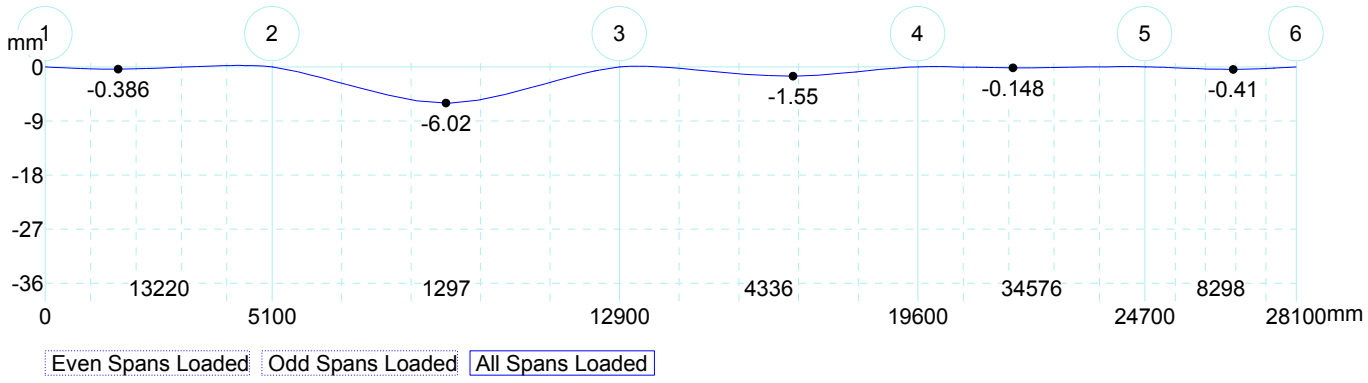
Deflections

All Spans Loaded

Transfer

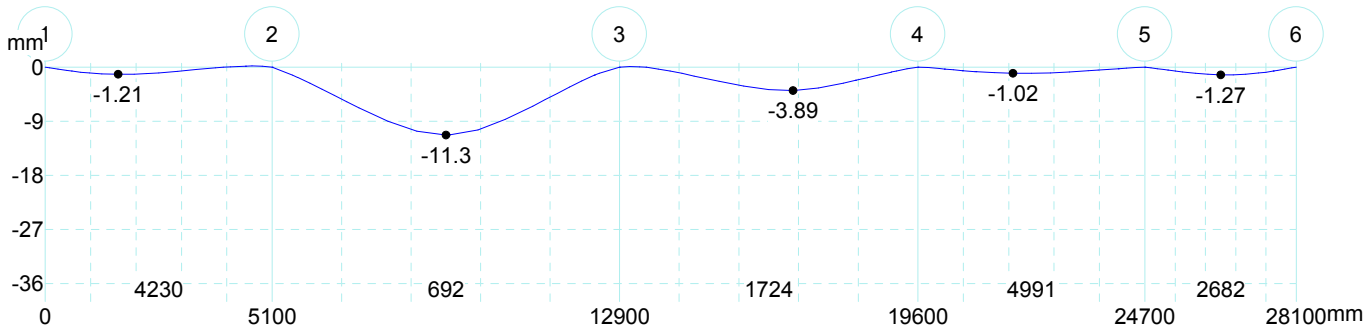


Short Term



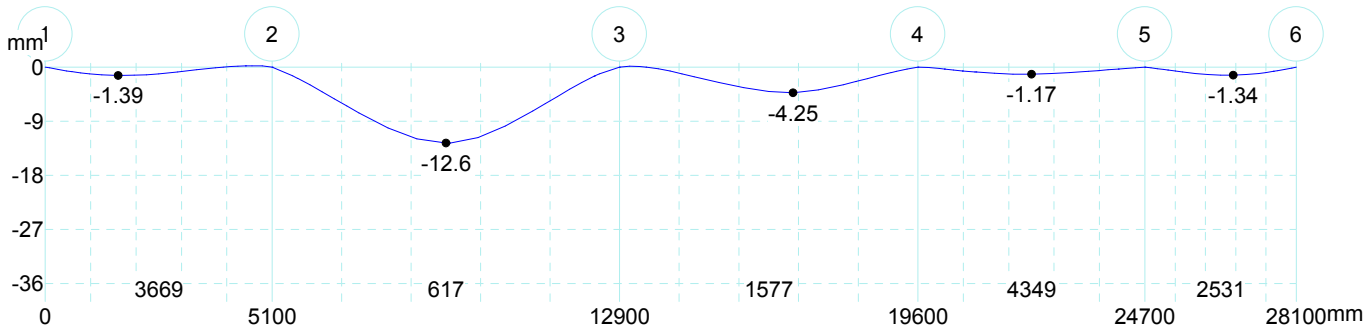
Even Spans Loaded | Odd Spans Loaded | All Spans Loaded

Incremental



Even Spans Loaded | Odd Spans Loaded | All Spans Loaded

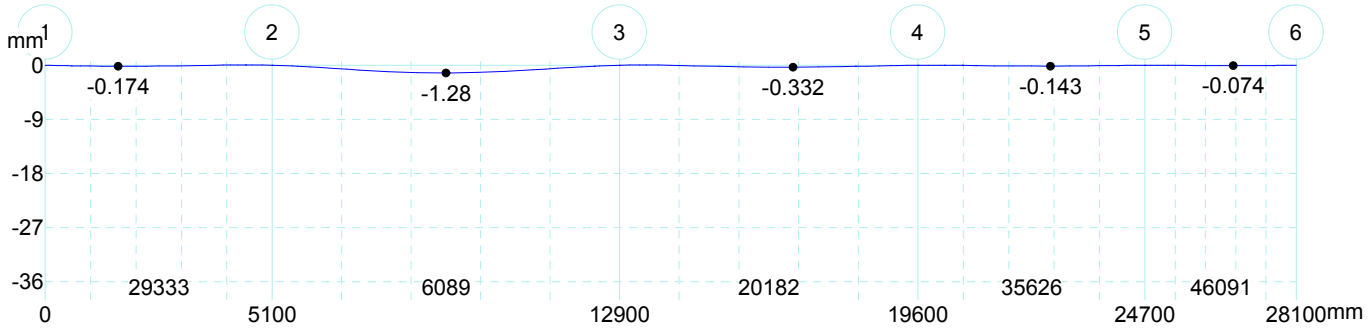
Total Long Term



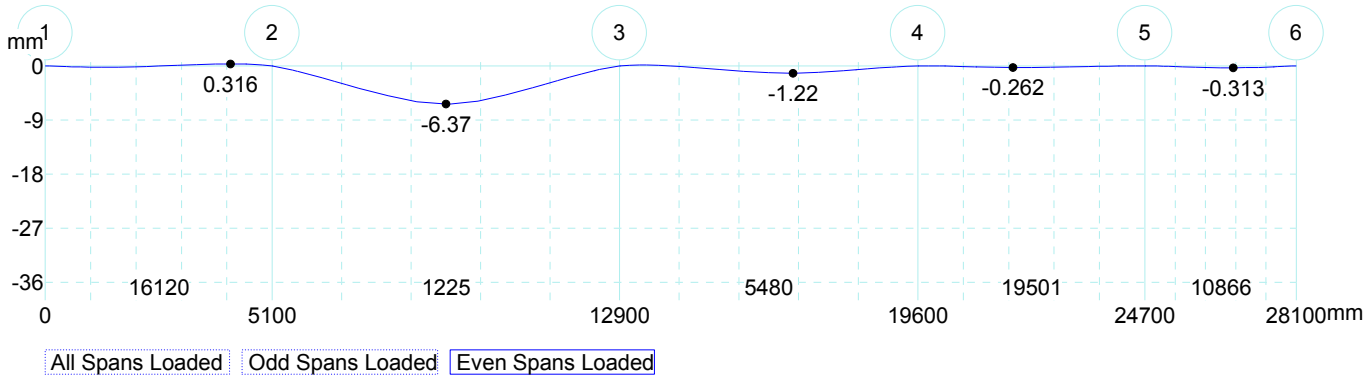
Even Spans Loaded | Odd Spans Loaded | All Spans Loaded

Even Spans Loaded

Transfer

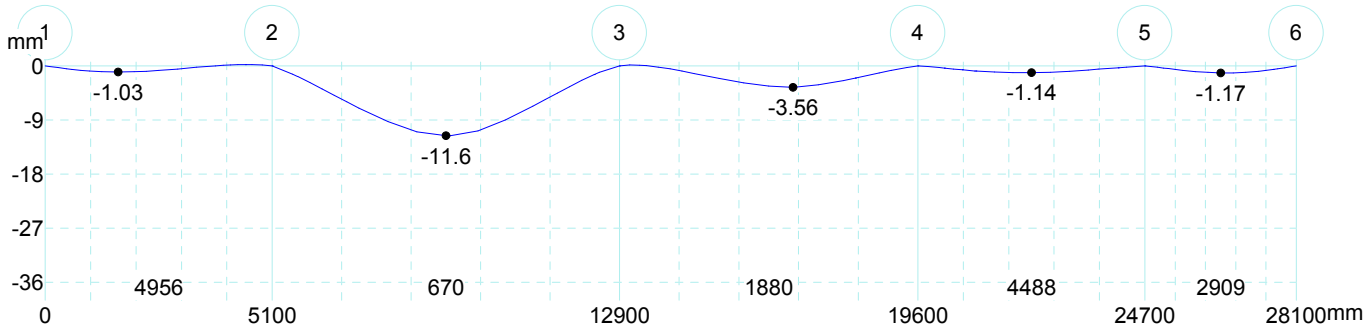


Short Term



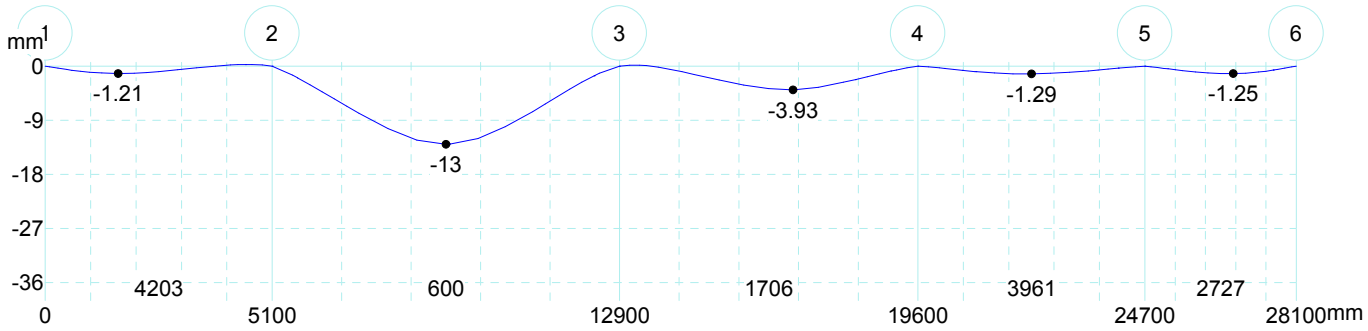
All Spans Loaded | Odd Spans Loaded | Even Spans Loaded

Incremental



All Spans Loaded | Odd Spans Loaded | Even Spans Loaded

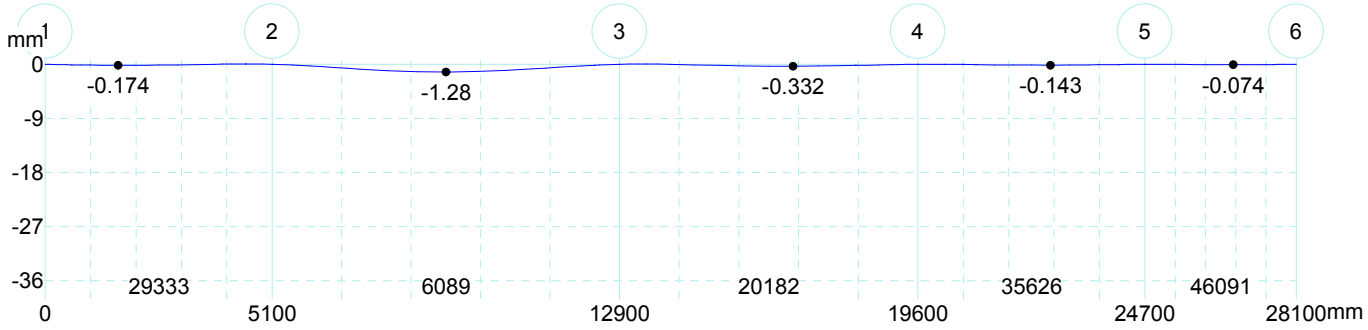
Total Long Term



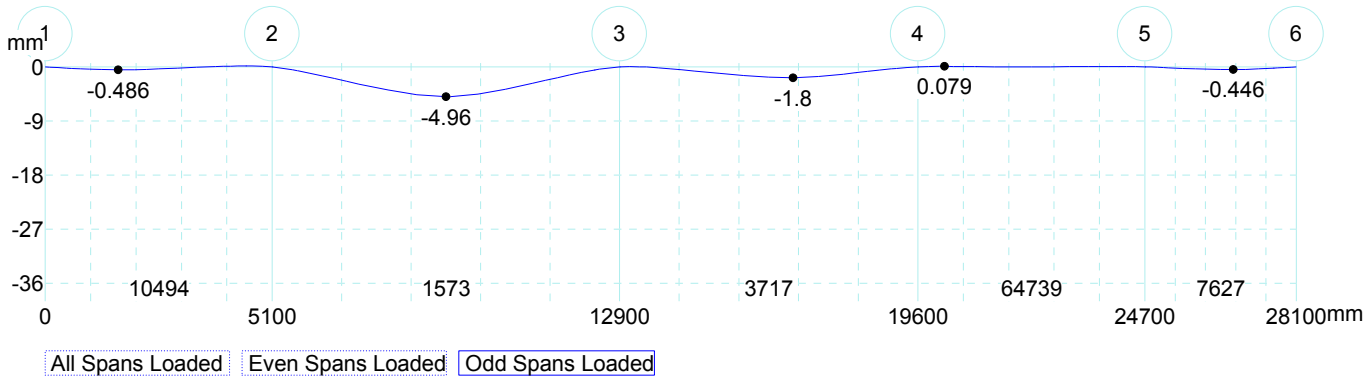
All Spans Loaded | Odd Spans Loaded | Even Spans Loaded

Odd Spans Loaded

Transfer

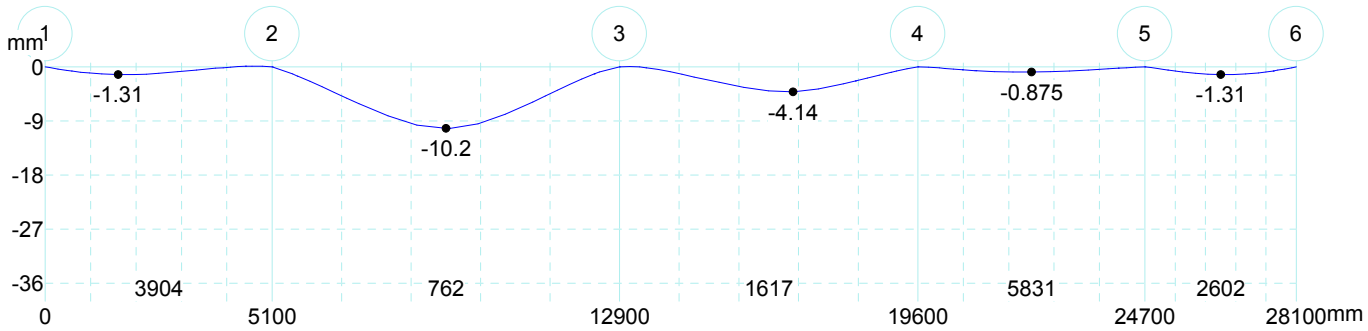


Short Term



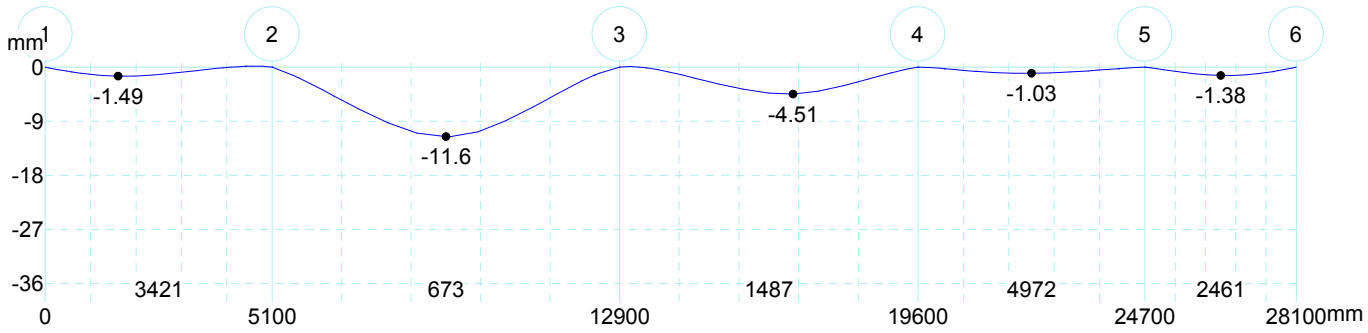
All Spans Loaded | Even Spans Loaded | Odd Spans Loaded

Incremental



All Spans Loaded | Even Spans Loaded | Odd Spans Loaded

Total Long Term



All Spans Loaded | Even Spans Loaded | Odd Spans Loaded

Detailed Reinforcement

Span 1

	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
100	0	0	0	46	1667	No Steel Added	40	300	0	554	800	No Steel Added
290	0	0	0	46	1667	No Steel Added	40	300	0	554	800	No Steel Added
480	0	0	0	46	1667	No Steel Added	40	300	0	554	800	No Steel Added
599	0	0	0	46	1667	No Steel Added	40	300	0	554	800	No Steel Added
601	0	0	0	46	1667	No Steel Added	40	300	0	554	800	No Steel Added
800	0	0	0	46	1667	No Steel Added	40	300	0	554	800	No Steel Added
1000	0	0	0	46	1667	No Steel Added	40	300	0	554	800	No Steel Added
1275	0	0	0	46	1667	No Steel Added	40	300	0	554	800	No Steel Added
1637	0	0	0	46	1667	No Steel Added	40	300	0	554	800	No Steel Added
2000	0	0	0	46	1667	No Steel Added	40	300	0	554	800	No Steel Added
2275	0	0	0	46	1667	No Steel Added	40	300	0	554	800	No Steel Added
2550	0	0	0	46	1667	No Steel Added	40	300	0	554	800	No Steel Added
2975	40	300	0	46	1667	No Steel Added	40	300	0	554	800	No Steel Added
3400	40	300	0	46	1667	No Steel Added	0	0	0	554	800	No Steel Added
3825	40	300	0	46	1667	No Steel Added	0	0	0	554	800	No Steel Added
3995	40	300	0	46	1667	No Steel Added	0	0	0	554	800	No Steel Added
4163	36	300	0	46	1667	No Steel Added	0	0	0	554	800	No Steel Added
4331	32	300	0	46	1667	No Steel Added	0	0	0	554	800	No Steel Added
4499	28	272	0	46	1667	No Steel Added	0	0	0	554	800	No Steel Added

	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
4501	28	272	0	46	1667	No Steel Added	0	0	0	554	800	No Steel Added
4644	24	245	0	46	1667	No Steel Added	0	0	0	554	800	No Steel Added
4872	20	200	0	46	1667	No Steel Added	0	0	0	554	800	No Steel Added
5099	16	153	0	46	1667	No Steel Added	0	0	0	554	800	No Steel Added

Shear Reinforcement				
	Spacing of Sets			
Area	2 legs N10	2 legs N12	2 legs N16	Shear Comments
mm2/mm	mm	mm	mm	A
0	0	0	0	
0	0	0	0	
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0	0	0	0	
0	0	0	0	

Design Comments:-
- - Column Grid 1 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Column Grid 2 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 1 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

Span 2

	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
1	20	220	0	46	1892	No Steel Added	0	0	0	524	800	No Steel Added
456	32	300	0	46	1892	No Steel Added	0	0	0	524	800	No Steel Added
569	36	300	0	46	1892	No Steel Added	0	0	0	524	800	No Steel Added
571	36	300	0	46	1892	No Steel Added	0	0	0	524	800	No Steel Added
846	40	300	0	46	1892	No Steel Added	0	0	0	524	800	No Steel Added
1121	40	300	0	46	1892	No Steel Added	0	0	0	524	800	No Steel Added
1396	40	300	0	46	1892	No Steel Added	0	0	0	524	800	No Steel Added
1671	0	0	0	46	1892	No Steel Added	40	300	0	524	800	No Steel Added
1950	0	0	0	46	1892	No Steel Added	40	300	0	524	800	No Steel Added
2600	0	0	0	46	1892	No Steel Added	40	300	0	524	800	No Steel Added
3250	0	0	0	46	1892	No Steel Added	28	288	0	524	800	No Steel Added
3900	0	0	0	46	1892	No Steel Added	20	233	0	524	800	No Steel Added
3999	0	0	0	46	1892	No Steel Added	20	226	0	524	800	No Steel Added
4001	0	0	0	46	1892	No Steel Added	20	226	0	524	800	No Steel Added
4618	0	0	0	46	1892	No Steel Added	28	290	0	524	800	No Steel Added
5234	0	0	0	46	1892	No Steel Added	40	300	0	524	800	No Steel Added
5850	0	0	0	46	1892	No Steel Added	40	300	0	524	800	No Steel Added
6129	40	300	0	46	1892	No Steel Added	40	300	0	524	800	No Steel Added
6404	40	300	0	46	1892	No Steel Added	0	0	0	524	800	No Steel Added
6679	40	300	0	46	1892	No Steel Added	0	0	0	524	800	No Steel Added
6954	40	300	0	46	1892	No Steel Added	0	0	0	524	800	No Steel Added
7229	28	296	0	46	1892	No Steel Added	0	0	0	524	800	No Steel Added

	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
7231	28	296	0	46	1892	No Steel Added	0	0	0	524	800	No Steel Added
7344	28	273	0	46	1892	No Steel Added	0	0	0	524	800	No Steel Added
7799	16	174	0	46	1892	No Steel Added	0	0	0	524	800	No Steel Added

Shear Reinforcement				
	Spacing of Sets			
Area	2 legs N10	2 legs N12	2 legs N16	Shear Comments
mm2/mm	mm	mm	mm	A
0	0	0	0	
0.56	280	404	428	Minimum Steel
0.56	280	404	428	Minimum Steel
0.56	280	404	428	Minimum Steel
0.56	280	404	428	Minimum Steel
0.56	280	404	428	Minimum Steel
0.56	280	404	428	Minimum Steel
0.56	280	404	428	Minimum Steel
0.56	280	404	428	Minimum Steel
0.56	280	404	428	Minimum Steel
0.56	280	404	428	Minimum Steel
0.56	280	404	428	Minimum Steel
0.56	280	404	428	Minimum Steel
0.56	280	404	428	Minimum Steel
0.56	280	404	428	Minimum Steel
0.56	280	404	428	Minimum Steel
0.56	280	404	428	Minimum Steel
0.56	280	404	428	Minimum Steel
0.56	280	404	428	Minimum Steel
0.56	280	404	428	Minimum Steel
0.56	280	404	428	Minimum Steel
0.56	280	404	428	Minimum Steel
0.56	280	404	428	Minimum Steel
0.56	280	404	428	Minimum Steel
0	0	0	0	

Design Comments:-
- - Column Grid 2 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Column Grid 3 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 2 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

Span 3

	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
1	16	195	0	46	1738	No Steel Added	0	0	0	554	800	No Steel Added
228	20	235	0	46	1738	No Steel Added	0	0	0	554	800	No Steel Added
456	28	277	0	46	1738	No Steel Added	0	0	0	554	800	No Steel Added
599	32	300	0	46	1738	No Steel Added	0	0	0	554	800	No Steel Added
601	32	300	0	46	1738	No Steel Added	0	0	0	554	800	No Steel Added
869	36	300	0	46	1738	No Steel Added	0	0	0	554	800	No Steel Added
1137	40	300	0	46	1738	No Steel Added	0	0	0	554	800	No Steel Added
1405	40	300	0	46	1738	No Steel Added	0	0	0	554	800	No Steel Added
1675	40	300	0	46	1738	No Steel Added	0	0	0	554	800	No Steel Added
2233	0	0	0	46	1738	No Steel Added	40	300	0	554	800	No Steel Added
2791	0	0	0	46	1738	No Steel Added	40	300	0	554	800	No Steel Added
3350	0	0	0	46	1738	No Steel Added	40	300	0	554	800	No Steel Added
3899	0	0	0	46	1738	No Steel Added	32	300	0	554	800	No Steel Added
3901	0	0	0	46	1738	No Steel Added	32	300	0	554	800	No Steel Added
4463	0	0	0	46	1738	No Steel Added	40	300	0	554	800	No Steel Added
5025	0	0	0	46	1738	No Steel Added	40	300	0	554	800	No Steel Added
5299	0	0	0	46	1738	No Steel Added	40	300	0	554	800	No Steel Added
5301	0	0	0	46	1738	No Steel Added	40	300	0	554	800	No Steel Added
5567	40	300	0	46	1738	No Steel Added	0	0	0	554	800	No Steel Added
5833	40	300	0	46	1738	No Steel Added	0	0	0	554	800	No Steel Added
6099	40	300	0	46	1738	No Steel Added	0	0	0	554	800	No Steel Added

	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
6101	40	300	0	46	1738	No Steel Added	0	0	0	554	800	No Steel Added
6220	40	300	0	46	1738	No Steel Added	0	0	0	554	800	No Steel Added
6460	36	300	0	46	1738	No Steel Added	0	0	0	554	800	No Steel Added
6699	28	288	0	46	1738	No Steel Added	0	0	0	554	800	No Steel Added

Shear Reinforcement				
	Spacing of Sets			
Area	2 legs N10	2 legs N12	2 legs N16	Shear Comments
mm2/mm	mm	mm	mm	A
0	0	0	0	
0	0	0	0	
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0	0	0	0	
0	0	0	0	

Design Comments:-
- \- Column Grid 3 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- \- Column Grid 4 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- \- Span 3 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

Span 4

	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
1	12	103	0	46	1514	No Steel Added	0	0	0	554	800	No Steel Added
240	20	208	0	46	1514	No Steel Added	0	0	0	554	800	No Steel Added
480	32	300	0	46	1514	No Steel Added	0	0	0	554	800	No Steel Added
599	40	300	0	46	1514	No Steel Added	0	0	0	554	800	No Steel Added
601	40	300	0	46	1514	No Steel Added	0	0	0	554	800	No Steel Added
800	40	300	0	46	1514	No Steel Added	0	0	0	554	800	No Steel Added
999	0	0	0	46	1514	No Steel Added	40	300	0	554	800	No Steel Added
1001	0	0	0	46	1514	No Steel Added	40	300	0	554	800	No Steel Added
1275	0	0	0	46	1514	No Steel Added	40	300	0	554	800	No Steel Added
1299	0	0	0	46	1514	No Steel Added	40	300	0	554	800	No Steel Added
1301	0	0	0	46	1514	No Steel Added	40	300	0	554	800	No Steel Added
1717	0	0	0	46	1514	No Steel Added	40	300	0	554	800	No Steel Added
2133	0	0	0	46	1514	No Steel Added	40	300	0	554	800	No Steel Added
2550	0	0	0	46	1514	No Steel Added	40	300	0	554	800	No Steel Added
2975	0	0	0	46	1514	No Steel Added	40	300	0	554	800	No Steel Added
3400	0	0	0	46	1514	No Steel Added	40	300	0	554	800	No Steel Added
3825	40	300	0	46	1514	No Steel Added	0	0	0	554	800	No Steel Added
4051	40	300	0	46	1514	No Steel Added	0	0	0	554	800	No Steel Added
4275	40	300	0	46	1514	No Steel Added	0	0	0	554	800	No Steel Added
4499	40	300	0	46	1514	No Steel Added	0	0	0	554	800	No Steel Added

	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
4501	40	300	0	46	1514	No Steel Added	0	0	0	554	800	No Steel Added
4684	40	300	0	46	1514	No Steel Added	0	0	0	554	800	No Steel Added
4892	40	300	0	46	1514	No Steel Added	0	0	0	554	800	No Steel Added
5099	32	300	0	46	1514	No Steel Added	0	0	0	554	800	No Steel Added

Shear Reinforcement				
	Spacing of Sets			
Area	2 legs N10	2 legs N12	2 legs N16	Shear Comments
mm2/mm	mm	mm	mm	A
0	0	0	0	
0	0	0	0	
0.94	168	242	300	
0.91	173	249	300	
0.91	173	249	300	
0.87	181	261	300	
0.64	244	300	300	
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0.56	280	404	450	Minimum Steel
0	0	0	0	
0	0	0	0	

Design Comments:-
- - Column Grid 4 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Column Grid 5 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 4 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

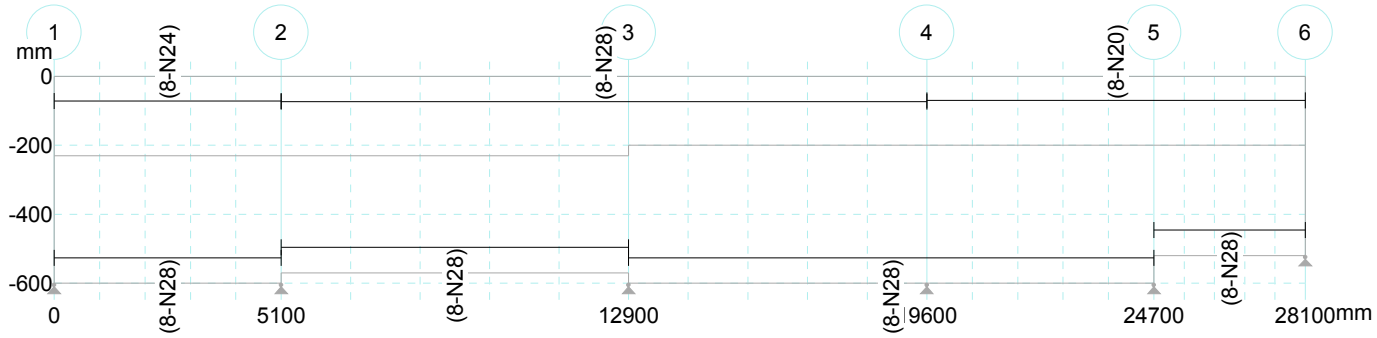
Span 5

	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
1	28	282	0	46	1378	No Steel Added	0	0	0	474	800	No Steel Added
139	36	300	0	46	1378	No Steel Added	0	0	0	474	800	No Steel Added
277	40	300	0	46	1378	No Steel Added	0	0	0	474	800	No Steel Added
416	40	300	0	46	1378	No Steel Added	0	0	0	474	800	No Steel Added
519	40	300	0	46	1378	No Steel Added	0	0	0	474	800	No Steel Added
521	40	300	0	46	1378	No Steel Added	0	0	0	474	800	No Steel Added
685	40	300	0	46	1378	No Steel Added	40	300	0	474	800	No Steel Added
850	0	0	0	46	1378	No Steel Added	40	300	0	474	800	No Steel Added
1133	0	0	0	46	1378	No Steel Added	40	300	0	474	800	No Steel Added
1416	0	0	0	46	1378	No Steel Added	40	300	0	474	800	No Steel Added
1700	0	0	0	46	1378	No Steel Added	40	300	0	474	800	No Steel Added
1984	0	0	0	46	1378	No Steel Added	40	300	0	474	800	No Steel Added
2267	0	0	0	46	1378	No Steel Added	40	300	0	474	800	No Steel Added
2550	0	0	0	46	1378	No Steel Added	40	300	0	474	800	No Steel Added
2715	0	0	0	46	1378	No Steel Added	40	300	0	474	800	No Steel Added
2879	0	0	0	46	1378	No Steel Added	40	300	0	474	800	No Steel Added
2881	0	0	0	46	1378	No Steel Added	40	300	0	474	800	No Steel Added
2984	0	0	0	46	1378	No Steel Added	40	300	0	474	800	No Steel Added
3142	0	0	0	46	1378	No Steel Added	40	300	0	474	800	No Steel Added
3300	0	0	0	46	1378	No Steel Added	40	300	0	474	800	No Steel Added

Shear Reinforcement				
	Spacing of Sets			
Area	2 legs N10	2 legs N12	2 legs N16	Shear Comments
mm2/mm	mm	mm	mm	A
0	0	0	0	
0	0	0	0	
0	0	0	0	
0.56	280	390	390	Minimum Steel
0.56	280	390	390	Minimum Steel
0.56	280	390	390	Minimum Steel
0.56	280	390	390	Minimum Steel
0.56	280	390	390	Minimum Steel
0.56	280	390	390	Minimum Steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0.56	280	390	390	Minimum Steel
0.56	280	390	390	Minimum Steel
0.56	280	390	390	Minimum Steel
0	0	0	0	
0	0	0	0	

Design Comments:-
- - Column Grid 5 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 5 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

Reinforcement Layout



- - Column Grid 1 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Column Grid 2 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 1 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

- - Column Grid 2 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Column Grid 3 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 2 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

- - Column Grid 3 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Column Grid 4 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 3 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

- - Column Grid 4 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Column Grid 5 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 4 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

- - Column Grid 5 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 5 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

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RAPT - Version: 6.5.16.0
Reinforced And Post-Tensioned Concrete Analysis & Design Package

Licensee
TMK Consulting Engineers
Level 6
100 Pirie Street
Adelaide SA 5000
111690651607 18WPN3

Input

General

Design Code	List	Australia - AS3600*SAVED*
Material	List	Australia - Australian Materials*SAVED*
Reinforcement Type	List	Reinforced
Member Type	List	Beam
Panel Type	List	Internal
Strip Type	List	One way - Nominal Width
Column Stiffness	List	Equivalent Column
Concrete Type	List	Standard Concrete - Brisbane/Sydney
Concrete - Spanning Members	List	40MPa
Concrete - Columns	List	40MPa
Top Reinforcement Cover	mm	30
Bottom Reinforcement Cover	mm	30
Top Reinforcement Axis Depth Limit	mm	30
Bottom Reinforcement Axis Depth Limit	mm	30
Concrete Unit Weight	kn/m3	25
Self Weight Definition	List	Program Calculated
Pattern Live Load	Y/N	Y
Earthquake Design	List	None
Moment Redistribution	%	0
Design Surface Levels	List	Extreme Surfaces

Span

Span	Span Length	Slab Depth	Panel Width Left	Panel Width Right
	mm	mm	mm	mm
LE	0			
1	3000	150	4000	4000
2	2500	150	4000	4000
3	9700	150	4000	4000
RE	0			

Columns

Column	Column Grid Reference	Support Type	Transverse Column spacing	Transverse prestress (P/A)
	A	List	mm	MPa
1	1	Knife-Edge	4000	
2	2	Knife-Edge	4000	
3	3	Knife-Edge	4000	
4	4	Knife-Edge	4000	

Beams

Beam Number	Beam Depth	Beam Width at Slab	Beam Width	Effective Flange Width
	mm	mm	mm	mm
1	400	2000	2000	2510
2	670	2000	2000	2350
3	670	2000	2000	3649

Load Cases

Load Case	Load Type	Load Definition	Live Load Deflection Case	Description
	List	List	Y/N	A
1	Self Weight	Applied Loads		
2	Initial Dead Load	Applied Loads		
3	Extra Dead Load	Applied Loads		
4	Live Load	Applied Loads	Y	

1. Self Weight - Line

Load	Left End Reference Column	Left end of load from reference column	Load at left end	Right End reference column	Right end of load from reference column	Load at right end	Description
	#	mm	kN/m	#	mm	kN/m	A
1	1	0	27.5	2	0	27.5	
2	2	0	41	3	0	41	
3	3	0	41	4	0	41	

2. Initial Dead Load - Panel

Load	Left End reference column	Left end of load from reference column	Load at left end	Right End reference column	Right end of load from reference column	Load at right end	Description
	#	mm	kN/m2	#	mm	kN/m2	A
1	1	0	1	4	0	1	

3. Extra Dead Load - Point

Load	Reference column	Distance to Load from reference column	Load	Load Length	Description
	#	mm	kN	mm	A
1	3	1000	580	1000	
2	3	6200	450	1000	

4. Live Load - Panel

Load	Left End reference column	Left end of load from reference column	Load at left end	Right End reference column	Right end of load from reference column	Load at right end	Live Load reduction	Description
	#	mm	kN/m2	#	mm	kN/m2	#.#	A
1	1	0	2	4	0	2	1	

4. Live Load - Point

Load	Reference column	Distance to Load from reference column	Load	Load Length	Live Load reduction	Description
	#	mm	kN	mm	#.#	A
1	3	1000	161	1000	1	
2	3	6200	130	1000	1	

Load Combinations : Ultimate

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Live Load	1.2	1.2	1.2	1.5
2	Live Load	0.9	0.9	0.9	1.5
3	Dead Load	1.35	1.35	1.35	0

Load Combinations : Short Term Service

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Live Load	1	1	1	0.7

Load Combinations : Permanent Service

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Live Load	1	1	1	0.4

Load Combinations : Deflection

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Short Term - Deflection	1	1	1	0.7
2	Permanent - Deflection	1	1	1	0.4
3	Initial - Deflection	1	1	0	0

Load Combinations : Transfer Prestress

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Transfer	1	0	0	0

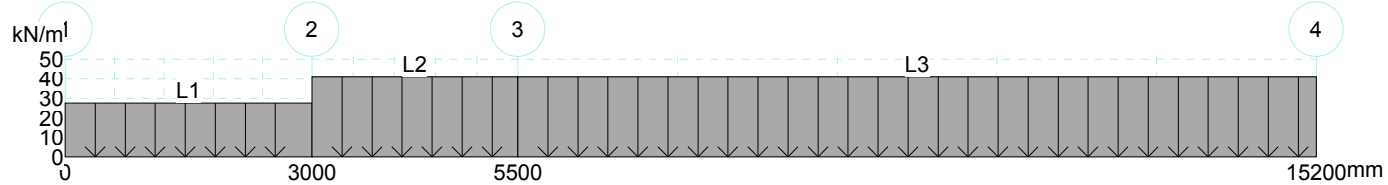
Load Combinations : Pre Existing

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Pre Existing	1	0	0	0

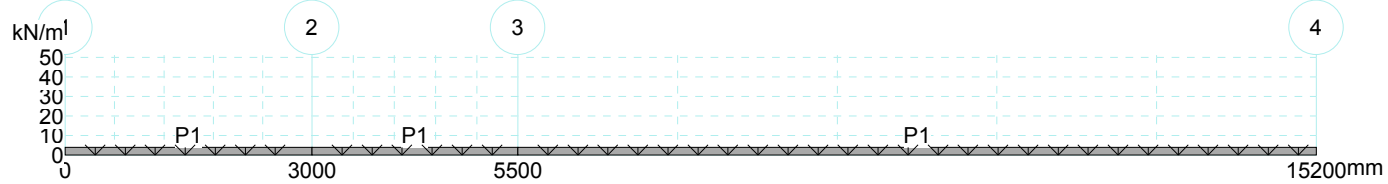
Load Combinations : Construction

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Construction	1	0	0	0

Load Case 1 : 1. Self Weight

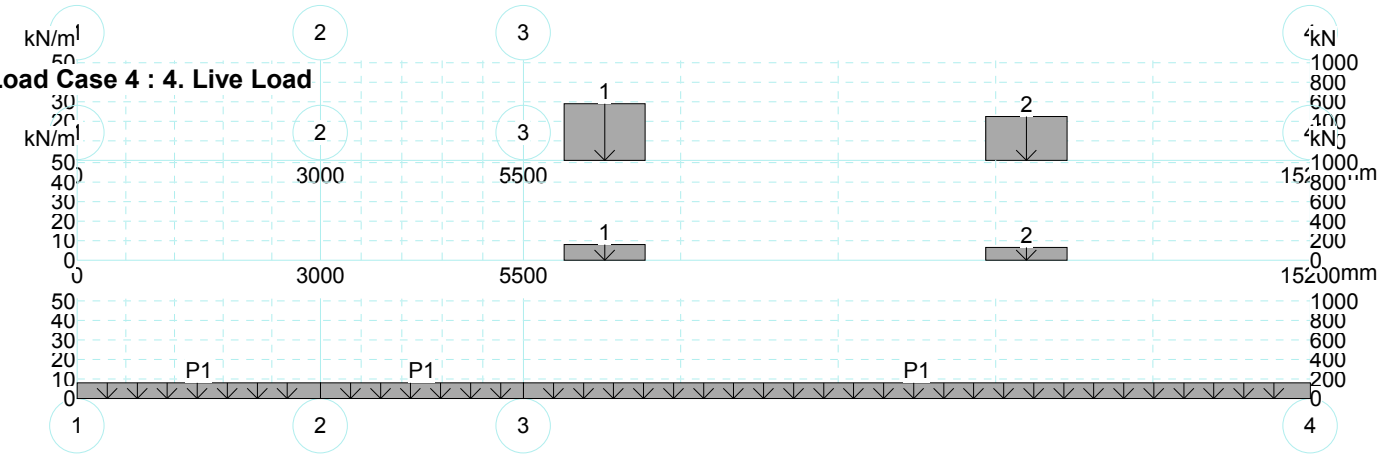


Load Case 2 : 2. Initial Dead Load



Load Case 3 : 3. Extra Dead Load

Load Case 4 : 4. Live Load



Reinforcement

Reinforcement Use	Reinforcement Type	Preferred Bar Size	Number of Legs
	List	List	#
Flexural Bar	N 500MPa		
Flexural Mesh	F 450MPa		
Shear Option 1	N 500MPa	10	2
Shear Option 2	N 500MPa	12	2
Shear Option 3	N 500MPa	16	2
Punching Shear	N 500MPa	10	1

Reinforcement

	Maximum Bar Spacing	Minimum Bar Spacing	Minimum Continuous Reinforcement	Minimum Span Reinforcement into End Support	Minimum Span Reinforcement into Internal Support	Infill Bars	Stagger Bars
	mm	mm	#.#	#.#	#.#	Y/N	Y/N
Support Reinforcement	300	60	0			N	N
Span Reinforcement	300	60		0	0	N	N

Design Zones : Top

Layer Number	Steel type	Left End Reference Column	Distance to left end of bar	Bar stagger length at left end	Top Cover at left end	Right End Reference Column	Distance to right end of bar	Bar stagger length at right end	Top Cover at Right end	Maximum Bar Size	Minimum Bar Size	Preferred bar size
	List	#	mm	mm	mm	#	mm	mm	mm	List	List	List
1	Bar	1	0	0	30	4	0	0	30	36	16	28

Layer Number	Minimum Number of Bars	Maximum Spacing of Bars	Minimum Steel area as %	% in Flange
	#	mm	%	%
1	0	0	0	0

Design Zones : Bottom

Layer Number	Steel type	Left End Reference Column	Distance to left end of bar	Bar stagger length at left end	Bottom Cover at left end	Right End Reference Column	Distance to right end of bar	Bar stagger length at right end	Bottom Cover at Right End	Maximum Bar Size	Minimum Bar Size	Preferred bar size
	List	#	mm	mm	mm	#	mm	mm	mm	List	List	List
1	Bar	1	0	0	30	4	0	0	30	36	16	28

Layer Number	Minimum Number of Bars	Maximum Spacing of Bars	Minimum Steel area as %	% in Flange
	#	mm	%	%
1	0	0	0	0

User Defined : Top

Layer Number	Steel type	Left End Reference Column	Distance to left end of bar	Bar stagger length at left end	Top Cover at left end	% Development of Left End of Bar in Tension	% Development of Left End of Bar in Compression	Right End Reference Column	Distance to right end of bar	Bar stagger length at right end	Top Cover at Right end
	List	#	mm	mm	mm	%	%	#	mm	mm	mm
1	N 500MPa	1	0	0	60	100	100	3	9700	0	60

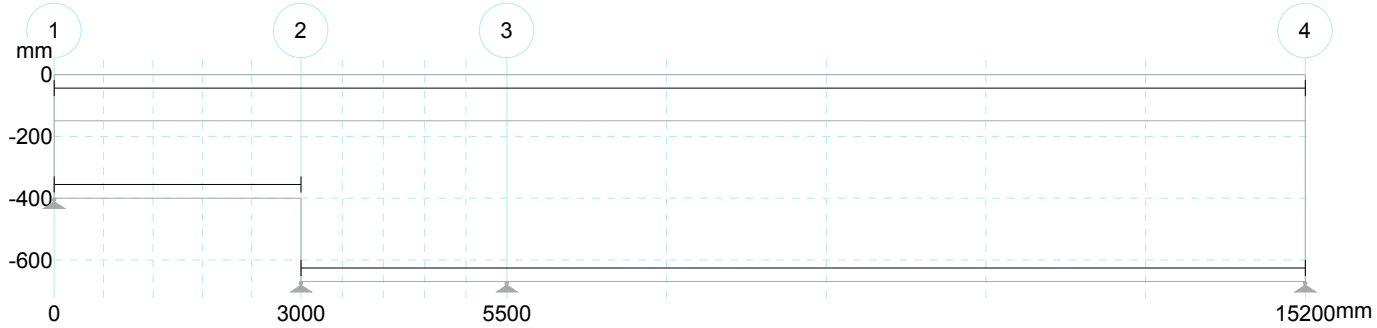
Layer Number	% Development of Right End of Bar in Tension	% Development of Right End of Bar in Compression	Bar Size	Number of Bars	Spacing of Bars	% in Flange	Layer attached after the PreExisting Load Case
	%	%	List	#	mm	%	Y/N
1	100	100	28	18	0	0	N

User Defined : Bottom

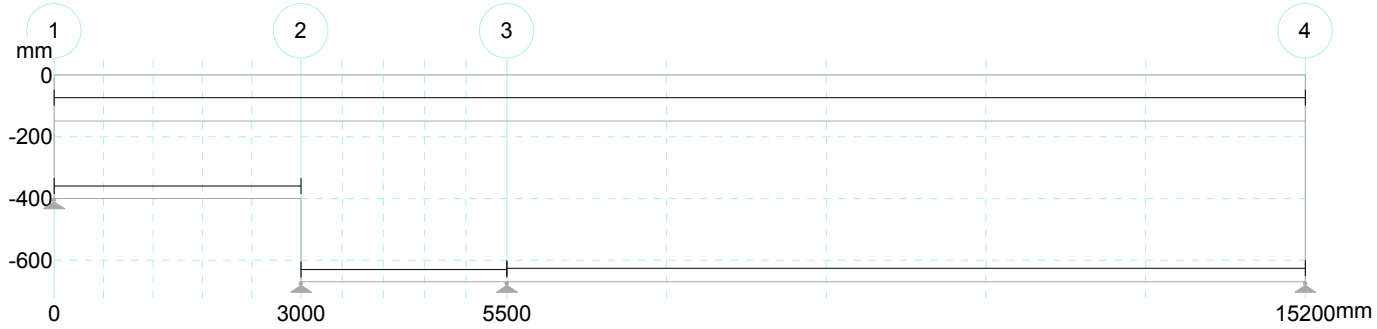
Layer Number	Steel type	Left End Reference Column	Distance to left end of bar	Bar stagger length at left end	Bottom Cover at Left end	% Development of Left End of Bar in Tension	% Development of Left End of Bar in Compression	Right End Reference Column	Distance to right end of bar	Bar stagger length at right end	Bottom Cover at Right End
	List	#	mm	mm	mm	%	%	#	mm	mm	mm
1	N 500MPa	1	0	0	30	100	100	2	0	0	30
2	N 500MPa	2	0	0	30	100	0	3	0	0	30
3	N 500MPa	3	0	0	30	100	0	4	0	0	30

Layer Number	% Development of Right End of Bar in Tension	% Development of Right End of Bar in Compression	Bar Size	Number of Bars	Spacing of Bars	% in Flange	Layer attached after the PreExisting Load Case
	%	%	List	#	mm	%	Y/N
1	100	100	20	10	0	0	N
2	100	0	20	10	0	0	N
3	100	0	28	18	0	0	N

Reinforcement Design Zones



Reinforcement Design Zones User Defined



Design Data

Capacity Reduction factor (phi) for Flexure	#.#	0.8
Capacity Reduction factor (phi) for Shear	#.#	0.7
Material Factor for Concrete in Flexure	#.#	1
Material Factor for Concrete in Shear	#.#	1
Material Factor for Reinforcement	#.#	1
Maximum Ratio of Neutral Axis Depth for Ductility	#.#	0.4
Ductility Limit - Strain	#.#	0
Ductility Check at Left End Column	Y/N	Y
Ductility Check at Right End Column	Y/N	Y
Minimum Reinforcement Strength Limit - #.## x M*	#.#	0

Flexural Critical Section - Consider Transverse Beams	Y/N	Y
Flexural Critical Section - Distance from centre of Support	#.#	-1
Beam Left Sideface Cover (Internal)	mm	25
Beam Right Sideface cover	mm	40
Prestress Minimum Reinforcement Basis	List	Program Default
Shear Enhancement at Supports	Y/N	N
Ast Value in Shear Calculations	List	Calculated
Limit Reinforcement Strain	Y/N	N
Include Strain Hardening of Reinforcement	Y/N	
Beam Shear Critical Section Location	List	Code Critical Section

Maximum Service Stress Change - Prestressed Sections	MPa	150
Maximum Service Stress Change - Reinforced Sections	MPa	0
Relative Humidity	%	50
Average Temperature	C.	20
Prestress Losses Calculations based on	List	Program Default
Crack Width Calculations	List	Code default
AS3600 Shrinkage and Temperature Reinforcement	List	Moderate
Degree of Restraint in Primary Direction	%	0
Degree of Restraint in Secondary Direction	%	0
Concrete Strength Gain Rate	List	N

Concrete Tensile Strength for Deflection Calculations- #.## x (Fc)n	#.#	-1
Maximum Value of Ieff/Igross for Deflection Calculations	#.#	0.6
Total Deflection Warning Limit - Maximum Span/Deflection	#.#	500
Total Deflection Warning Limit - Maximum Deflection	mm	30
Incremental Deflection Warning Limit - Maximum Span/Deflection	#.#	500
Incremental Deflection Warning Limit - Maximum Deflection	mm	30
Initial Time for Shrinkage	List	Full Shrinkage
Time of Loading in days	#.#	10
Age Adjustment Factor	#.#	0.76
Concrete Strength at Time of Loading	MPa	33.8
Loaded Period in years	#.#	30
Tension stiffening Approach	List	Modified Concrete Tensile Modulus Method

Live Load Pattern Factor	#.#	1
Pattern Live Load for Ultimate Strength	Y/N	Y
Pattern Live Load for Crack Control	Y/N	Y
Pattern Live Load For Deflections	Y/N	Y
Pattern Live Load for Deflection Permanent Load Combination	Y/N	N

Material Properties

Concrete : Standard Concrete - Brisbane/Sydney : Concrete Strength Basis - Cylinder

Description	A	40MPa
Characteristic Compressive Strength	MPa	40
Mean Compressive Strength	MPa	45.9
Lower Characteristic Tensile Strength	MPa	3.79
Upper Characteristic Tensile Strength	MPa	6.83
Concrete Density	kg/m3	2447
Design Concrete Modulus	MPa	32919.2
Mean Concrete Modulus	MPa	35263.5
Basic Shrinkage Strain	mm/mm	850
Shrinkage Multiplier	#.#	1
Basic Creep Factor	#.#	2.5
Creep Multiplier	#.#	1
Concrete Strain at Peak Stress	#.#	0.002
Squash Load Factor	#.#	0.85
Concrete Strain Limit	#.#	0.004
Strength Gain Rate	List	Normal

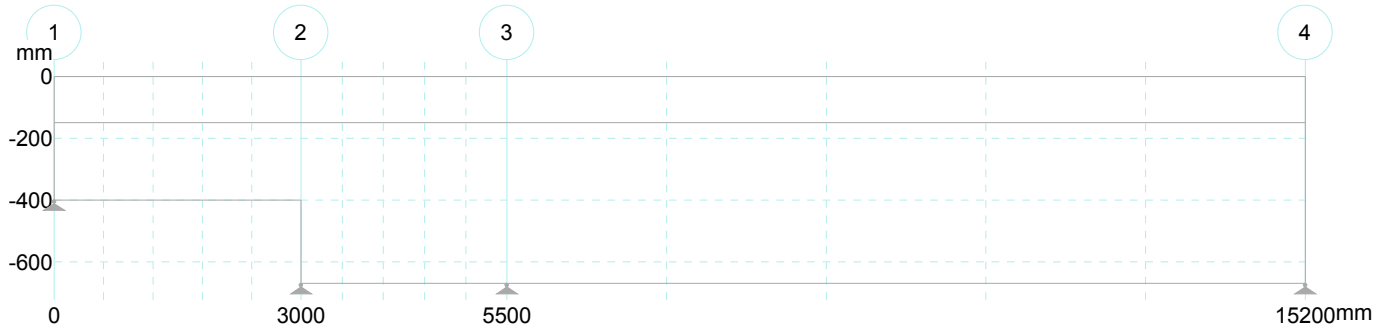
Reinforcement Bar

Designation	Type	Yield Stress	Elastic Modulus	Ductility	Peak Strain	Peak Stress	Design Strain Limit	Material Factor Flexure	Material Factor Shear	Material Capacity Reduction Factor - Flexure	Material Capacity Reduction Factor - Shear	Include as Flexural Reinforcement for Shear
N	Deformed	500	2e5	N	0.05	540	90	-1	-1	-1	-1	Y

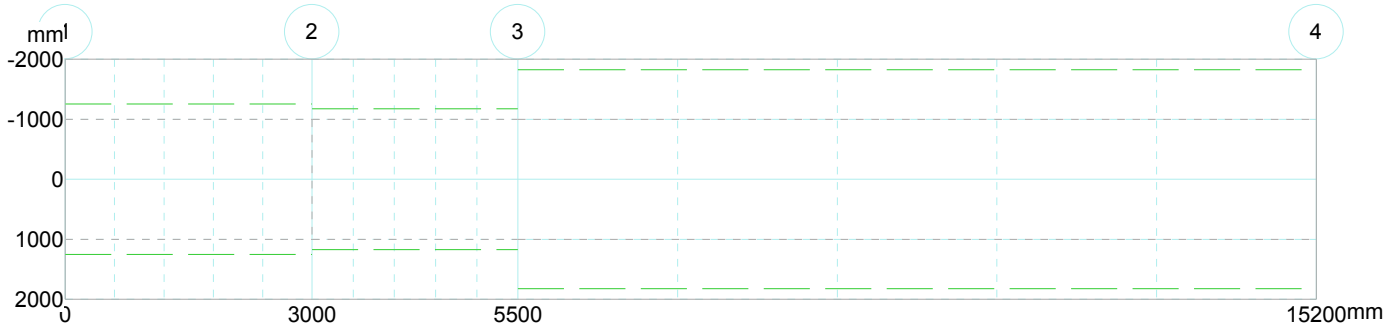
Description

Nominal Bar Size	Bar Diameter	Bar Area	Bar Inertia	Bar Weight	Stock Length
A	mm	mm2	mm4	kg/m	mm
10	10	78.5	491.07	0.62	12000
12	12	113	1018.29	0.89	12000
16	16	201	3218.29	1.58	12000
20	20	314	7857.14	2.47	12000
24	24	452	16292.6	3.55	12000
28	28	616	30184	4.83	12000
32	32	804	51492.6	6.31	12000
36	36	1020	82481.1	7.99	12000
40	40	1260	1.257e5	9.86	12000

Elevation view



Plan view



Warnings

Input

No errors or warnings were found.

Output

Warning:Total Deflection span/deflection ratio in at least one span is less than defined limit.

Bending Moments

Load Cases

Column Actions

Col No. 1		Self Weight	Initial Dead Load	Extra Dead Load	Live Load
Moment Above	kNm	-0	-0	-0	-0
Moment Below	kNm	-0	-0	-0	-0
Reaction	kN	40.64	5.52	23.42	17.69
Elastic Rotation	#.#	0	0	0	0
Elastic Axial Shortening	mm	0	0	0	0

Col No. 2		Self Weight	Initial Dead Load	Extra Dead Load	Live Load
Moment Above	kNm	-0	-0	-0	-0
Moment Below	kNm	-0	-0	-0	-0
Reaction	kN	-56.25	-2.53	-411.73	-122.06

Col No. 2		Self Weight	Initial Dead Load	Extra Dead Load	Live Load
Elastic Rotation	#.#	0	0	-1.67e-4	0
Elastic Axial Shortening	mm	0	0	0	0

Col No. 3		Self Weight	Initial Dead Load	Extra Dead Load	Live Load
Moment Above	kNm	-0	-0	-0	-0
Moment Below	kNm	-0	-0	-0	-0
Reaction	kN	438.14	42.17	1163.72	412.37
Elastic Rotation	#.#	1.52e-4	0	3.81e-4	1.38e-4
Elastic Axial Shortening	mm	0	0	0	0

Col No. 4		Self Weight	Initial Dead Load	Extra Dead Load	Live Load
Moment Above	kNm	-0	-0	-0	-0
Moment Below	kNm	-0	-0	-0	-0
Reaction	kN	160.17	15.64	254.59	104.59
Elastic Rotation	#.#	-4.17e-4	0	-9.31e-4	-3.49e-4
Elastic Axial Shortening	mm	0	0	0	0

Load Combinations

Column Actions

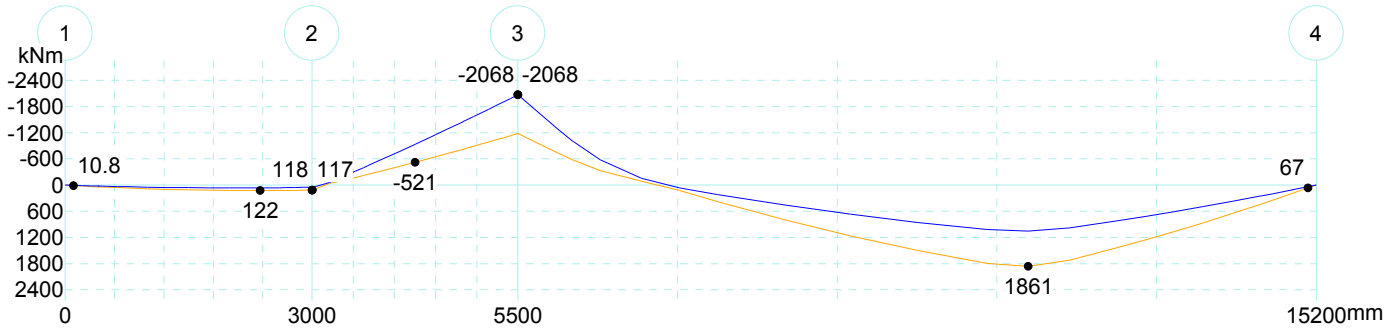
Col No. 1		Characteristic Service	Characteristic Service (Reversal)	Service	Service (Reversal)	Ultimate Flexure	Ultimate Flexure (Reversal)	Ultimate Shear	Ultimate Shear (Reversal)
Moment Above	kNm	0	0	0	0	0	0	0	0
Moment Below	kNm	0	0	0	0	0	0	0	0
Reaction	kN	87.27	87.27	81.96	81.96	110.04	110.04	62.19	110.04
Elastic Rotation	#.#	2.06e-4	2.06e-4	1.94e-4	1.94e-4	2.6e-4	2.6e-4	1.46e-4	2.6e-4
Elastic Axial Shortening	mm	0	0	0	0	0	0	0	0

Col No. 2		Characteristic Service	Characteristic Service (Reversal)	Service	Service (Reversal)	Ultimate Flexure	Ultimate Flexure (Reversal)	Ultimate Shear	Ultimate Shear (Reversal)
Moment Above	kNm	0	0	0	0	0	0	0	0
Moment Below	kNm	0	0	0	0	0	0	0	0
Reaction	kN	-592.56	-592.56	-555.95	-555.95	-747.69	-747.69	-779.01	-381.35
Elastic Rotation	#.#	-3.06e-4	-3.06e-4	-2.88e-4	-2.88e-4	-3.86e-4	-3.86e-4	-3.86e-4	-2.21e-4
Elastic Axial Shortening	mm	0	0	0	0	0	0	0	0

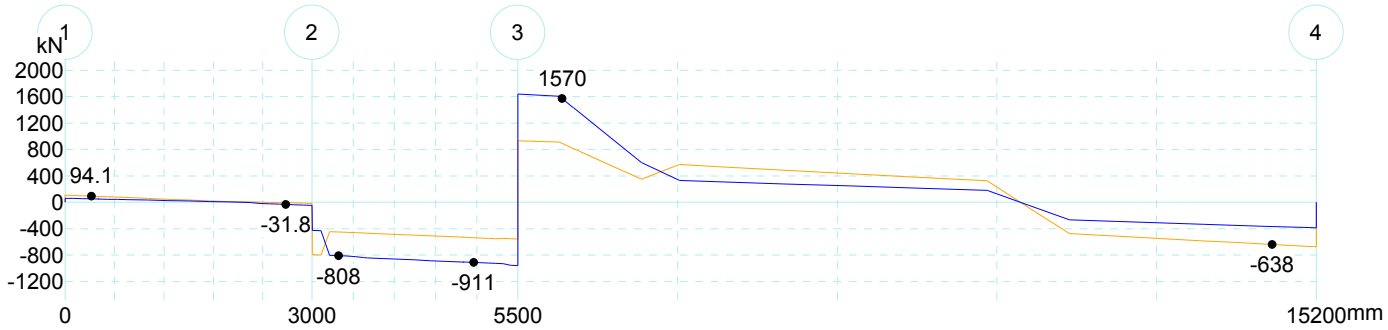
Col No. 3		Characteristic Service	Characteristic Service (Reversal)	Service	Service (Reversal)	Ultimate Flexure	Ultimate Flexure (Reversal)	Ultimate Shear	Ultimate Shear (Reversal)
Moment Above	kNm	0	0	0	0	0	0	0	0
Moment Below	kNm	0	0	0	0	0	0	0	0
Reaction	kN	2056.41	2056.41	1932.69	1932.69	2591.4	2591.4	1489.86	2596.69
Elastic Rotation	#.#	6.86e-4	6.86e-4	6.45e-4	6.45e-4	8.65e-4	8.65e-4	4.92e-4	8.63e-4
Elastic Axial Shortening	mm	0	0	0	0	0	0	0	0

Col No. 4		Characteristic Service	Characteristic Service (Reversal)	Service	Service (Reversal)	Ultimate Flexure	Ultimate Flexure (Reversal)	Ultimate Shear	Ultimate Shear (Reversal)
Moment Above	kNm	0	0	0	0	0	0	0	0
Moment Below	kNm	0	0	0	0	0	0	0	0
Reaction	kN	534.98	534.98	503.61	503.61	673.36	673.36	387.14	673.49
Elastic Rotation	#.#	-1.74e-3	-1.74e-3	-1.63e-3	-1.63e-3	-2.19e-3	-2.19e-3	-1.25e-3	-2.19e-3
Elastic Axial Shortening	mm	0	0	0	0	0	0	0	0

Ultimate Flexure



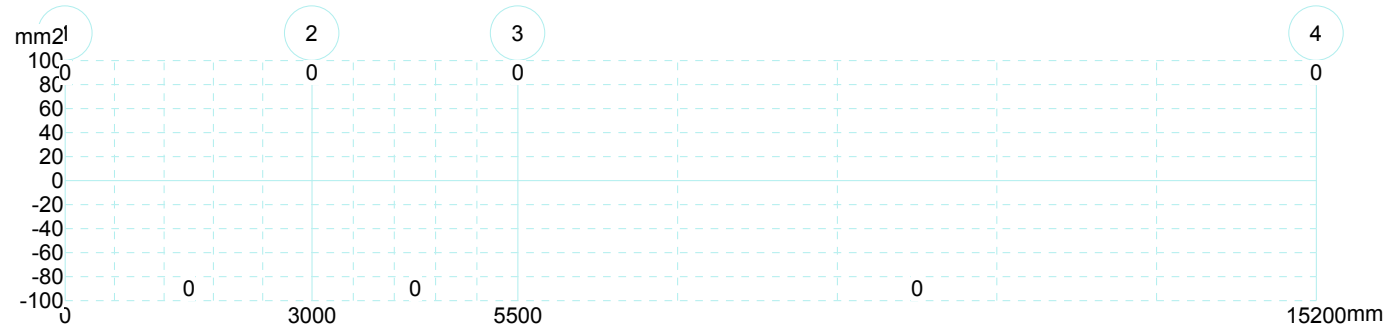
Moment Moment 1 Moment 2



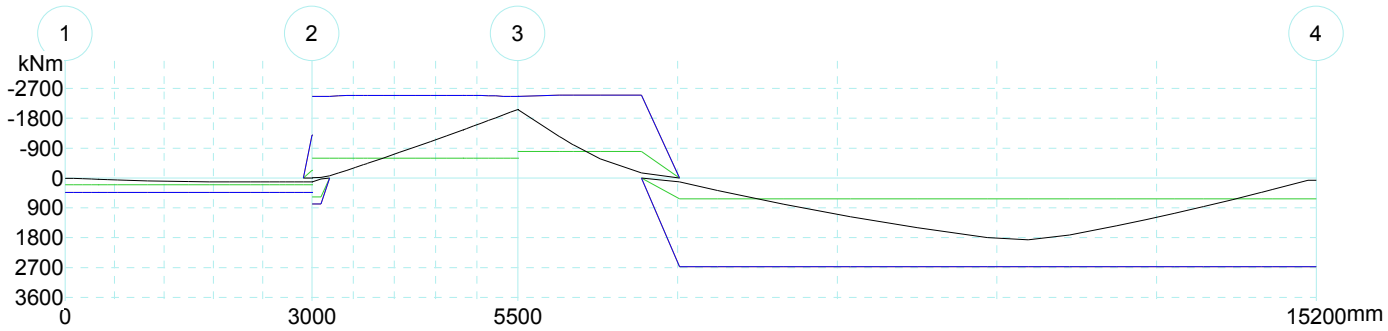
Shear Shear 1 Shear 2

Flexural Design

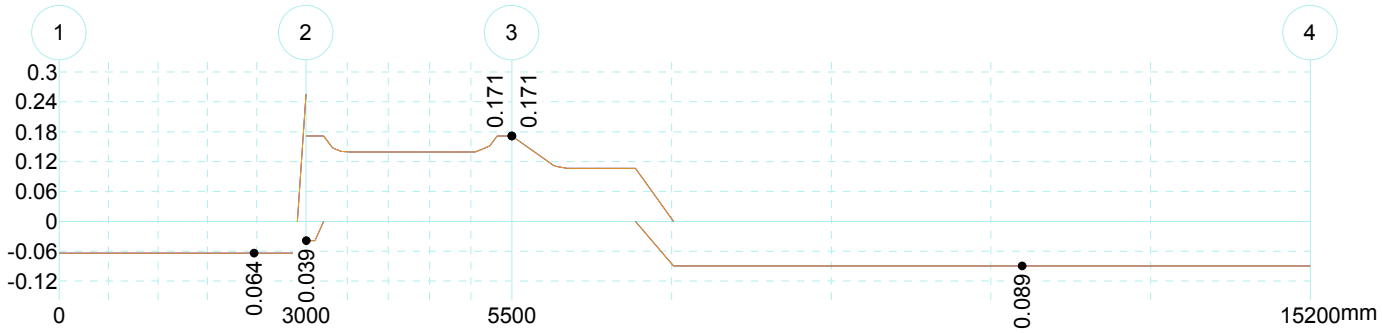
Ultimate



Reinforcement Top Total Bottom Total Top Ultimate Bottom Ultimate Min Top Min Bot



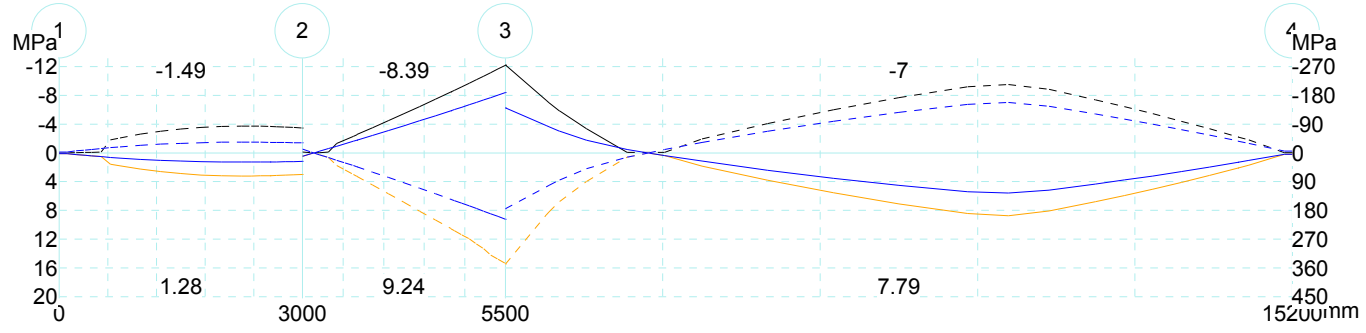
Capacity Minimum Ultimate Design Initial Final



Neutral Axis Depth Initial Final

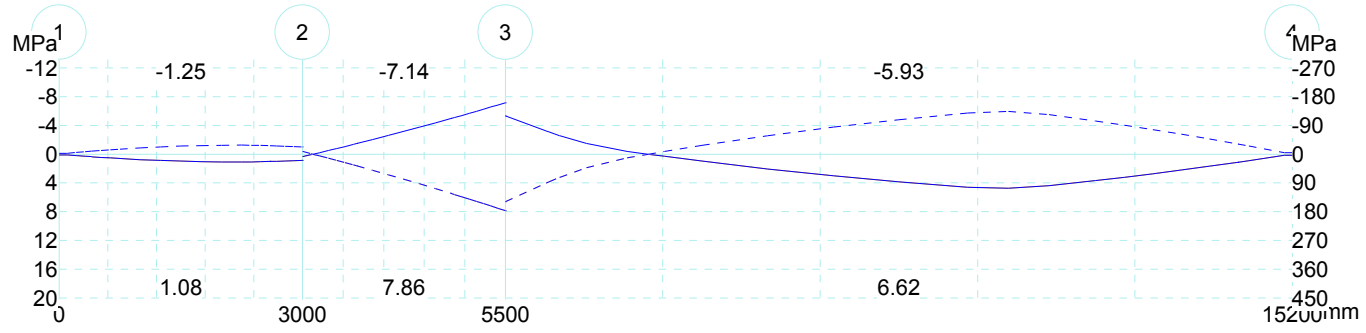
Service

Maximum Moment Condition



Gross Stress Top | Gross Stress Bottom | Cracked Compression | Reinforcement Tension

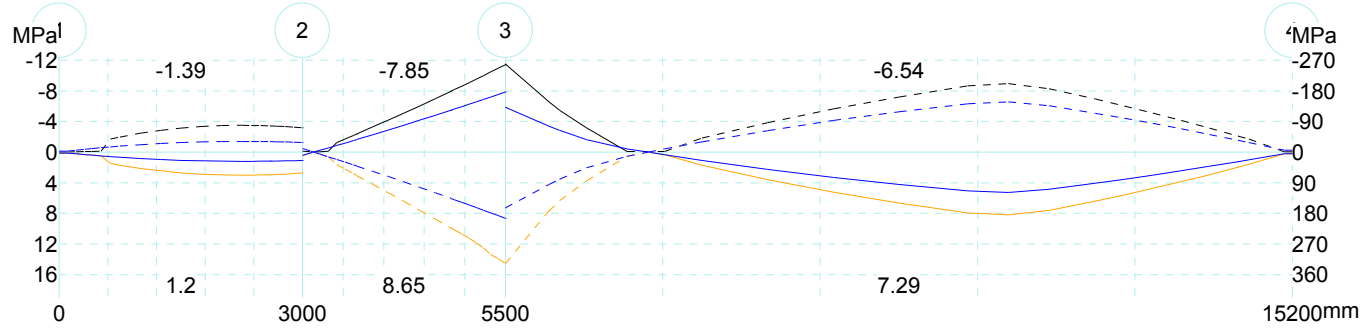
Reversal Moment Condition



Gross Stress Top | Gross Stress Bottom | Cracked Compression | Reinforcement Tension

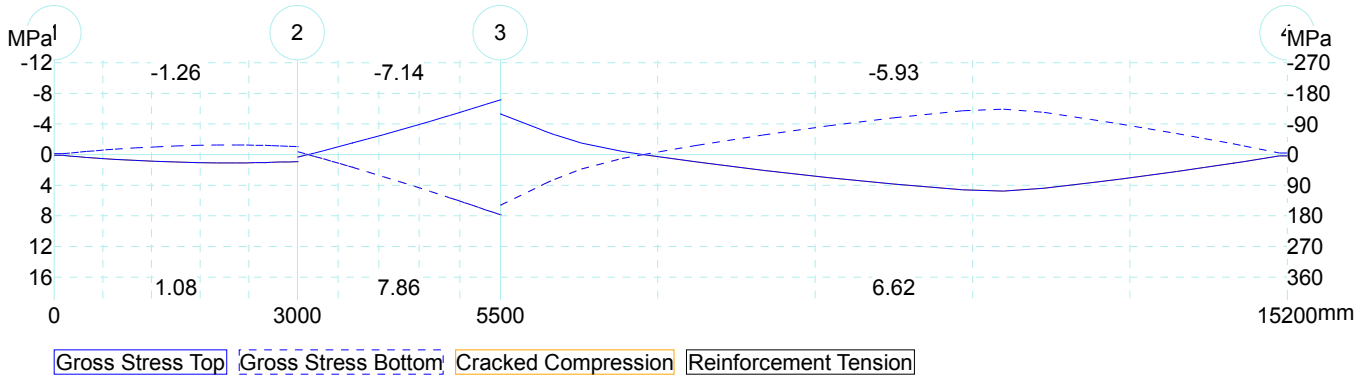
Permanent

Maximum Moment Condition



Gross Stress Top | Gross Stress Bottom | Cracked Compression | Reinforcement Tension

Reversal Moment Condition



Shear Design

Beam

Span 1

Locat	V*	Mv*	Mdec	d	Ast	bv	phi Vuc	phi Vut	phi Vu	Phi Vumax	phi VuMin	phi Vus	Theta	Asv/s
mm	kN	kNm	kNm	mm	mm2	mm	kN	kN	kN	kN	kN	kN	#.#	mm2/mm
100	105.49	10.8	0	360	0	2000	0	0	0	4032	0	0	0	0
320	94.53	32.8	0	360	0	2000	635.63	99999	635.63	4032	941.16	0	30	0
399	91	39.43	0	360	0	2000	635.63	99999	635.63	4032	941.16	0	30	0
401	90.9	39.61	0	360	0	2000	635.63	99999	635.63	4032	941.16	0	30	0
517	85.12	49.82	0	360	0	2000	635.63	99999	635.63	4032	941.16	0	30	0
633	79.35	59.36	0	360	0	2000	635.63	99999	635.63	4032	941.16	0	30	0
750	74.71	66.66	0	360	0	2000	635.63	99999	635.63	4032	941.16	0	30	0
1000	62.7	81.6	0	360	0	2000	635.63	99999	635.63	4032	941.16	0	30	0
1250	51.75	96	0	360	0	2000	635.63	99999	635.63	4032	941.16	0	30	0
1500	41.95	105.44	0	360	0	2000	635.63	99999	635.63	4032	941.16	0	30	0
1750	31.26	112.59	0	360	0	2000	635.63	99999	635.63	4032	941.16	0	30	0
2000	21.09	117.79	0	360	0	2000	635.63	99999	635.63	4032	941.16	0	30	0
2250	-15.21	91.82	0	360	0	2000	635.63	99999	635.63	4032	941.16	0	30	0
2367	-20.72	90.46	0	360	0	2000	635.63	99999	635.63	4032	941.16	0	30	0
2483	-26.5	87.72	0	360	0	2000	635.63	99999	635.63	4032	941.16	0	30	0
2599	-32.27	84.31	0	360	0	2000	635.63	99999	635.63	4032	941.16	0	30	0
2601	-32.37	84.25	0	360	0	2000	635.63	99999	635.63	4032	941.16	0	30	0
2680	-36.24	81.72	0	360	0	2000	635.63	99999	635.63	4032	941.16	0	30	0
2999	-52.12	67.63	0	360	0	2000	0	0	0	4032	0	0	0	0

Spacing of Sets				Minimum Legs	Shear Comments
2 legs N10	2 legs N12	2 legs N16	Min legs N10		
mm	mm	mm	mm	#	A
0	0	0	0	0	
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	

Span 2

Locat	V*	Mv*	Mdec	d	Ast	bv	phi Vuc	phi Vut	phi Vu	Phi Vumax	phi VuMin	phi Vus	Theta	Asv/s
mm	kN	kNm	kNm	mm	mm2	mm	kN	kN	kN	kN	kN	kN	#.#	mm2/mm
1	-806.95	118	0	630	0	2000	0	0	0	7056	0	0	0	0
320	-824.41	-141.73	0	596	0	2000	662.8	99999	662.8	6675.2	1168.62	161.61	30	1.4
421	-829.86	-225.27	0	596	0	2000	662.8	99999	662.8	6675.2	1168.62	167.06	30	1.4
522	-835.31	-309.36	0	596	0	2000	662.8	99999	662.8	6675.2	1168.62	172.52	30	1.4
625	-841.58	-394.55	0	596	0	2000	662.8	99999	662.8	6675.2	1168.62	178.78	30	1.4
669	-843.95	-431.63	0	596	0	2000	662.8	99999	662.8	6675.2	1168.62	181.16	30	1.4
671	-844.06	-433.32	0	596	0	2000	662.8	99999	662.8	6675.2	1168.62	181.26	30	1.4
864	-854.79	-595.6	0	596	0	2000	662.8	99999	662.8	6675.2	1168.62	191.99	30	1.4
1057	-866.09	-761.71	0	596	0	2000	662.8	99999	662.8	6675.2	1168.62	203.3	30	1.4
1250	-878.2	-928.13	0	596	0	2000	662.8	99999	662.8	6675.2	1168.62	215.4	30	1.4
1443	-889.36	-1096.81	0	596	0	2000	662.8	99999	662.8	6675.2	1168.62	226.57	30	1.4
1636	-901.22	-1269.66	0	596	0	2000	662.8	99999	662.8	6675.2	1168.62	238.43	30	1.4
1829	-913.75	-1443.2	0	596	0	2000	662.8	99999	662.8	6675.2	1168.62	250.95	30	1.4
1831	-913.88	-1445.03	0	596	0	2000	662.8	99999	662.8	6675.2	1168.62	251.09	30	1.4
1875	-916.79	-1485.31	0	596	0	2000	662.8	99999	662.8	6675.2	1168.62	253.99	30	1.4
1964	-922.03	-1566.03	0	596	0	2000	662.8	99999	662.8	6675.2	1168.62	259.23	30	1.4
2499	-957.14	-2068.3	0	596	0	2000	0	0	0	6675.2	0	0	0	0

Spacing of Sets				Minimum Legs	Shear Comments
2 legs N10	2 legs N12	2 legs N16	Min legs N10		
mm	mm	mm	mm	#	A
0	0	0	0	0	
112	161	287	280	5	Minimum Steel
112	161	287	280	5	Minimum Steel
112	161	287	280	5	Minimum Steel
112	161	287	280	5	Minimum Steel
112	161	287	280	5	Minimum Steel
112	161	287	280	5	Minimum Steel
112	161	287	280	5	Minimum Steel
112	161	287	280	5	Minimum Steel
112	161	287	280	5	Minimum Steel
112	161	287	280	5	Minimum Steel
112	161	287	280	5	Minimum Steel
112	161	287	280	5	Minimum Steel
112	161	287	280	5	Minimum Steel
112	161	287	280	5	Minimum Steel
112	161	287	280	5	Minimum Steel
0	0	0	0	0	

Span 3

Locat	V*	Mv*	Mdec	d	Ast	bv	phi Vuc	phi Vut	phi Vu	Phi Vumax	phi VuMin	phi Vus	Theta	Asv/s
mm	kN	kNm	kNm	mm	mm2	mm	kN	kN	kN	kN	kN	kN	#.#	mm2/mm
1	1639.42	-2067.61	0	596	0	2000	0	0	0	6675.2	0	0	0	0
536	1570.36	-1200.58	0	596	0	2000	662.8	99999	662.8	6675.2	1168.62	907.56	31.0943	2.62
669	1436.89	-1000.6	0	596	0	2000	662.8	99999	662.8	6675.2	1168.62	774.09	30.7308	2.21
671	1434.88	-997.73	0	596	0	2000	662.8	99999	662.8	6675.2	1168.62	772.09	30.7253	2.2
1000	1104.73	-579.96	0	596	0	2000	662.8	99999	662.8	6675.2	1168.62	441.94	30	1.4
1500	608.35	-197.09	0	596	0	2000	662.8	99999	662.8	6675.2	1168.62	0	30	0
1962	577.86	76.93	0	626	0	2000	664.39	99999	664.39	7011.2	1213.42	0	30	0
2425	552.24	301.53	0	626	0	2000	664.39	99999	664.39	7011.2	1213.42	0	30	0
3233	498.91	726.19	0	626	0	2000	664.39	99999	664.39	7011.2	1213.42	0	30	0
4041	448.11	1093.44	0	626	0	2000	664.39	99999	664.39	7011.2	1213.42	0	30	0
4850	398.94	1413.88	0	626	0	2000	664.39	99999	664.39	7011.2	1213.42	0	30	0
5700	342.84	1729.13	0	626	0	2000	664.39	99999	664.39	7011.2	1213.42	0	30	0
6200	-114.7	1609.68	0	626	0	2000	664.39	99999	664.39	7011.2	1213.42	0	30	0
6700	-480.57	1703.41	0	626	0	2000	664.39	99999	664.39	7011.2	1213.42	0	30	0
7275	-518.52	1416.18	0	626	0	2000	664.39	99999	664.39	7011.2	1213.42	0	30	0
7629	-538.14	1247.21	0	626	0	2000	664.39	99999	664.39	7011.2	1213.42	0	30	0
7979	-561.24	1054.82	0	626	0	2000	664.39	99999	664.39	7011.2	1213.42	0	30	0
8329	-584.34	854.34	0	626	0	2000	664.39	99999	664.39	7011.2	1213.42	0	30	0
8679	-606.19	653.32	0	626	0	2000	664.39	99999	664.39	7011.2	1213.42	0	30	0
9029	-629.29	437.11	0	626	0	2000	664.39	99999	664.39	7011.2	1213.42	0	30	0
9031	-629.42	435.85	0	626	0	2000	664.39	99999	664.39	7011.2	1213.42	0	30	0
9164	-638.2	351.55	0	626	0	2000	664.39	99999	664.39	7011.2	1213.42	0	30	0

Locat	V*	Mv*	Mdec	d	Ast	bv	phi Vuc	phi Vut	phi Vu	Phi Vumax	phi VuMin	phi Vus	Theta	Asv/s
mm	kN	kNm	kNm	mm	mm2	mm	kN	kN	kN	kN	kN	kN	#.#	mm2/mm
9600	-666.97	67.03	0	626	0	2000	0	0	0	7011.2	0	0	0	0

Spacing of Sets				Minimum Legs	Shear Comments
2 legs N10	2 legs N12	2 legs N16	Min legs N10		
mm	mm	mm	mm	#	A
0	0	0	0	0	
60	86	153	150	5	
71	102	182	178	5	
71	103	183	178	5	
112	161	287	280	5	Minimum Steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	

Punching

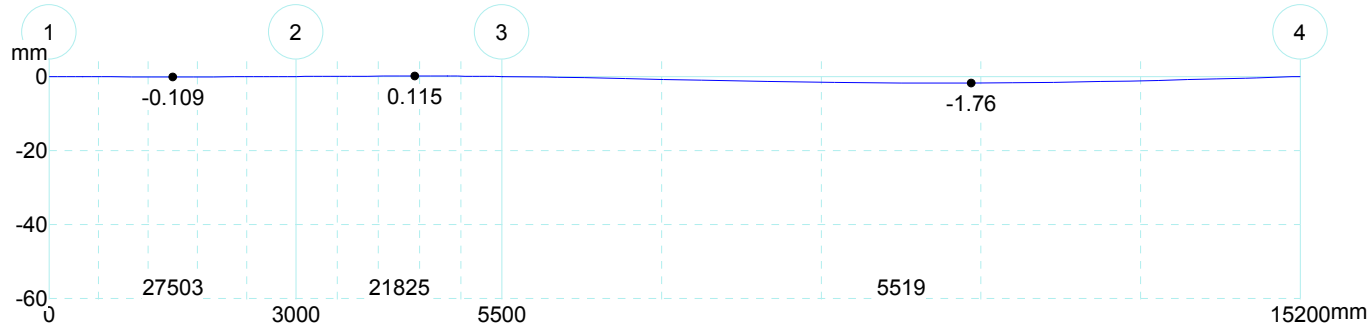
Column Head Critical Section

Column No.	Bh	a	at	u	d	fcv	P/A	Asw/s min	V*	Mv*	phi Vuo	phi Vu	phi VuMin	phi Vumax	side beam	Moment Transfer	Asw/s reqd
A	#.#	mm	mm	mm	mm	MPa	MPa	mm2/mm	kN	kNm	kN	kN	kN	kN	A	A	mm2/mm
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0

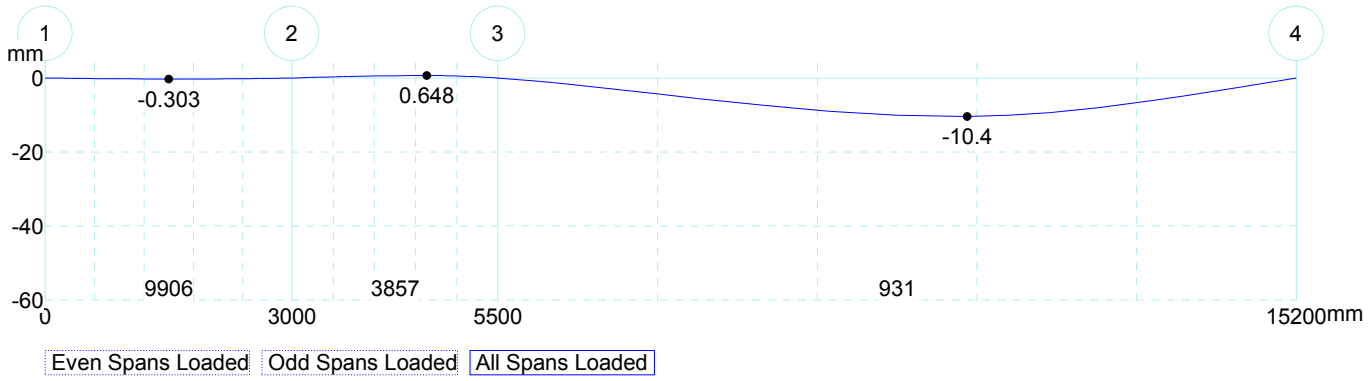
result
A
Check Not Carried Out!
Check Not Carried Out!
Check Not Carried Out!
Check Not Carried Out!

Deflections

All Spans Loaded

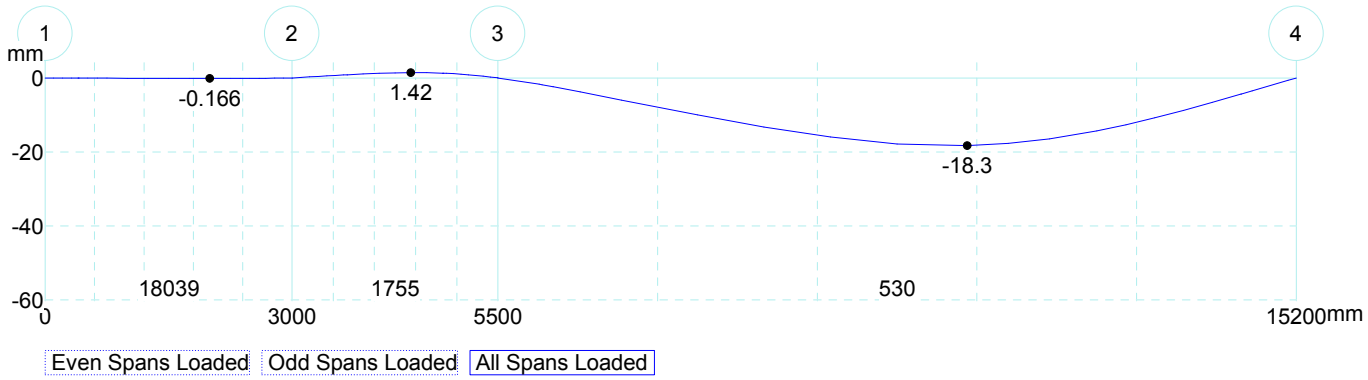


Short Term



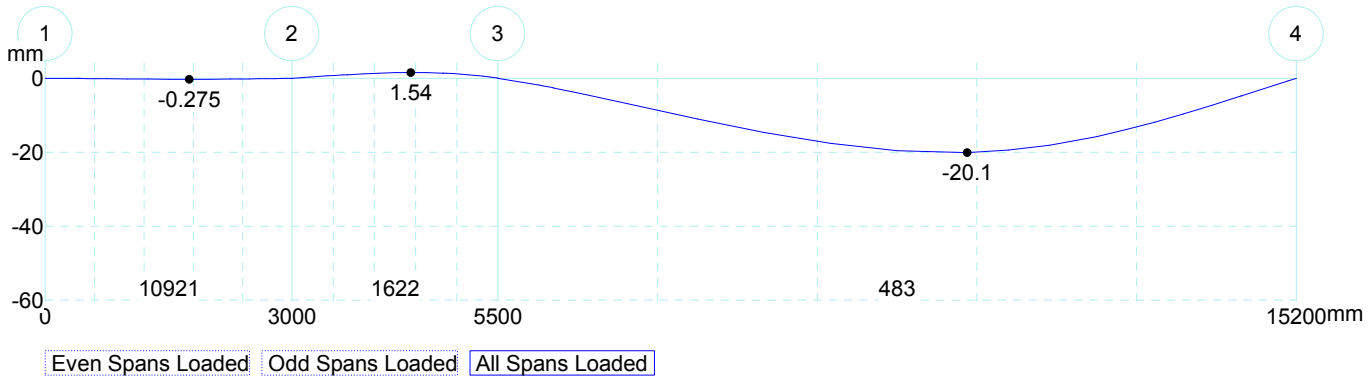
Even Spans Loaded | Odd Spans Loaded | All Spans Loaded

Incremental



Even Spans Loaded | Odd Spans Loaded | All Spans Loaded

Total Long Term



Even Spans Loaded | Odd Spans Loaded | All Spans Loaded

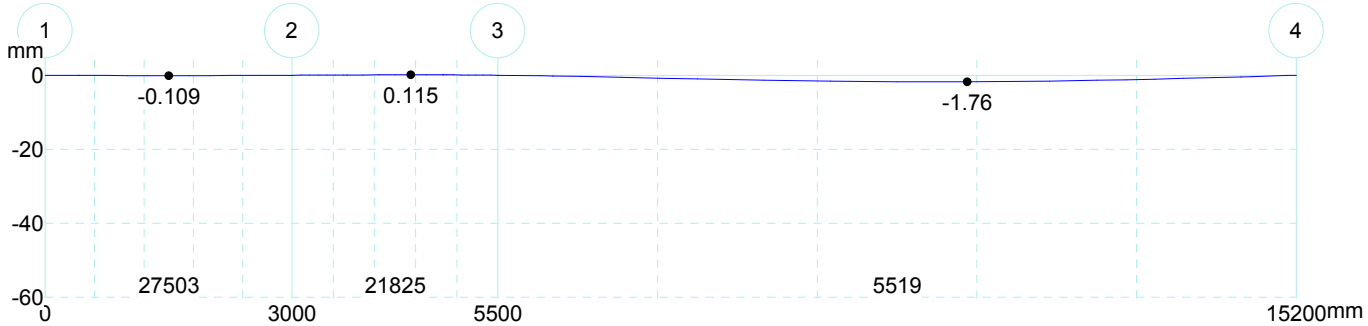
Span 3

Design Comments:-

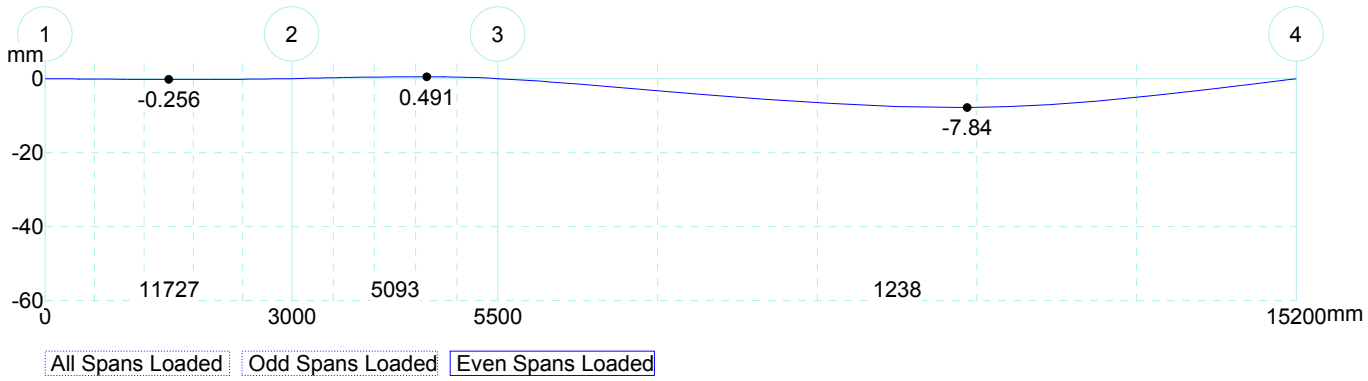
- Total Span/Deflection ratio less than user defined limit = 483

Even Spans Loaded

Transfer

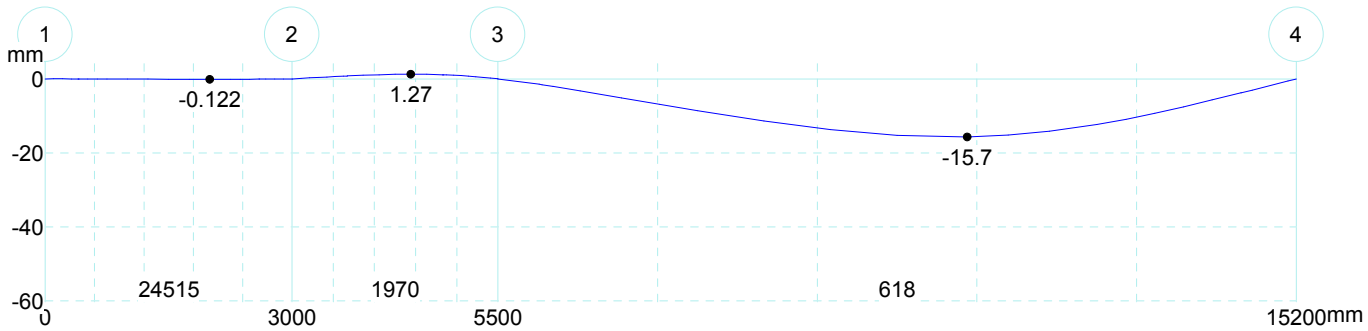


Short Term



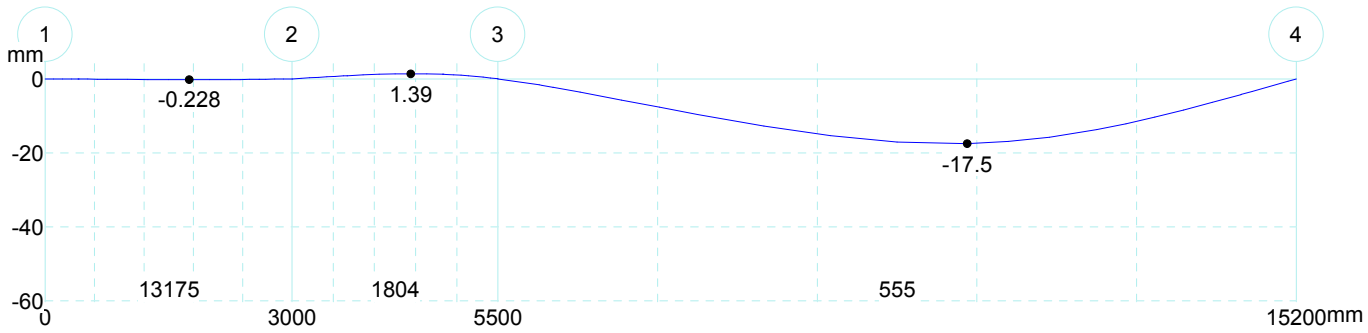
All Spans Loaded | Odd Spans Loaded | Even Spans Loaded

Incremental



All Spans Loaded | Odd Spans Loaded | Even Spans Loaded

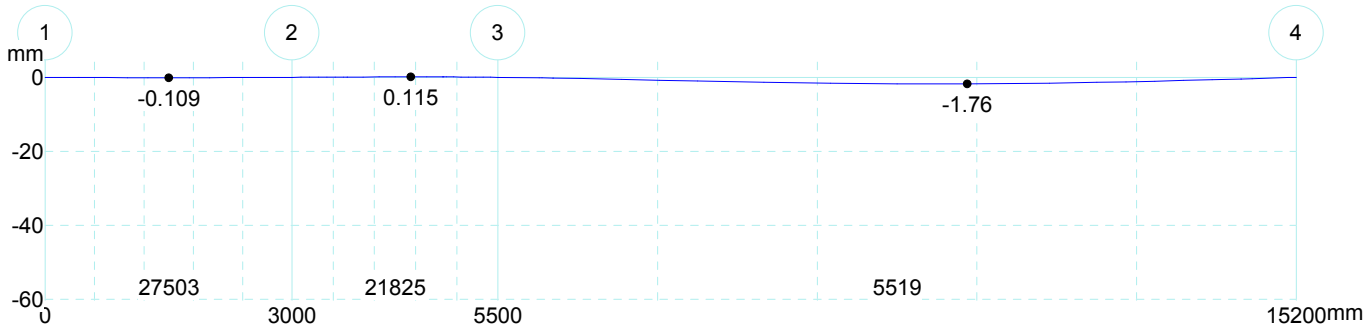
Total Long Term



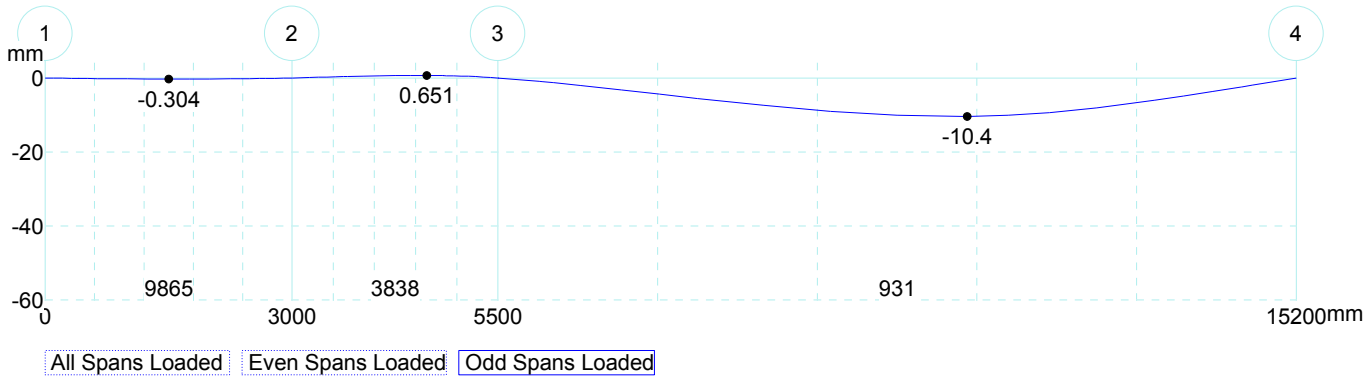
All Spans Loaded | Odd Spans Loaded | Even Spans Loaded

Odd Spans Loaded

Transfer

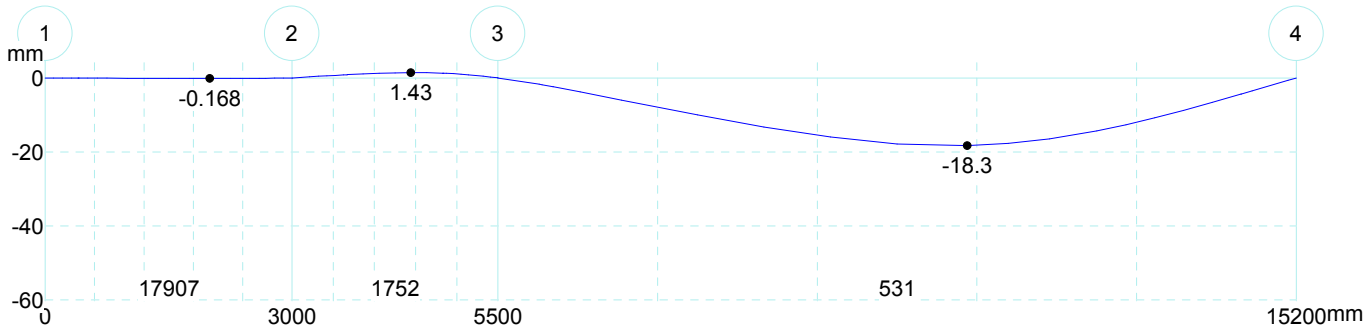


Short Term



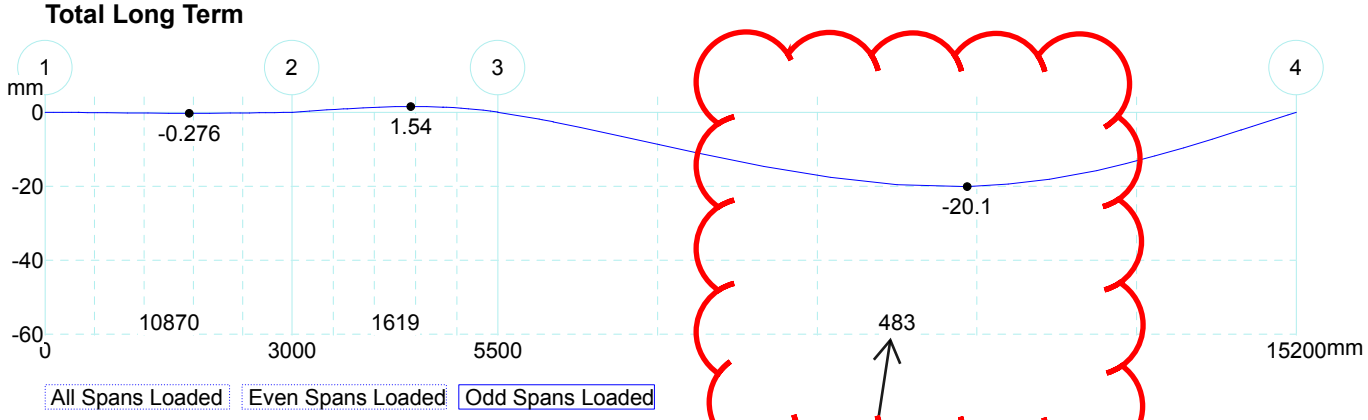
All Spans Loaded | Even Spans Loaded | Odd Spans Loaded

Incremental



All Spans Loaded | Even Spans Loaded | Odd Spans Loaded

Total Long Term



All Spans Loaded | Even Spans Loaded | Odd Spans Loaded

Span 3

Design Comments:-
- Total Span/Deflection ratio less than user defined limit = 483

SHORT OF LESS THAN 5%, ACCEPTABLE

Detailed Reinforcement

Span 1

	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
100	0	0	0	44	2510	No Steel Added	40	300	0	356	2000	No Steel Added
210	0	0	0	44	2510	No Steel Added	40	300	0	356	2000	No Steel Added
320	0	0	0	44	2510	No Steel Added	40	300	0	356	2000	No Steel Added
399	0	0	0	44	2510	No Steel Added	40	300	0	356	2000	No Steel Added
401	0	0	0	44	2510	No Steel Added	40	300	0	356	2000	No Steel Added
517	0	0	0	44	2510	No Steel Added	40	300	0	356	2000	No Steel Added
633	0	0	0	44	2510	No Steel Added	40	300	0	356	2000	No Steel Added
750	0	0	0	44	2510	No Steel Added	40	300	0	356	2000	No Steel Added
1000	0	0	0	44	2510	No Steel Added	40	300	0	356	2000	No Steel Added
1250	0	0	0	44	2510	No Steel Added	40	300	0	356	2000	No Steel Added
1500	0	0	0	44	2510	No Steel Added	40	300	0	356	2000	No Steel Added
1750	0	0	0	44	2510	No Steel Added	40	300	0	356	2000	No Steel Added
2000	0	0	0	44	2510	No Steel Added	40	300	0	356	2000	No Steel Added
2250	0	0	0	44	2510	No Steel Added	40	300	0	356	2000	No Steel Added

	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
2367	0	0	0	44	2510	No Steel Added	40	300	0	356	2000	No Steel Added
2483	0	0	0	44	2510	No Steel Added	40	300	0	356	2000	No Steel Added
2599	0	0	0	44	2510	No Steel Added	40	300	0	356	2000	No Steel Added
2601	0	0	0	44	2510	No Steel Added	40	300	0	356	2000	No Steel Added
2680	0	0	0	44	2510	No Steel Added	40	300	0	356	2000	No Steel Added
2787	0	0	0	44	2510	No Steel Added	40	300	0	356	2000	No Steel Added
2893	0	0	0	44	2510	No Steel Added	40	300	0	356	2000	No Steel Added
2999	0	0	0	44	2510	No Steel Added	40	300	0	356	2000	No Steel Added

Shear Reinforcement				
	Spacing of Sets			
Area	2 legs N10	2 legs N12	2 legs N16	Shear Comments
mm2/mm	mm	mm	mm	A
0	0	0	0	
0	0	0	0	
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	
0	0	0	0	
0	0	0	0	

Design Comments:-
- - Column Grid 1 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Column Grid 2 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 1 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

Span 2

	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
1	0	0	0	44	2350	No Steel Added	40	300	0	626	2000	No Steel Added
107	0	0	0	44	2350	No Steel Added	40	300	0	626	2000	No Steel Added
213	40	300	0	44	2350	No Steel Added	0	0	0	626	2000	No Steel Added
320	40	300	0	44	2350	No Steel Added	0	0	0	626	2000	No Steel Added
421	40	300	0	44	2350	No Steel Added	0	0	0	626	2000	No Steel Added
522	40	300	0	44	2350	No Steel Added	0	0	0	626	2000	No Steel Added
625	40	300	0	44	2350	No Steel Added	0	0	0	626	2000	No Steel Added
669	40	300	0	44	2350	No Steel Added	0	0	0	626	2000	No Steel Added
671	40	300	0	44	2350	No Steel Added	0	0	0	626	2000	No Steel Added
864	40	300	0	44	2350	No Steel Added	0	0	0	626	2000	No Steel Added
1057	40	300	0	44	2350	No Steel Added	0	0	0	626	2000	No Steel Added
1250	36	300	0	44	2350	No Steel Added	0	0	0	626	2000	No Steel Added
1443	32	300	0	44	2350	No Steel Added	0	0	0	626	2000	No Steel Added
1636	28	290	0	44	2350	No Steel Added	0	0	0	626	2000	No Steel Added
1829	24	261	0	44	2350	No Steel Added	0	0	0	626	2000	No Steel Added
1831	24	261	0	44	2350	No Steel Added	0	0	0	626	2000	No Steel Added
1875	24	254	0	44	2350	No Steel Added	0	0	0	626	2000	No Steel Added
1964	24	241	0	44	2350	No Steel Added	0	0	0	626	2000	No Steel Added
2054	20	227	0	44	2350	No Steel Added	0	0	0	626	2000	No Steel Added

	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
2143	20	213	0	44	2350	No Steel Added	0	0	0	626	2000	No Steel Added
2232	20	199	0	44	2350	No Steel Added	0	0	0	626	2000	No Steel Added
2321	16	185	0	44	2350	No Steel Added	0	0	0	626	2000	No Steel Added
2410	16	171	0	44	2350	No Steel Added	0	0	0	626	2000	No Steel Added
2499	16	157	0	44	2350	No Steel Added	0	0	0	626	2000	No Steel Added

Shear Reinforcement				
	Spacing of Sets			
Area	2 legs N10	2 legs N12	2 legs N16	Shear Comments
mm2/mm	mm	mm	mm	A
0	0	0	0	
0	0	0	0	
0	0	0	0	
1.4	112	161	287	Minimum Steel
1.4	112	161	287	Minimum Steel
1.4	112	161	287	Minimum Steel
1.4	112	161	287	Minimum Steel
1.4	112	161	287	Minimum Steel
1.4	112	161	287	Minimum Steel
1.4	112	161	287	Minimum Steel
1.4	112	161	287	Minimum Steel
1.4	112	161	287	Minimum Steel
1.4	112	161	287	Minimum Steel
1.4	112	161	287	Minimum Steel
1.4	112	161	287	Minimum Steel
1.4	112	161	287	Minimum Steel
1.4	112	161	287	Minimum Steel
1.4	112	161	287	Minimum Steel
1.4	112	161	287	Minimum Steel
0	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	

Design Comments:-
- - Column Grid 2 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Column Grid 3 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 2 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

Span 3

	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
1	16	155	0	44	3649	No Steel Added	0	0	0	626	2000	No Steel Added
500	28	293	0	44	3649	No Steel Added	0	0	0	626	2000	No Steel Added
536	32	300	0	44	3649	No Steel Added	0	0	0	626	2000	No Steel Added
669	36	300	0	44	3649	No Steel Added	0	0	0	626	2000	No Steel Added
671	36	300	0	44	3649	No Steel Added	0	0	0	626	2000	No Steel Added
1000	40	300	0	44	3649	No Steel Added	0	0	0	626	2000	No Steel Added
1500	40	300	0	44	3649	No Steel Added	0	0	0	626	2000	No Steel Added
1962	0	0	0	44	3649	No Steel Added	40	300	0	626	2000	No Steel Added
2425	0	0	0	44	3649	No Steel Added	40	300	0	626	2000	No Steel Added
3233	0	0	0	44	3649	No Steel Added	40	300	0	626	2000	No Steel Added
4041	0	0	0	44	3649	No Steel Added	36	300	0	626	2000	No Steel Added
4850	0	0	0	44	3649	No Steel Added	28	284	0	626	2000	No Steel Added
5700	0	0	0	44	3649	No Steel Added	24	240	0	626	2000	No Steel Added
6200	0	0	0	44	3649	No Steel Added	20	231	0	626	2000	No Steel Added
6700	0	0	0	44	3649	No Steel Added	24	251	0	626	2000	No Steel Added
7275	0	0	0	44	3649	No Steel Added	28	292	0	626	2000	No Steel Added
7629	0	0	0	44	3649	No Steel Added	32	300	0	626	2000	No Steel Added
7979	0	0	0	44	3649	No Steel Added	36	300	0	626	2000	No Steel Added
8329	0	0	0	44	3649	No Steel Added	40	300	0	626	2000	No Steel Added
8679	0	0	0	44	3649	No Steel Added	40	300	0	626	2000	No Steel Added

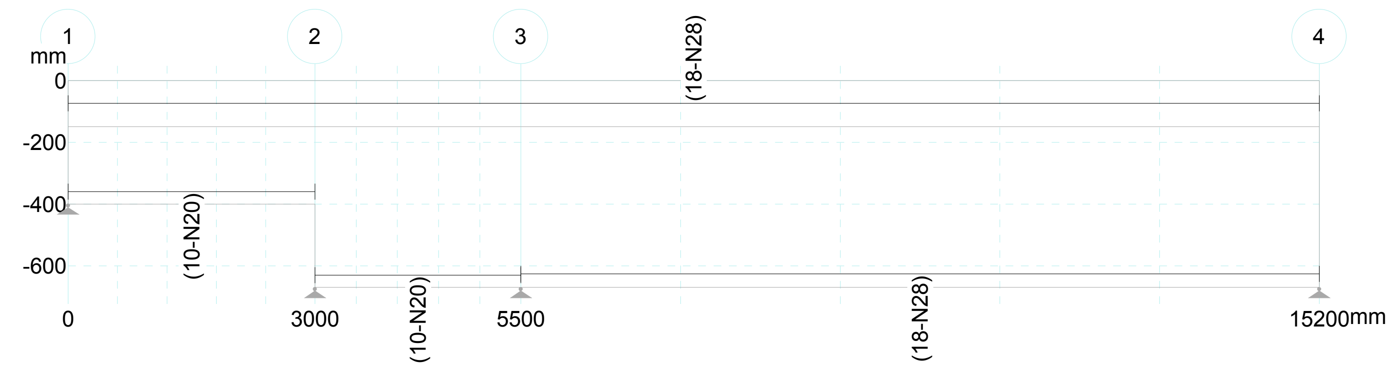
	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
9029	0	0	0	44	3649	No Steel Added	40	300	0	626	2000	No Steel Added
9031	0	0	0	44	3649	No Steel Added	40	300	0	626	2000	No Steel Added
9164	0	0	0	44	3649	No Steel Added	40	300	0	626	2000	No Steel Added
9600	0	0	0	44	3649	No Steel Added	40	300	0	626	2000	No Steel Added

Shear Reinforcement				
	Spacing of Sets			
Area	2 legs N10	2 legs N12	2 legs N16	Shear Comments
mm2/mm	mm	mm	mm	A
0	0	0	0	
0	0	0	0	
2.62	60	86	153	
2.21	71	102	182	
2.2	71	103	183	
1.4	112	161	287	Minimum Steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	

Design Comments:-

- - Column Grid 3 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 3 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

Reinforcement Layout



- - Column Grid 1 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Column Grid 2 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 1 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

- - Column Grid 2 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Column Grid 3 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 2 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

- - Column Grid 3 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 3 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

K:\2019\03\1903075\Structural Drawings and Calcs\Design Calculations and Details\ENG replies to certifier\RAPT\CB4 R0.1.rpf

RAPT - Version: 6.5.16.0
Reinforced And Post-Tensioned Concrete Analysis & Design Package

Licensee
TMK Consulting Engineers
Level 6
100 Pirie Street
Adelaide SA 5000
11169065160718WPN3

Input

General

Design Code	List	Australia - AS3600*SAVED*
Material	List	Australia - Australian Materials*SAVED*
Reinforcement Type	List	Reinforced
Member Type	List	Beam
Panel Type	List	Internal
Strip Type	List	One way - Nominal Width
Column Stiffness	List	Equivalent Column
Concrete Type	List	Standard Concrete - Brisbane/Sydney
Concrete - Spanning Members	List	40MPa
Concrete - Columns	List	40MPa
Top Reinforcement Cover	mm	32
Bottom Reinforcement Cover	mm	32
Top Reinforcement Axis Depth Limit	mm	30
Bottom Reinforcement Axis Depth Limit	mm	30
Concrete Unit Weight	kn/m3	25
Self Weight Definition	List	Program Calculated
Pattern Live Load	Y/N	
Earthquake Design	List	None
Moment Redistribution	%	0
Design Surface Levels	List	Extreme Surfaces

Span

Span	Span Length	Slab Depth	Panel Width Left	Panel Width Right
	mm	mm	mm	mm
LE	0			
1	6000	200	9350	9350
RE	0			

Columns

Column	Column Grid Reference	Support Type	Transverse Column spacing	Transverse prestress (P/A)
	A	List	mm	MPa
1	1	Knife-Edge	9350	
2	2	Knife-Edge	9350	

Beams

Beam Number	Beam Depth	Beam Width at Slab	Beam Width	Effective Flange Width
	mm	mm	mm	mm
1	600	3000	3000	4200

Load Cases

Load Case	Load Type	Load Definition	Live Load Deflection Case	Description
	List	List	Y/N	A
1	Self Weight	Applied Loads		
2	Initial Dead Load	Applied Loads		
3	Extra Dead Load	Applied Loads		
4	Live Load	Applied Loads	Y	

1. Self Weight - Line

Load	Left End Reference Column	Left end of load from reference column	Load at left end	Right End reference column	Right end of load from reference column	Load at right end	Description
	#	mm	kN/m	#	mm	kN/m	A
1	1	0	76.75	2	0	76.75	

2. Initial Dead Load - Panel

Load	Left End reference column	Left end of load from reference column	Load at left end	Right End reference column	Right end of load from reference column	Load at right end	Description
	#	mm	kN/m2	#	mm	kN/m2	A
1	1	0	1	2	0	1	

3. Extra Dead Load - Line

Load	Left End Reference Column	Left end of load from reference column	Load at left end	Right End reference column	Right end of load from reference column	Load at right end	Description
	#	mm	kN/m	#	mm	kN/m	A
1	1	0	25	2	0	25	

3. Extra Dead Load - Point

Load	Reference column	Distance to Load from reference column	Load	Load Length	Description
	#	mm	kN	mm	A
1	1	2000	280	800	

4. Live Load - Line

Load	Left End Reference Column	Left end of load from reference column	Load at left end	Right End reference column	Right end of load from reference column	Load at right end	Live Load reduction	Description
	#	mm	kN/m	#	mm	kN/m	#.#	A
1	1	0	46.15	2	0	46.15	1	

4. Live Load - Panel

Load	Left End reference column	Left end of load from reference column	Load at left end	Right End reference column	Right end of load from reference column	Load at right end	Live Load reduction	Description
	#	mm	kN/m2	#	mm	kN/m2	#.#	A
1	1	0	2	2	0	2	1	

4. Live Load - Point

Load	Reference column	Distance to Load from reference column	Load	Load Length	Live Load reduction	Description
	#	mm	kN	mm	#.#	A
1	1	2000	110	800	1	

Load Combinations : Ultimate

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Live Load	1.2	1.2	1.2	1.5
2	Live Load	0.9	0.9	0.9	1.5
3	Dead Load	1.35	1.35	1.35	0

Load Combinations : Short Term Service

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Live Load	1	1	1	0.7

Load Combinations : Permanent Service

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Live Load	1	1	1	0.4

Load Combinations : Deflection

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Short Term - Deflection	1	1	1	0.7
2	Permanent - Deflection	1	1	1	0.4
3	Initial - Deflection	1	1	0	0

Load Combinations : Transfer Prestress

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Transfer	1	0	0	0

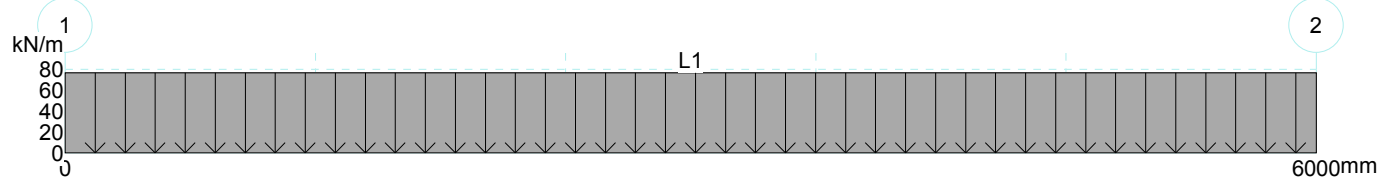
Load Combinations : Pre Existing

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Pre Existing	1	0	0	0

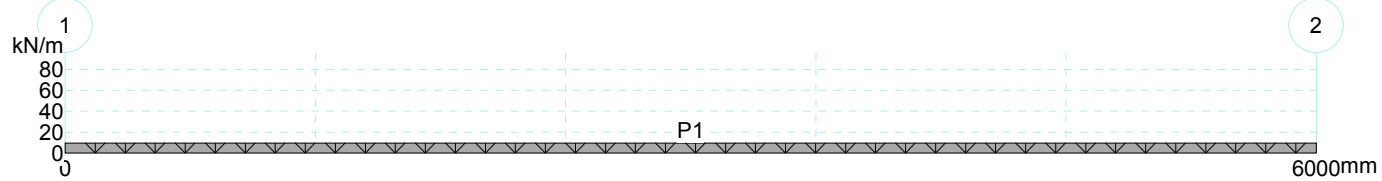
Load Combinations : Construction

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Construction	1	0	0	0

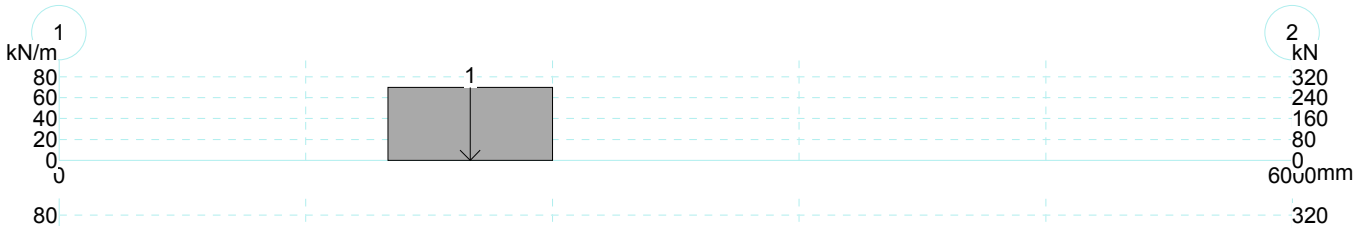
Load Case 1 : 1. Self Weight



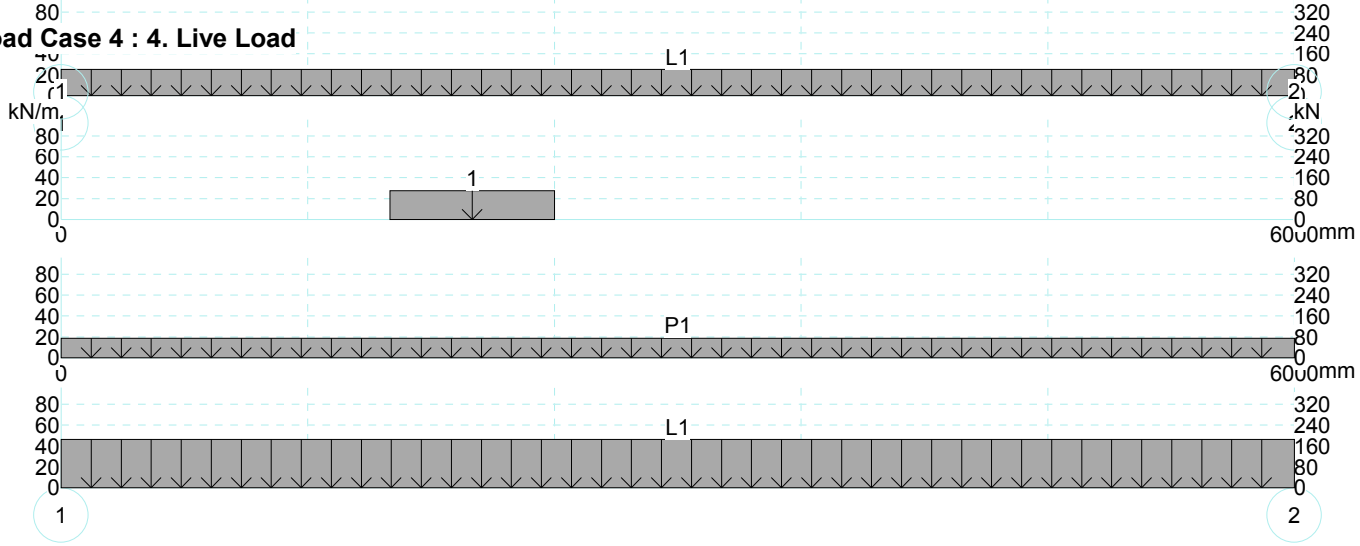
Load Case 2 : 2. Initial Dead Load



Load Case 3 : 3. Extra Dead Load



Load Case 4 : 4. Live Load



Reinforcement

Reinforcement Use	Reinforcement Type	Preferred Bar Size	Number of Legs
	List	List	#
Flexural Bar	N 500MPa		
Flexural Mesh	F 450MPa		
Shear Option 1	N 500MPa	10	2
Shear Option 2	N 500MPa	12	2
Shear Option 3	N 500MPa	16	2
Punching Shear	N 500MPa	10	1

Reinforcement

	Maximum Bar Spacing	Minimum Bar Spacing	Minimum Continuous Reinforcement	Minimum Span Reinforcement into End Support	Minimum Span Reinforcement into Internal Support	Infill Bars	Stagger Bars
	mm	mm	#.#	#.#	#.#	Y/N	Y/N
Support Reinforcement	300	60	0			N	N
Span Reinforcement	300	60		0	0	N	N

Design Zones : Top

Layer Number	Steel type	Left End Reference Column	Distance to left end of bar	Bar stagger length at left end	Top Cover at left end	Right End Reference Column	Distance to right end of bar	Bar stagger length at right end	Top Cover at Right end	Maximum Bar Size	Minimum Bar Size	Preferred bar size
	List	#	mm	mm	mm	#	mm	mm	mm	List	List	List
1	Bar	1	0	0	32	2	0	0	32	36	16	28

Layer Number	Minimum Number of Bars	Maximum Spacing of Bars	Minimum Steel area as %	% in Flange
	#	mm	%	%
1	0	0	0	0

Design Zones : Bottom

Layer Number	Steel type	Left End Reference Column	Distance to left end of bar	Bar stagger length at left end	Bottom Cover at left end	Right End Reference Column	Distance to right end of bar	Bar stagger length at right end	Bottom Cover at Right End	Maximum Bar Size	Minimum Bar Size	Preferred bar size
	List	#	mm	mm	mm	#	mm	mm	mm	List	List	List
1	Bar	1	0	0	32	2	0	0	32	36	16	28

Layer Number	Minimum Number of Bars	Maximum Spacing of Bars	Minimum Steel area as %	% in Flange
	#	mm	%	%
1	0	0	0	0

User Defined : Top

Layer Number	Steel type	Left End Reference Column	Distance to left end of bar	Bar stagger length at left end	Top Cover at left end	% Development of Left End of Bar in Tension	% Development of Left End of Bar in Compression	Right End Reference Column	Distance to right end of bar	Bar stagger length at right end	Top Cover at Right end
	List	#	mm	mm	mm	%	%	#	mm	mm	mm
1	N 500MPa	1	0	0	30	0	0	2	0	0	30

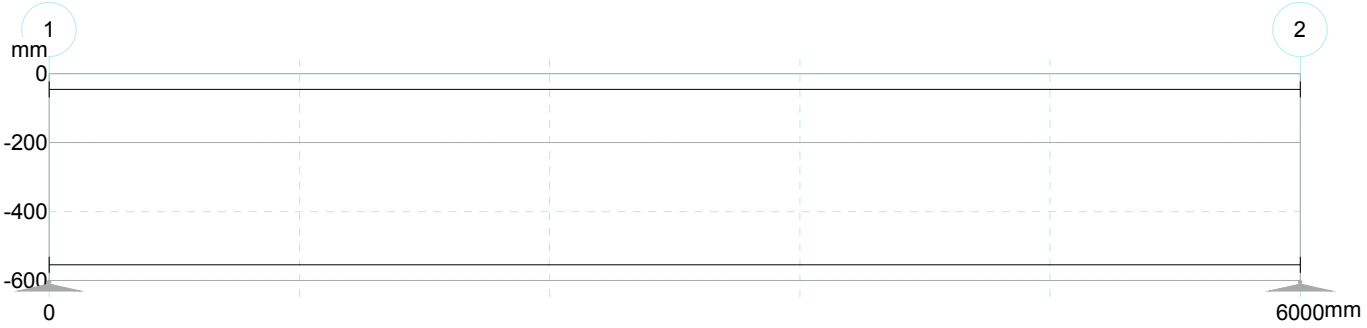
Layer Number	% Development of Right End of Bar in Tension	% Development of Right End of Bar in Compression	Bar Size	Number of Bars	Spacing of Bars	% in Flange	Layer attached after the PreExisting Load Case
	%	%	List	#	mm	%	Y/N
1	0	0	20	25	0	0	N

User Defined : Bottom

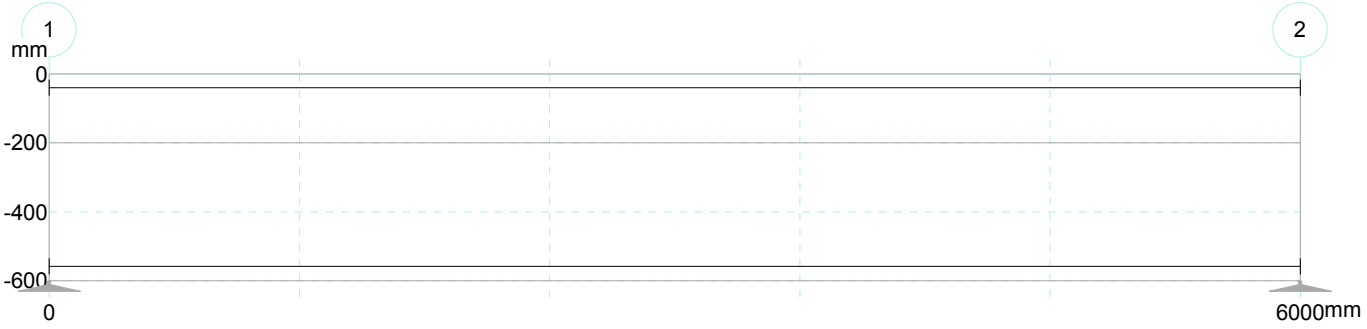
Layer Number	Steel type	Left End Reference Column	Distance to left end of bar	Bar stagger length at left end	Bottom Cover at Left end	% Development of Left End of Bar in Tension	% Development of Left End of Bar in Compression	Right End Reference Column	Distance to right end of bar	Bar stagger length at right end	Bottom Cover at Right End
	List	#	mm	mm	mm	%	%	#	mm	mm	mm
1	N 500MPa	1	0	0	30	100	100	2	0	0	30

Layer Number	% Development of Right End of Bar in Tension	% Development of Right End of Bar in Compression	Bar Size	Number of Bars	Spacing of Bars	% in Flange	Layer attached after the PreExisting Load Case
	%	%	List	#	mm	%	Y/N
1	100	100	24	25	0	0	N

Reinforcement Design Zones



Reinforcement Design Zones User Defined



Design Data

Capacity Reduction factor (phi) for Flexure	#.#	0.8
Capacity Reduction factor (phi) for Shear	#.#	0.7
Material Factor for Concrete in Flexure	#.#	1
Material Factor for Concrete in Shear	#.#	1
Material Factor for Reinforcement	#.#	1
Maximum Ratio of Neutral Axis Depth for Ductility	#.#	0.4
Ductility Limit - Strain	#.#	0

Ductility Check at Left End Column	Y/N	Y
Ductility Check at Right End Column	Y/N	Y
Minimum Reinforcement Strength Limit - #.## x M*	#.#	0
Flexural Critical Section - Consider Transverse Beams	Y/N	Y
Flexural Critical Section - Distance from centre of Support	#.#	-1
Beam Left Sideface Cover (Internal)	mm	25
Beam Right Sideface cover	mm	40
Prestress Minimum Reinforcement Basis	List	Program Default
Shear Enhancement at Supports	Y/N	N
Ast Value in Shear Calculations	List	Calculated
Limit Reinforcement Strain	Y/N	N
Include Strain Hardening of Reinforcement	Y/N	
Beam Shear Critical Section Location	List	Code Critical Section

Maximum Service Stress Change - Prestressed Sections	MPa	150
Maximum Service Stress Change - Reinforced Sections	MPa	0
Relative Humidity	%	50
Average Temperature	C.	20
Prestress Losses Calculations based on	List	Program Default
Crack Width Calculations	List	Code default
AS3600 Shrinkage and Temperature Reinforcement	List	Moderate
Degree of Restraint in Primary Direction	%	0
Degree of Restraint in Secondary Direction	%	0
Concrete Strength Gain Rate	List	N

Concrete Tensile Strength for Deflection Calculations- #.## x (Fc)n	#.#	-1
Maximum Value of Ieff/Igross for Deflection Calculations	#.#	0.6
Total Deflection Warning Limit - Maximum Span/Deflection	#.#	500
Total Deflection Warning Limit - Maximum Deflection	mm	25
Incremental Deflection Warning Limit - Maximum Span/Deflection	#.#	500
Incremental Deflection Warning Limit - Maximum Deflection	mm	25
Initial Time for Shrinkage	List	Full Shrinkage
Time of Loading in days	#.#	10
Age Adjustment Factor	#.#	0.76
Concrete Strength at Time of Loading	MPa	33.8
Loaded Period in years	#.#	30
Tension stiffening Approach	List	Modified Concrete Tensile Modulus Method

Live Load Pattern Factor	#.#
Pattern Live Load for Ultimate Strength	Y/N
Pattern Live Load for Crack Control	Y/N
Pattern Live Load For Deflections	Y/N
Pattern Live Load for Deflection Permanent Load Combination	Y/N

Material Properties

Concrete : Standard Concrete - Brisbane/Sydney : Concrete Strength Basis - Cylinder

Description	A	40MPa
Characteristic Compressive Strength	MPa	40
Mean Compressive Strength	MPa	45.9
Lower Characteristic Tensile Strength	MPa	3.79
Upper Characteristic Tensile Strength	MPa	6.83
Concrete Density	kg/m3	2447
Design Concrete Modulus	MPa	32919.2
Mean Concrete Modulus	MPa	35263.5
Basic Shrinkage Strain	mm/mm	850
Shrinkage Multiplier	#.#	1
Basic Creep Factor	#.#	2.5
Creep Multiplier	#.#	1
Concrete Strain at Peak Stress	#.#	0.002
Squash Load Factor	#.#	0.85
Concrete Strain Limit	#.#	0.004
Strength Gain Rate	List	Normal

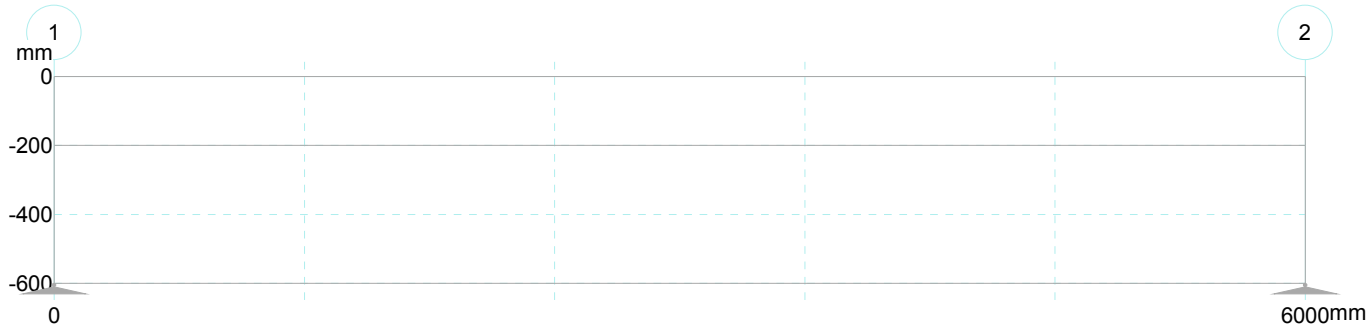
Reinforcement Bar

Designation	Type	Yield Stress	Elastic Modulus	Ductility	Peak Strain	Peak Stress	Design Strain Limit	Material Factor Flexure	Material Factor Shear	Material Capacity Reduction Factor - Flexure	Material Capacity Reduction Factor - Shear	Include as Flexural Reinforcement for Shear
N	Deformed	500	2e5	N	0.05	540	90	-1	-1	-1	-1	Y

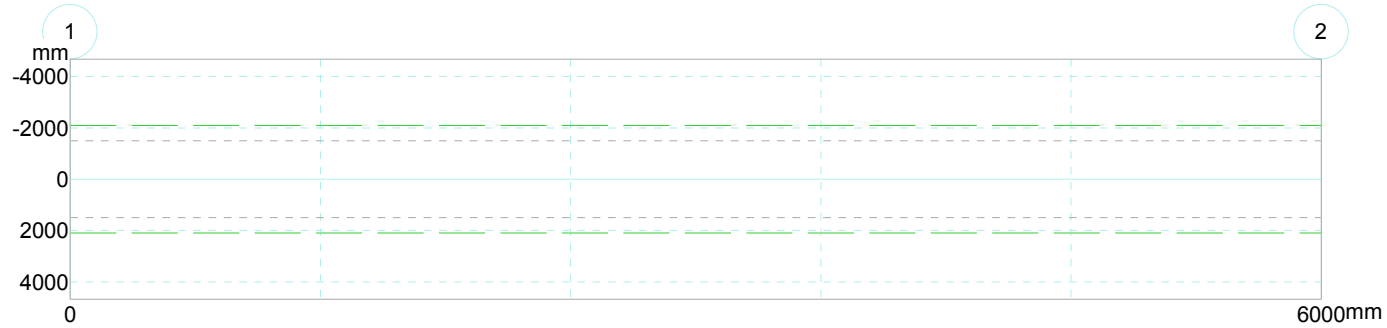
Description

Nominal Bar Size	Bar Diameter	Bar Area	Bar Inertia	Bar Weight	Stock Length
A	mm	mm2	mm4	kg/m	mm
10	10	78.5	491.07	0.62	12000
12	12	113	1018.29	0.89	12000
16	16	201	3218.29	1.58	12000
20	20	314	7857.14	2.47	12000
24	24	452	16292.6	3.55	12000
28	28	616	30184	4.83	12000
32	32	804	51492.6	6.31	12000
36	36	1020	82481.1	7.99	12000
40	40	1260	1.257e5	9.86	12000

Elevation view



Plan view



Warnings

Input

No errors or warnings were found.

Output

No errors or warnings were found.

Bending Moments

Load Cases

Column Actions

Col No. 1		Self Weight	Initial Dead Load	Extra Dead Load	Live Load
Moment Above	kNm	-0	-0	-0	-0
Moment Below	kNm	-0	-0	-0	-0
Reaction	kN	230.25	28.05	261.67	267.88
Elastic Rotation	#.#	3.1e-4	0	3.77e-4	3.7e-4
Elastic Axial Shortening	mm	0	0	0	0

Col No. 2		Self Weight	Initial Dead Load	Extra Dead Load	Live Load
Moment Above	kNm	-0	-0	-0	-0
Moment Below	kNm	-0	-0	-0	-0

Col No. 2		Self Weight	Initial Dead Load	Extra Dead Load	Live Load
Reaction	kN	230.25	28.05	168.33	231.22
Elastic Rotation	#.#	-3.1e-4	0	-3.23e-4	-3.49e-4
Elastic Axial Shortening	mm	0	0	0	0

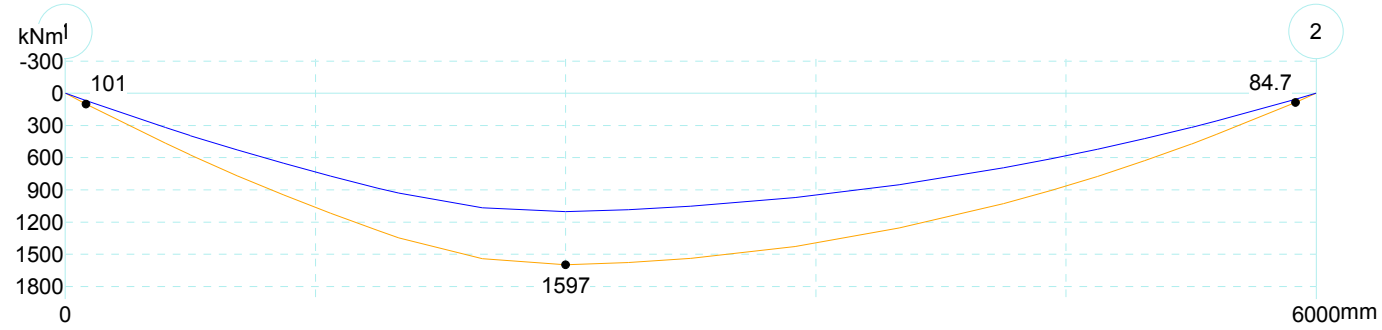
Load Combinations

Column Actions

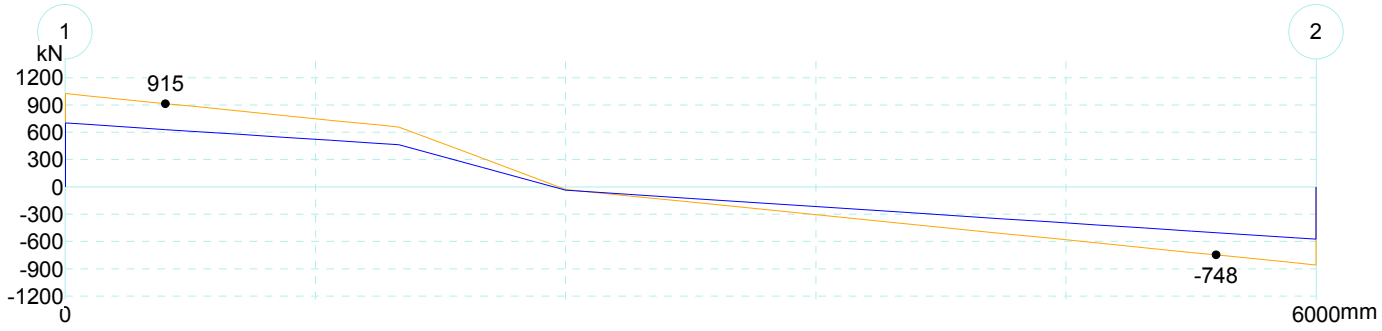
Col No. 1		Characteristic Service	Characteristic Service (Reversal)	Service	Service (Reversal)	Ultimate Flexure	Ultimate Flexure (Reversal)	Ultimate Shear	Ultimate Shear (Reversal)
Moment Above	kNm	0	0	0	0	0	0	0	0
Moment Below	kNm	0	0	0	0	0	0	0	0
Reaction	kN	787.85	787.85	707.49	707.49	1025.79	1025.79	701.96	1025.79
Elastic Rotation	#.#	1.1e-3	1.1e-3	9.84e-4	9.84e-4	1.43e-3	1.43e-3	9.78e-4	1.43e-3
Elastic Axial Shortening	mm	0	0	0	0	0	0	0	0

Col No. 2		Characteristic Service	Characteristic Service (Reversal)	Service	Service (Reversal)	Ultimate Flexure	Ultimate Flexure (Reversal)	Ultimate Shear	Ultimate Shear (Reversal)
Moment Above	kNm	0	0	0	0	0	0	0	0
Moment Below	kNm	0	0	0	0	0	0	0	0
Reaction	kN	657.85	657.85	588.48	588.48	858.79	858.79	575.96	858.79
Elastic Rotation	#.#	-1.02e-3	-1.02e-3	-9.14e-4	-9.14e-4	-1.33e-3	-1.33e-3	-9.05e-4	-1.33e-3
Elastic Axial Shortening	mm	0	0	0	0	0	0	0	0

Ultimate Flexure



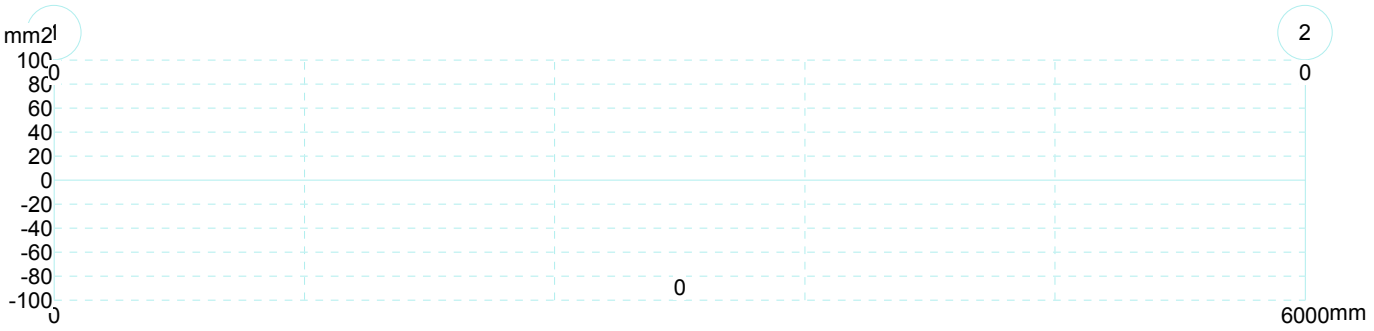
Moment Moment 1 Moment 2



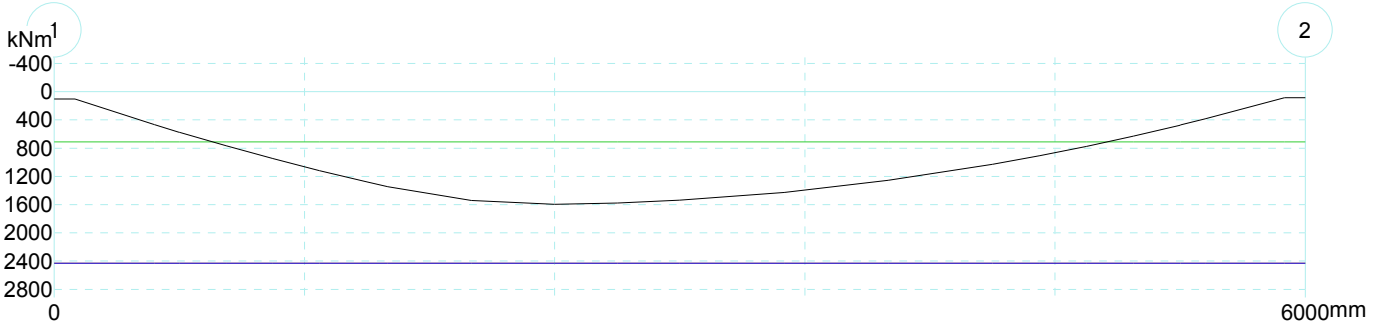
Shear Shear 1 Shear 2

Flexural Design

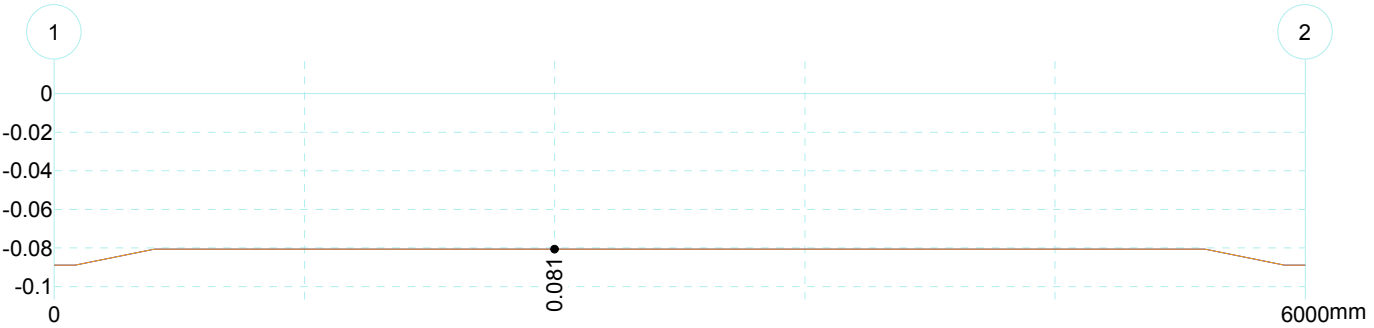
Ultimate



Reinforcement Top Total | Bottom Total | Top Ultimate | Bottom Ultimate | Min Top | Min Bot



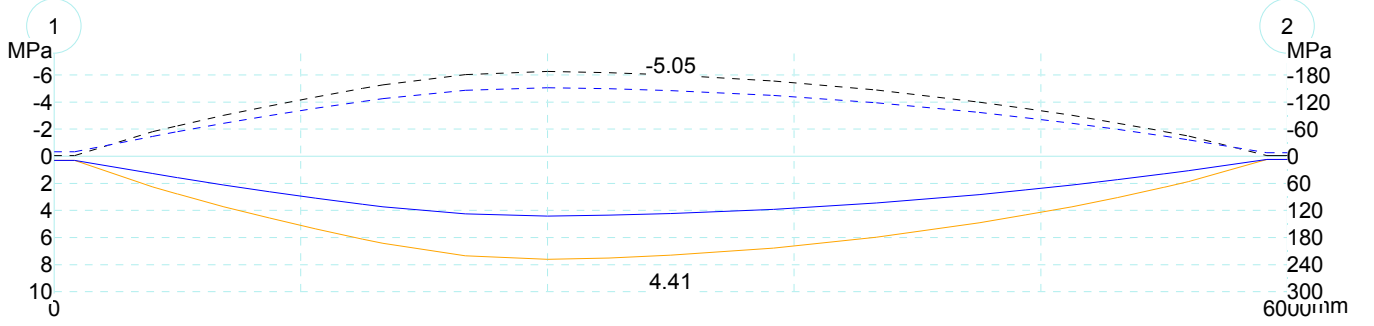
Capacity Minimum | Ultimate Design | Initial | Final



Neutral Axis Depth Initial | Final

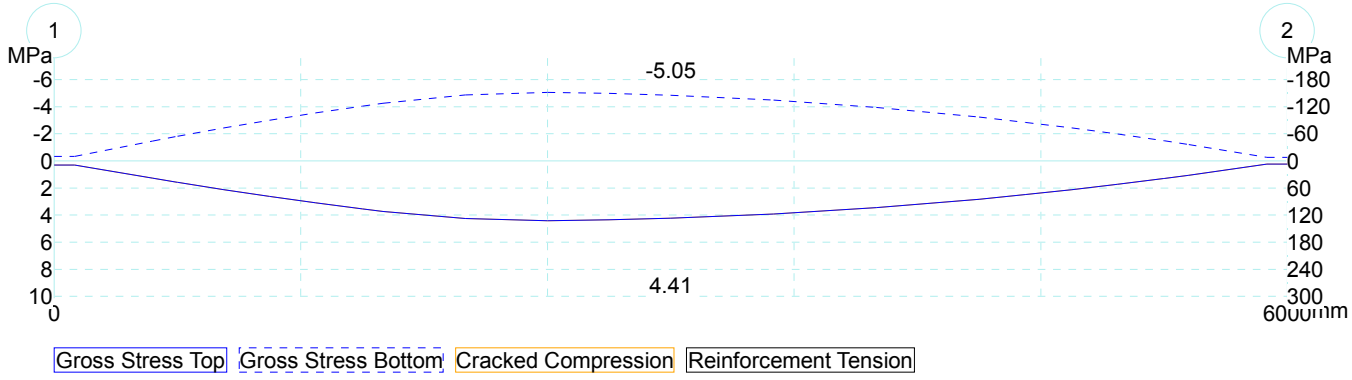
Service

Maximum Moment Condition



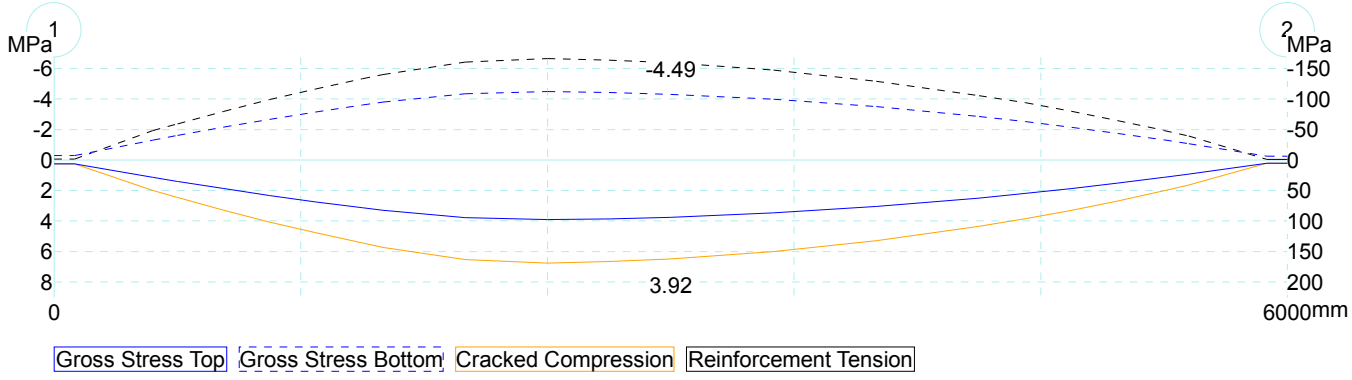
Gross Stress Top | Gross Stress Bottom | Cracked Compression | Reinforcement Tension

Reversal Moment Condition

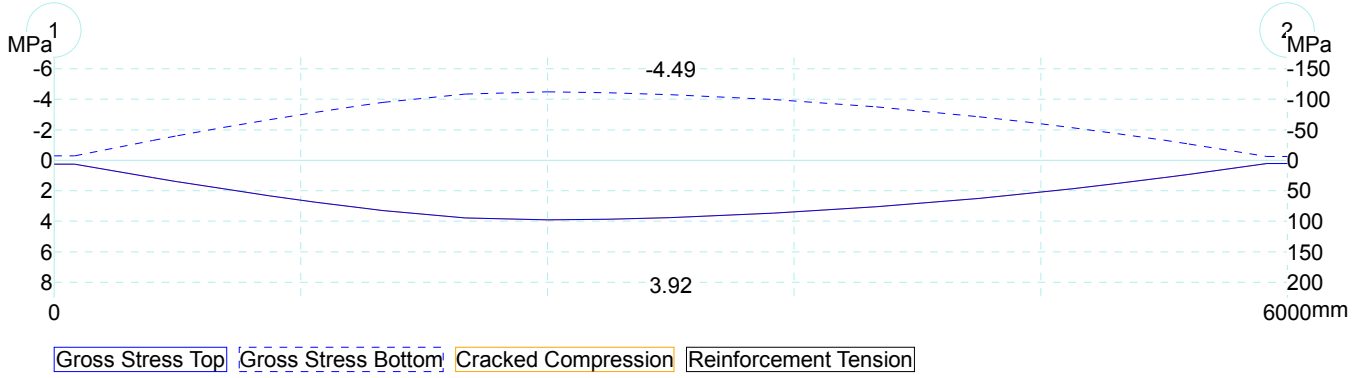


Permanent

Maximum Moment Condition



Reversal Moment Condition



Shear Design

Beam

Span 1

Locat	V*	Mv*	Mdec	d	Ast	bv	phi Vuc	phi Vut	phi Vu	Phi Vumax	phi VuMin	phi Vus	Theta	Asv/s
mm	kN	kNm	kNm	mm	mm2	mm	kN	kN	kN	kN	kN	kN	#.#	mm2/mm
100	1002.73	101.43	0	558	0	3000	0	0	0	9374.4	0	0	0	0
480	915.1	465.81	0	558	0	3000	868.11	99999	868.11	9374.4	1578.48	46.99	30	2.1
599	887.66	573.08	0	558	0	3000	868.11	99999	868.11	9374.4	1578.48	19.55	30	2.1
601	887.2	574.85	0	558	0	3000	868.11	99999	868.11	9374.4	1578.48	19.09	30	2.1
825	840.1	744.2	0	558	0	3000	868.11	99999	868.11	9374.4	1578.48	0	30	0
1049	788.45	926.6	0	558	0	3000	868.11	99999	868.11	9374.4	1578.48	0	30	0
1273	736.8	1097.43	0	558	0	3000	868.11	99999	868.11	9374.4	1578.48	0	30	0
1500	698.13	1197.18	0	558	0	3000	868.11	99999	868.11	9374.4	1578.48	0	30	0
1600	675.07	1265.84	0	558	0	3000	868.11	99999	868.11	9374.4	1578.48	0	30	0
2000	332.33	1467.32	0	558	0	3000	868.11	99999	868.11	9374.4	1578.48	0	30	0
2400	-116.06	1281.72	0	558	0	3000	868.11	99999	868.11	9374.4	1578.48	0	30	0
2700	-170.78	1381.42	0	558	0	3000	868.11	99999	868.11	9374.4	1578.48	0	30	0
3000	-239.96	1319.81	0	558	0	3000	868.11	99999	868.11	9374.4	1578.48	0	30	0
3500	-323.34	1282.72	0	558	0	3000	868.11	99999	868.11	9374.4	1578.48	0	30	0
4000	-415.83	1183.42	0	558	0	3000	868.11	99999	868.11	9374.4	1578.48	0	30	0
4500	-531.13	946.68	0	558	0	3000	868.11	99999	868.11	9374.4	1578.48	0	30	0
4727	-569.8	884.84	0	558	0	3000	868.11	99999	868.11	9374.4	1578.48	0	30	0

Locat	V*	Mv*	Mdec	d	Ast	bv	phi Vuc	phi Vut	phi Vu	Phi Vumax	phi VuMin	phi Vus	Theta	Asv/s
mm	kN	kNm	kNm	mm	mm2	mm	kN	kN	kN	kN	kN	kN	#.#	mm2/mm
4951	-621.45	751.42	0	558	0	3000	868.11	99999	868.11	9374.4	1578.48	0	30	0
5175	-673.1	606.43	0	558	0	3000	868.11	99999	868.11	9374.4	1578.48	0	30	0
5399	-720.2	474.48	0	558	0	3000	868.11	99999	868.11	9374.4	1578.48	0	30	0
5401	-720.66	473.04	0	558	0	3000	868.11	99999	868.11	9374.4	1578.48	0	30	0
5520	-748.1	385.65	0	558	0	3000	868.11	99999	868.11	9374.4	1578.48	0	30	0
5900	-835.73	84.73	0	558	0	3000	0	0	0	9374.4	0	0	0	0

Spacing of Sets				Minimum Legs	Shear Comments
2 legs N10	2 legs N12	2 legs N16	Min legs N10		
mm	mm	mm	mm	#	A
0	0	0	0	0	
75	108	191	224	6	Minimum Steel
75	108	191	224	6	Minimum Steel
75	108	191	224	6	Minimum Steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	

Punching

Column Head Critical Section

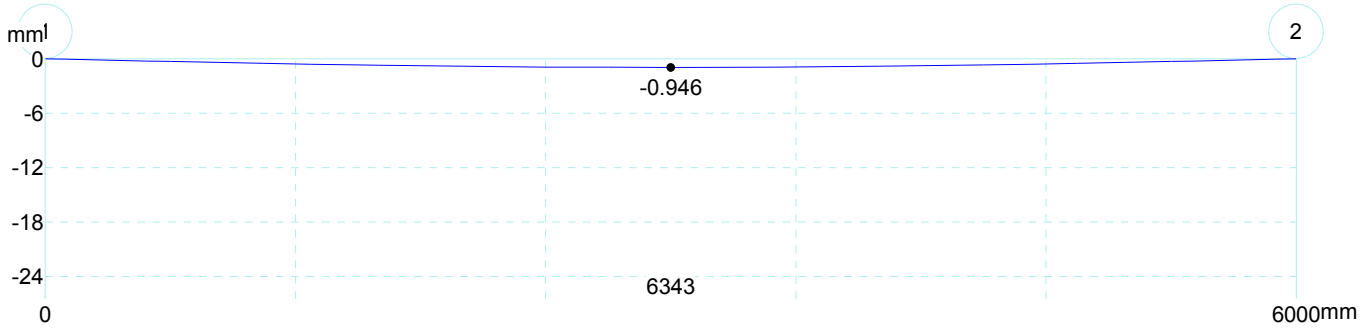
Column No.	Bh	a	at	u	d	fcv	P/A	Asw/s min	V*	Mv*	phi Vuo	phi Vu	phi VuMin	phi Vumax	side beam	Moment Transfer	Asw/s reqd
A	#.#	mm	mm	mm	mm	MPa	MPa	mm2/mm	kN	kNm	kN	kN	kN	kN	A	A	mm2/mm
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0

result
A
Check Not Carried Out!
Check Not Carried Out!

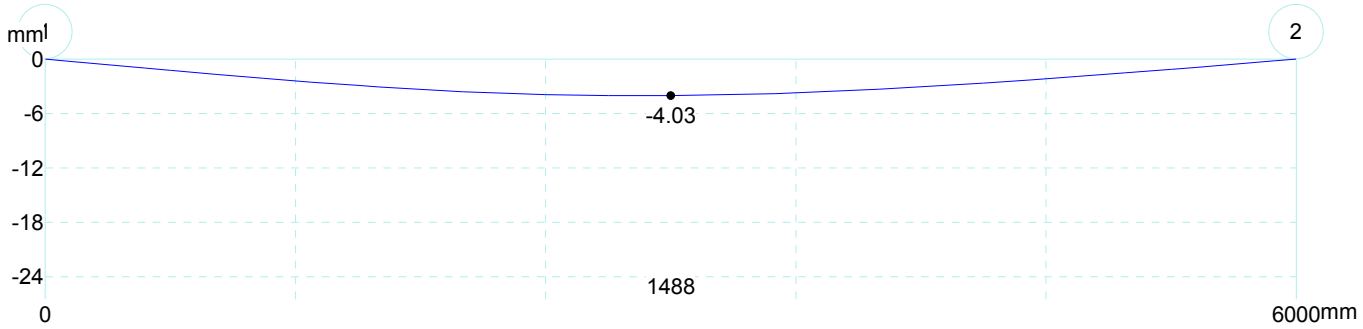
Deflections

All Spans Loaded

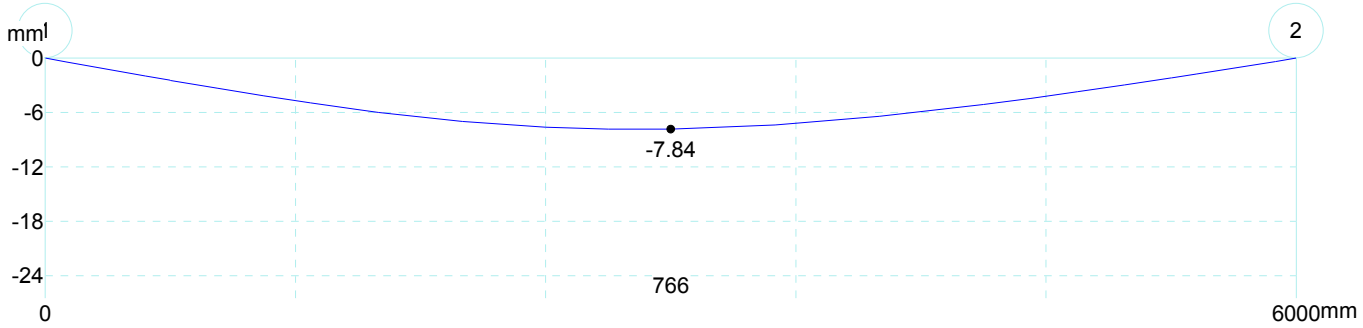
Transfer



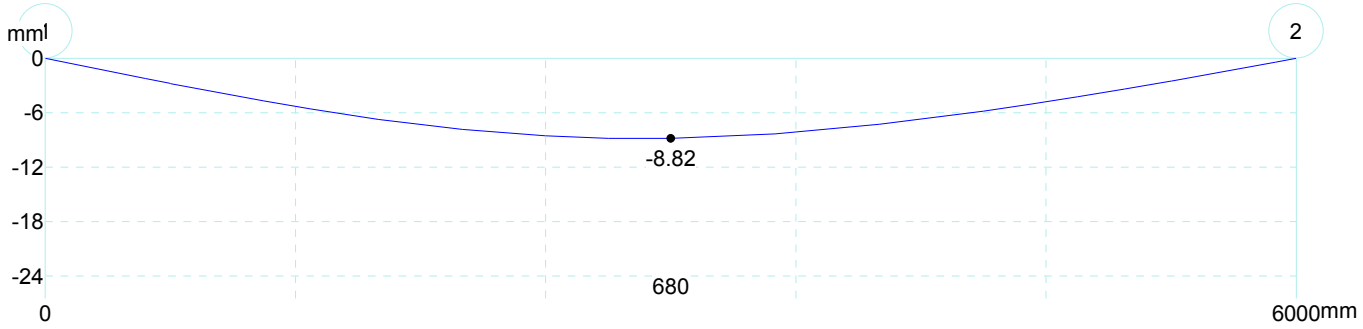
Short Term



Incremental



Total Long Term



Detailed Reinforcement

Span 1

	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
100	0	0	0	46	4200	No Steel Added	40	300	0	554	3000	No Steel Added
480	0	0	0	46	4200	No Steel Added	40	300	0	554	3000	No Steel Added
599	0	0	0	46	4200	No Steel Added	40	300	0	554	3000	No Steel Added
601	0	0	0	46	4200	No Steel Added	40	300	0	554	3000	No Steel Added
825	0	0	0	46	4200	No Steel Added	40	300	0	554	3000	No Steel Added
1049	0	0	0	46	4200	No Steel Added	40	300	0	554	3000	No Steel Added
1273	0	0	0	46	4200	No Steel Added	36	300	0	554	3000	No Steel Added
1500	0	0	0	46	4200	No Steel Added	32	300	0	554	3000	No Steel Added

	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
1600	0	0	0	46	4200	No Steel Added	32	300	0	554	3000	No Steel Added
2000	0	0	0	46	4200	No Steel Added	28	274	0	554	3000	No Steel Added
2400	0	0	0	46	4200	No Steel Added	24	265	0	554	3000	No Steel Added
2700	0	0	0	46	4200	No Steel Added	24	269	0	554	3000	No Steel Added
3000	0	0	0	46	4200	No Steel Added	28	275	0	554	3000	No Steel Added
3500	0	0	0	46	4200	No Steel Added	28	292	0	554	3000	No Steel Added
4000	0	0	0	46	4200	No Steel Added	32	300	0	554	3000	No Steel Added
4500	0	0	0	46	4200	No Steel Added	40	300	0	554	3000	No Steel Added
4727	0	0	0	46	4200	No Steel Added	40	300	0	554	3000	No Steel Added
4951	0	0	0	46	4200	No Steel Added	40	300	0	554	3000	No Steel Added
5175	0	0	0	46	4200	No Steel Added	40	300	0	554	3000	No Steel Added
5399	0	0	0	46	4200	No Steel Added	40	300	0	554	3000	No Steel Added
5401	0	0	0	46	4200	No Steel Added	40	300	0	554	3000	No Steel Added
5520	0	0	0	46	4200	No Steel Added	40	300	0	554	3000	No Steel Added
5900	0	0	0	46	4200	No Steel Added	40	300	0	554	3000	No Steel Added

Shear Reinforcement				
	Spacing of Sets			
Area	2 legs N10	2 legs N12	2 legs N16	Shear Comments
mm2/mm	mm	mm	mm	A
0	0	0	0	
2.1	75	108	191	Minimum Steel
2.1	75	108	191	Minimum Steel
2.1	75	108	191	Minimum Steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	

Design Comments:-

- - Column Grid 1 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 1 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

Reinforcement Layout

- - Column Grid 1 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 1 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

K:\2019\03\1903075\Structural Drawings and Calcs\Design Calculations and Details\ENG replies to certifier\RAPT\CB5 R0.1.rpf

RAPT - Version: 6.5.16.0
Reinforced And Post-Tensioned Concrete Analysis & Design Package

Licensee
TMK Consulting Engineers
Level 6
100 Pirie Street
Adelaide SA 5000
111690651607 18WPN3

Input

General

Design Code	List	Australia - AS3600-2009*SAVED*
Material	List	Australia - Australian Materials - 2009*SAVED*
Reinforcement Type	List	Reinforced
Member Type	List	Beam
Panel Type	List	Internal
Strip Type	List	One way - Nominal Width
Column Stiffness	List	Equivalent Column
Concrete Type	List	Standard Concrete - Australia
Concrete - Spanning Members	List	40MPa
Concrete - Columns	List	40MPa
Top Reinforcement Cover	mm	30
Bottom Reinforcement Cover	mm	30
Top Reinforcement Axis Depth Limit	mm	30
Bottom Reinforcement Axis Depth Limit	mm	30
Concrete Unit Weight	kn/m3	25
Self Weight Definition	List	Program Calculated
Pattern Live Load	Y/N	Y
Earthquake Design	List	None
Moment Redistribution	%	0
Design Surface Levels	List	Extreme Surfaces

Span

Span	Span Length	Slab Depth	Panel Width Left	Panel Width Right
	mm	mm	mm	mm
LE	0			
1	4300	230	4500	4500
2	7700	150	4500	4500
3	2500	150	4500	4500
RE	0			

Columns

Column	Column Grid Reference	Support Type	Transverse Column spacing	Transverse prestress (P/A)
	A	List	mm	MPa
1	1	Knife-Edge	4500	
2	2	Knife-Edge	4500	
3	3	Knife-Edge	4500	
4	4	Knife-Edge	4500	

Beams

Beam Number	Beam Depth	Beam Width at Slab	Beam Width	Effective Flange Width
	mm	mm	mm	mm
1	520	1200	1200	1931
2	520	1200	1200	2278
3	520	1200	1200	1625

Load Cases

Load Case	Load Type	Load Definition	Live Load Deflection Case	Description
	List	List	Y/N	A
1	Self Weight	Applied Loads		
2	Initial Dead Load	Applied Loads		
3	Extra Dead Load	Applied Loads		
4	Live Load	Applied Loads	Y	

1. Self Weight - Line

Load	Left End Reference Column	Left end of load from reference column	Load at left end	Right End reference column	Right end of load from reference column	Load at right end	Description
	#	mm	kN/m	#	mm	kN/m	A
1	1	0	34.58	2	0	34.58	
2	2	0	27.98	3	0	27.98	
3	3	0	27.98	4	0	27.98	

2. Initial Dead Load - Panel

Load	Left End reference column	Left end of load from reference column	Load at left end	Right End reference column	Right end of load from reference column	Load at right end	Description
	#	mm	kN/m2	#	mm	kN/m2	A
1	1	0	0.5	4	0	0.5	

3. Extra Dead Load - Panel

Load	Left End reference column	Left end of load from reference column	Load at left end	Right End reference column	Right end of load from reference column	Load at right end	Description
	#	mm	kN/m2	#	mm	kN/m2	A
1	1	0	0.5	4	0	0.5	

3. Extra Dead Load - Point

Load	Reference column	Distance to Load from reference column	Load	Load Length	Description
	#	mm	kN	mm	A
1	2	2900	345	800	

4. Live Load - Panel

Load	Left End reference column	Left end of load from reference column	Load at left end	Right End reference column	Right end of load from reference column	Load at right end	Live Load reduction	Description
	#	mm	kN/m2	#	mm	kN/m2	#.#	A
1	1	0	2	4	0	2	1	

4. Live Load - Point

Load	Reference column	Distance to Load from reference column	Load	Load Length	Live Load reduction	Description
	#	mm	kN	mm	#.#	A
1	2	2900	113	800	1	

Load Combinations : Ultimate

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Live Load	1.2	1.2	1.2	1.5
2	Live Load	0.9	0.9	0.9	1.5
3	Dead Load	1.35	1.35	1.35	0

Load Combinations : Short Term Service

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Live Load	1	1	1	0.7

Load Combinations : Permanent Service

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Live Load	1	1	1	0.4

Load Combinations : Deflection

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Short Term - Deflection	1	1	1	0.7
2	Permanent - Deflection	1	1	1	0.4
3	Initial - Deflection	1	1	0	0

Load Combinations : Transfer Prestress

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Transfer	1	0	0	0

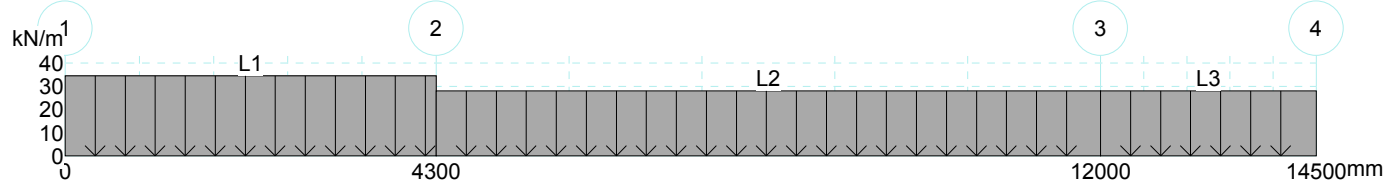
Load Combinations : Pre Existing

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Pre Existing	1	0	0	0

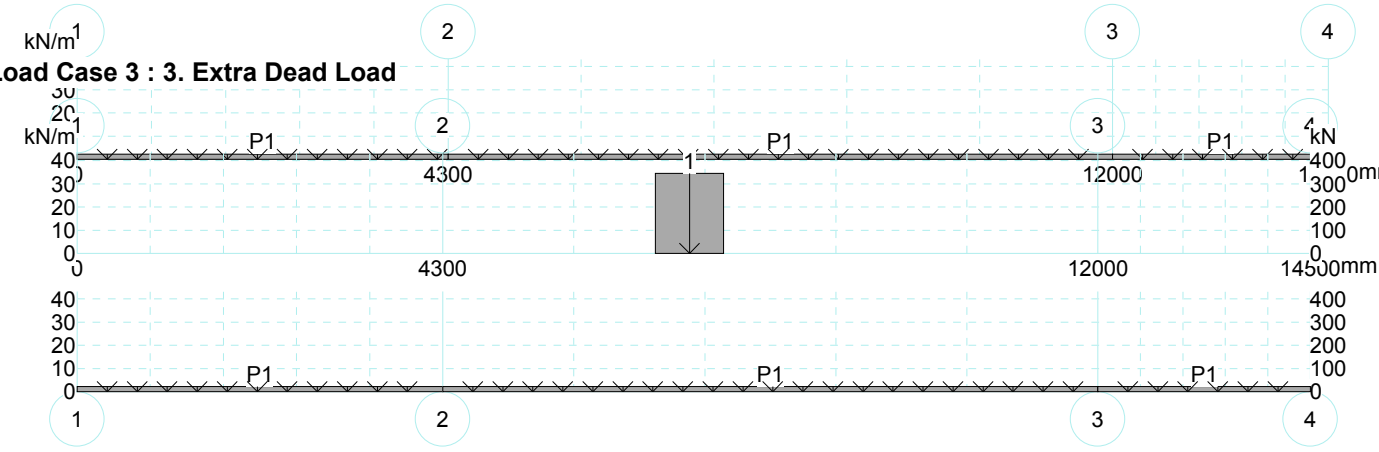
Load Combinations : Construction

Load Combination	Description	1. Self Weight	2. Initial Dead Load	3. Extra Dead Load	4. Live Load
	A	#.#	#.#	#.#	#.#
1	Construction	1	0	0	0

Load Case 1 : 1. Self Weight

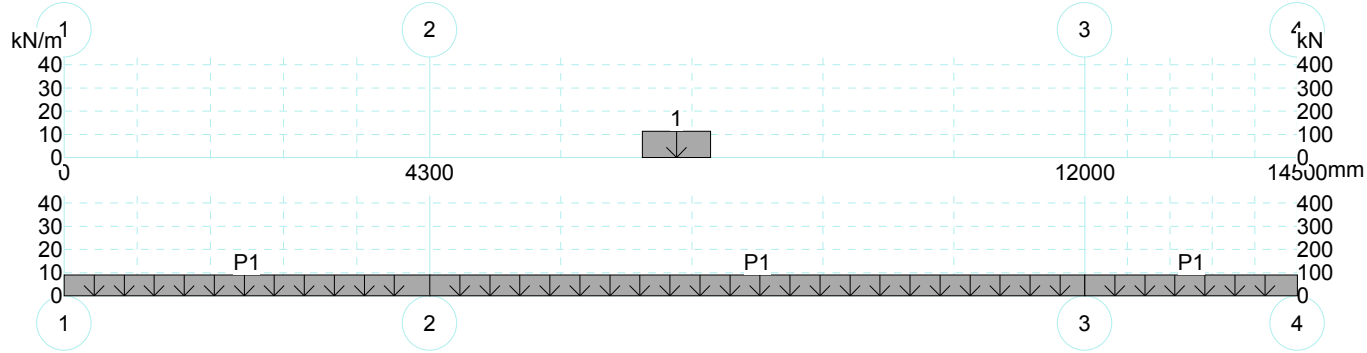


Load Case 2 : 2. Initial Dead Load



Load Case 3 : 3. Extra Dead Load

Load Case 4 : 4. Live Load



Reinforcement

Reinforcement Use	Reinforcement Type	Preferred Bar Size	Number of Legs
	List	List	#
Flexural Bar	N 500MPa		
Flexural Mesh	F 450MPa		
Shear Option 1	N 500MPa	12	2
Shear Option 2	N 500MPa	12	4
Shear Option 3	N 500MPa	12	6
Punching Shear	N 500MPa	12	1

Reinforcement

	Maximum Bar Spacing	Minimum Bar Spacing	Minimum Continuous Reinforcement	Minimum Span Reinforcement into End Support	Minimum Span Reinforcement into Internal Support	Infill Bars	Stagger Bars
	mm	mm	#.#	#.#	#.#	Y/N	Y/N
Support Reinforcement	300	60	0			N	N
Span Reinforcement	300	60		0	0	N	N

Design Zones : Top

Layer Number	Steel type	Left End Reference Column	Distance to left end of bar	Bar stagger length at left end	Top Cover at left end	Right End Reference Column	Distance to right end of bar	Bar stagger length at right end	Top Cover at Right end	Maximum Bar Size	Minimum Bar Size	Preferred bar size
	List	#	mm	mm	mm	#	mm	mm	mm	List	List	List
1	Bar	1	0	0	30	4	0	0	30	36	16	28

Layer Number	Minimum Number of Bars	Maximum Spacing of Bars	Minimum Steel area as %	% in Flange
	#	mm	%	%
1	0	0	0	0

Design Zones : Bottom

Layer Number	Steel type	Left End Reference Column	Distance to left end of bar	Bar stagger length at left end	Bottom Cover at left end	Right End Reference Column	Distance to right end of bar	Bar stagger length at right end	Bottom Cover at Right End	Maximum Bar Size	Minimum Bar Size	Preferred bar size
	List	#	mm	mm	mm	#	mm	mm	mm	List	List	List
1	Bar	1	0	0	30	4	0	0	30	36	16	28

Layer Number	Minimum Number of Bars	Maximum Spacing of Bars	Minimum Steel area as %	% in Flange
	#	mm	%	%
1	0	0	0	0

User Defined : Top

Layer Number	Steel type	Left End Reference Column	Distance to left end of bar	Bar stagger length at left end	Top Cover at left end	% Development of Left End of Bar in Tension	% Development of Left End of Bar in Compression	Right End Reference Column	Distance to right end of bar	Bar stagger length at right end	Top Cover at Right end
	List	#	mm	mm	mm	%	%	#	mm	mm	mm
1	N 500MPa	1	0	0	30	100	0	4	0	0	30

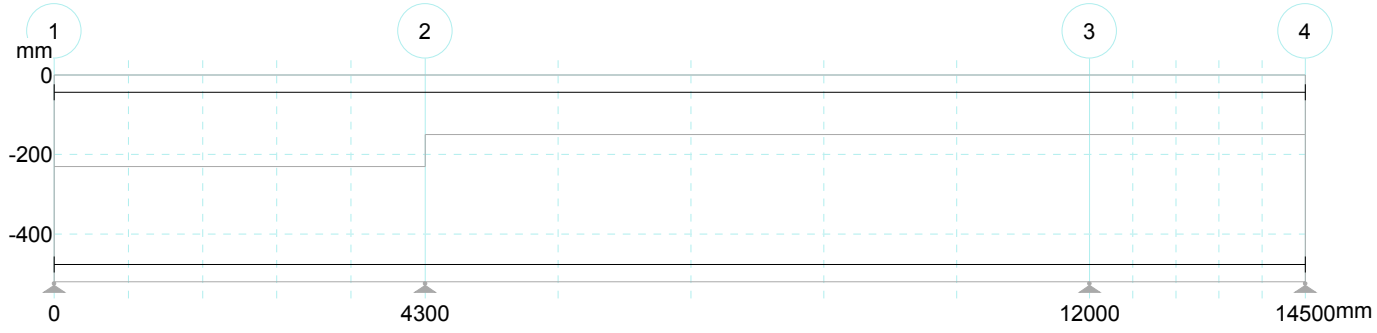
Layer Number	% Development of Right End of Bar in Tension	% Development of Right End of Bar in Compression	Bar Size	Number of Bars	Spacing of Bars	% in Flange	Layer attached after the PreExisting Load Case
	%	%	List	#	mm	%	Y/N
1	100	0	28	10	0	0	N

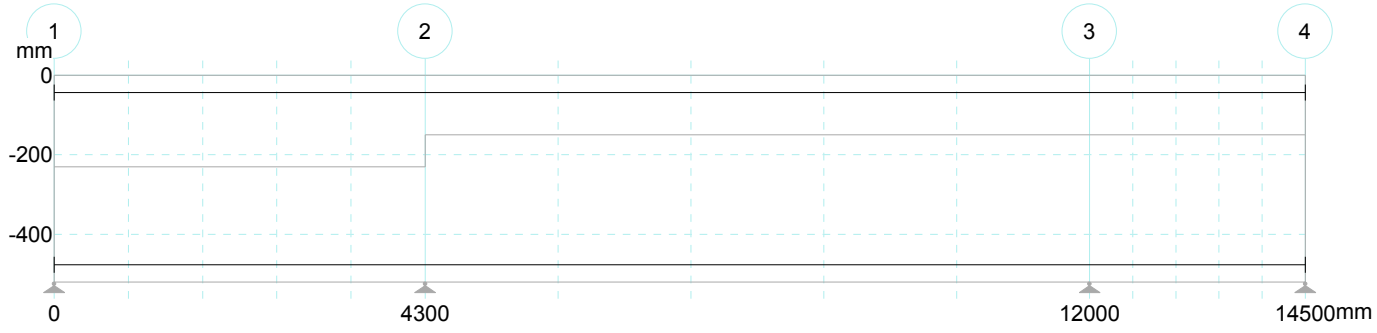
User Defined : Bottom

Layer Number	Steel type	Left End Reference Column	Distance to left end of bar	Bar stagger length at left end	Bottom Cover at Left end	% Development of Left End of Bar in Tension	% Development of Left End of Bar in Compression	Right End Reference Column	Distance to right end of bar	Bar stagger length at right end	Bottom Cover at Right End
	List	#	mm	mm	mm	%	%	#	mm	mm	mm
1	N 500MPa	1	0	0	30	100	0	4	0	0	30

Layer Number	% Development of Right End of Bar in Tension	% Development of Right End of Bar in Compression	Bar Size	Number of Bars	Spacing of Bars	% in Flange	Layer attached after the PreExisting Load Case
	%	%	List	#	mm	%	Y/N
1	100	0	28	10	0	0	N

Reinforcement Design Zones





Design Data

Capacity Reduction factor (phi) for Flexure	#.#	0.8
Capacity Reduction factor (phi) for Shear	#.#	0.7
Material Factor for Concrete in Flexure	#.#	1
Material Factor for Concrete in Shear	#.#	1
Material Factor for Reinforcement	#.#	1
Maximum Ratio of Neutral Axis Depth for Ductility	#.#	0.4
Ductility Limit - Strain	#.#	0
Ductility Check at Left End Column	Y/N	Y
Ductility Check at Right End Column	Y/N	Y
Minimum Reinforcement Strength Limit - #.## x M*	#.#	0
Flexural Critical Section - Consider Transverse Beams	Y/N	Y
Flexural Critical Section - Distance from centre of Support	#.#	-1
Beam Left Sideface Cover (Internal)	mm	25
Beam Right Sideface cover	mm	40
Prestress Minimum Reinforcement Basis	List	Program Default
Shear Enhancement at Supports	Y/N	N
Ast Value in Shear Calculations	List	Calculated
Limit Reinforcement Strain	Y/N	Y
Include Strain Hardening of Reinforcement	Y/N	N
Beam Shear Critical Section Location	List	Code Critical Section

Maximum Service Stress Change - Prestressed Sections	MPa	0
Maximum Service Stress Change - Reinforced Sections	MPa	0
Relative Humidity	%	50
Average Temperature	C.	20
Prestress Losses Calculations based on	List	Program Default
Crack Width Calculations	List	Code default
AS3600 Shrinkage and Temperature Reinforcement	List	Moderate
Degree of Restraint in Primary Direction	%	0
Degree of Restraint in Secondary Direction	%	0
Concrete Strength Gain Rate	List	N

Concrete Tensile Strength for Deflection Calculations- #.## x (Fc)n	#.#	-1
Maximum Value of Ieff/Igross for Deflection Calculations	#.#	0.6
Total Deflection Warning Limit - Maximum Span/Deflection	#.#	500
Total Deflection Warning Limit - Maximum Deflection	mm	30
Incremental Deflection Warning Limit - Maximum Span/Deflection	#.#	500
Incremental Deflection Warning Limit - Maximum Deflection	mm	30
Initial Time for Shrinkage	List	Full Shrinkage
Time of Loading in days	#.#	10
Age Adjustment Factor	#.#	0.76
Concrete Strength at Time of Loading	MPa	33.8
Loaded Period in years	#.#	30
Tension stiffening Approach	List	Modified Concrete Tensile Modulus Method

Live Load Pattern Factor	#.#	1
Pattern Live Load for Ultimate Strength	Y/N	Y
Pattern Live Load for Crack Control	Y/N	Y
Pattern Live Load For Deflections	Y/N	Y
Pattern Live Load for Deflection Permanent Load Combination	Y/N	N

Material Properties

Concrete : Standard Concrete - Australia : Concrete Strength Basis - Cylinder

Description	A	40MPa
Characteristic Compressive Strength	MPa	40
Mean Compressive Strength	MPa	48.51
Lower Characteristic Tensile Strength	MPa	3.79
Upper Characteristic Tensile Strength	MPa	6.83
Concrete Density	kg/m3	2447
Design Concrete Modulus	MPa	31956.2
Mean Concrete Modulus	MPa	33721.2
Basic Shrinkage Strain	mm/mm	1000
Shrinkage Multiplier	#.#	1
Basic Creep Factor	#.#	2.8
Creep Multiplier	#.#	1
Concrete Strain at Peak Stress	#.#	0.002
Squash Load Factor	#.#	0.9
Concrete Strain Limit	#.#	0.004
Strength Gain Rate	List	Normal

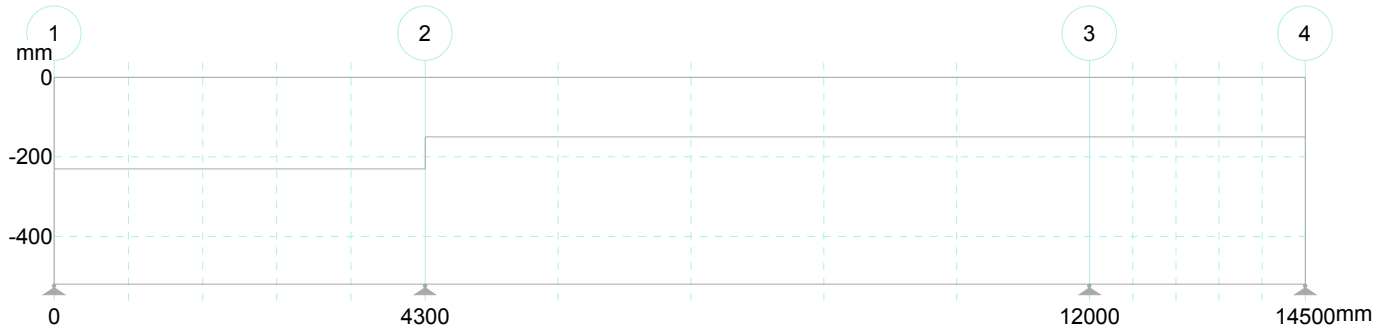
Reinforcement Bar

Designation	Type	Yield Stress	Elastic Modulus	Ductility	Peak Strain	Peak Stress	Design Strain Limit	Material Factor Flexure	Material Factor Shear	Material Capacity Reduction Factor - Flexure	Material Capacity Reduction Factor - Shear	Include as Flexural Reinforcement for Shear
N	Deformed	500	2e5	N	0.05	540	90	-1	-1	-1	-1	Y

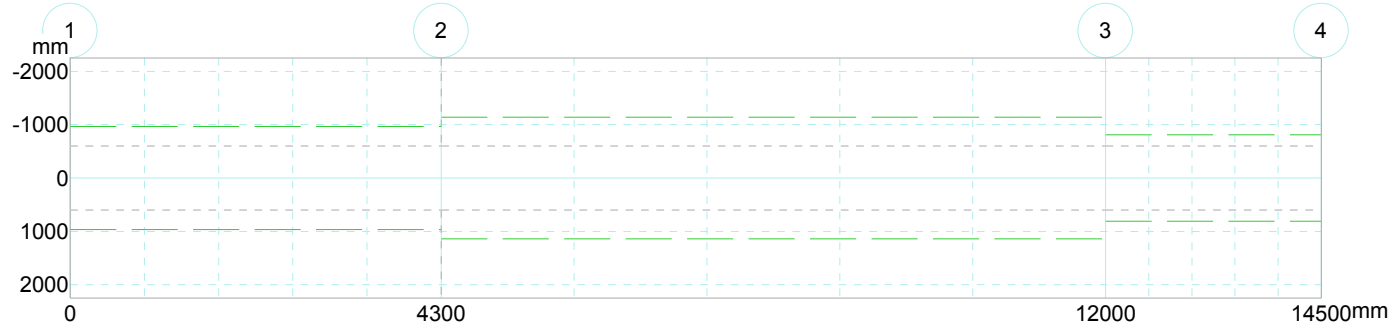
Description

Nominal Bar Size	Bar Diameter	Bar Area	Bar Inertia	Bar Weight	Stock Length
A	mm	mm2	mm4	kg/m	mm
10	10	78.5	491.07	0.62	12000
12	12	113	1018.29	0.89	12000
16	16	201	3218.29	1.58	12000
20	20	314	7857.14	2.47	12000
24	24	452	16292.6	3.55	12000
28	28	616	30184	4.83	12000
32	32	804	51492.6	6.31	12000
36	36	1020	82481.1	7.99	12000
40	40	1260	1.257e5	9.86	12000

Elevation view



Plan view



Warnings

Input

No errors or warnings were found.

Output

Warning:Total Deflection span/deflection ratio in at least one span is less than defined limit.

Bending Moments

Load Cases

Column Actions

Col No. 1		Self Weight	Initial Dead Load	Extra Dead Load	Live Load
Moment Above	kNm	-0	-0	-0	-0
Moment Below	kNm	-0	-0	-0	-0
Reaction	kN	45.28	2.62	-54.71	-8.29
Elastic Rotation	#.#	0	0	-2.97e-4	0

Col No. 1		Self Weight	Initial Dead Load	Extra Dead Load	Live Load
Elastic Axial Shortening	mm	0	0	0	0

Col No. 2		Self Weight	Initial Dead Load	Extra Dead Load	Live Load
Moment Above	kNm	-0	-0	-0	-0
Moment Below	kNm	-0	-0	-0	-0
Reaction	kN	212.87	15.77	291.44	153.37
Elastic Rotation	#.#	1.09e-4	0	6.06e-4	2.37e-4
Elastic Axial Shortening	mm	0	0	0	0

Col No. 3		Self Weight	Initial Dead Load	Extra Dead Load	Live Load
Moment Above	kNm	-0	-0	-0	-0
Moment Below	kNm	-0	-0	-0	-0
Reaction	kN	185.37	15.08	230.25	130.78
Elastic Rotation	#.#	-1.37e-4	0	-3.5e-4	-1.56e-4
Elastic Axial Shortening	mm	0	0	0	0

Col No. 4		Self Weight	Initial Dead Load	Extra Dead Load	Live Load
Moment Above	kNm	-0	-0	-0	-0
Moment Below	kNm	-0	-0	-0	-0
Reaction	kN	-9.51	-0.84	-89.35	-32.35
Elastic Rotation	#.#	0	0	1.73e-4	0
Elastic Axial Shortening	mm	0	0	0	0

Load Combinations

Column Actions

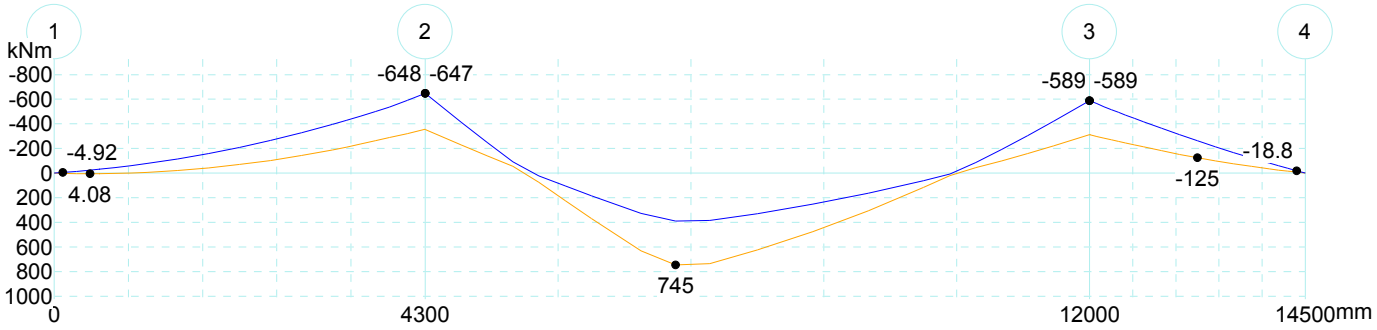
Col No. 1		Characteristic Service	Characteristic Service (Reversal)	Service	Service (Reversal)	Ultimate Flexure	Ultimate Flexure (Reversal)	Ultimate Shear	Ultimate Shear (Reversal)
Moment Above	kNm	0	0	0	0	0	0	0	0
Moment Below	kNm	0	0	0	0	0	0	0	0
Reaction	kN	-15.1	-15.1	-12.61	-12.61	-20.6	-20.6	-46.81	19.94
Elastic Rotation	#.#	-3.47e-4	-3.47e-4	-3.19e-4	-3.19e-4	-4.44e-4	-4.44e-4	-5.05e-4	-1.68e-4
Elastic Axial Shortening	mm	0	0	0	0	0	0	0	0

Col No. 2		Characteristic Service	Characteristic Service (Reversal)	Service	Service (Reversal)	Ultimate Flexure	Ultimate Flexure (Reversal)	Ultimate Shear	Ultimate Shear (Reversal)
Moment Above	kNm	0	0	0	0	0	0	0	0
Moment Below	kNm	0	0	0	0	0	0	0	0
Reaction	kN	673.45	673.45	627.44	627.44	854.15	854.15	481.04	854.94
Elastic Rotation	#.#	9.63e-4	9.63e-4	8.91e-4	8.91e-4	1.23e-3	1.23e-3	6.33e-4	1.23e-3
Elastic Axial Shortening	mm	0	0	0	0	0	0	0	0

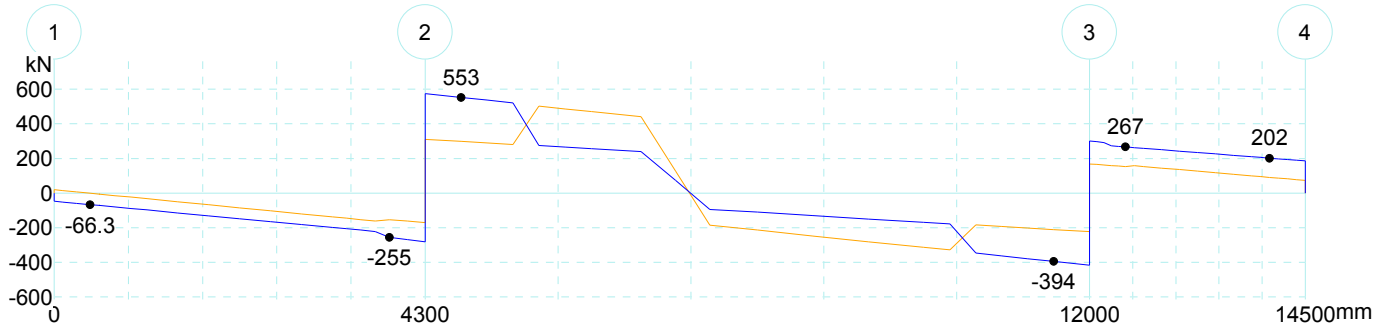
Col No. 3		Characteristic Service	Characteristic Service (Reversal)	Service	Service (Reversal)	Ultimate Flexure	Ultimate Flexure (Reversal)	Ultimate Shear	Ultimate Shear (Reversal)
Moment Above	kNm	0	0	0	0	0	0	0	0
Moment Below	kNm	0	0	0	0	0	0	0	0
Reaction	kN	561.47	561.47	522.23	522.23	713	713	390.88	717.23
Elastic Rotation	#.#	-6.54e-4	-6.54e-4	-6.07e-4	-6.07e-4	-8.31e-4	-8.31e-4	-4.36e-4	-8.38e-4
Elastic Axial Shortening	mm	0	0	0	0	0	0	0	0

Col No. 4		Characteristic Service	Characteristic Service (Reversal)	Service	Service (Reversal)	Ultimate Flexure	Ultimate Flexure (Reversal)	Ultimate Shear	Ultimate Shear (Reversal)
Moment Above	kNm	0	0	0	0	0	0	0	0
Moment Below	kNm	0	0	0	0	0	0	0	0
Reaction	kN	-132.05	-132.05	-122.35	-122.35	-168.17	-168.17	-185.65	-73.4
Elastic Rotation	#.#	3.02e-4	3.02e-4	2.8e-4	2.8e-4	3.84e-4	3.84e-4	4.01e-4	1.91e-4
Elastic Axial Shortening	mm	0	0	0	0	0	0	0	0

Ultimate Flexure



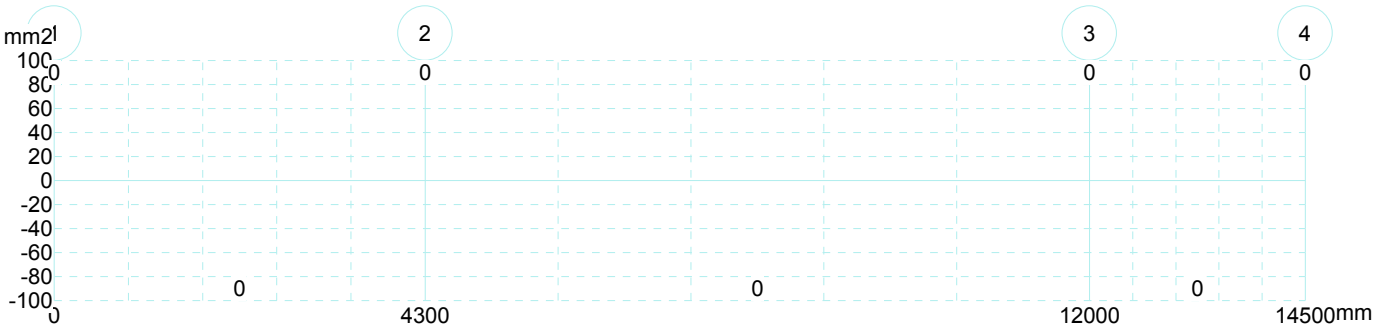
Moment Moment 1 Moment 2



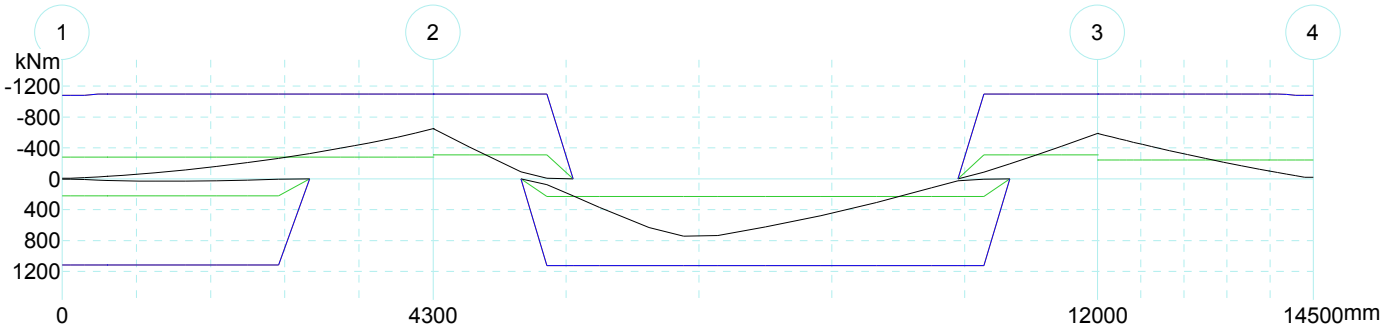
Shear Shear 1 Shear 2

Flexural Design

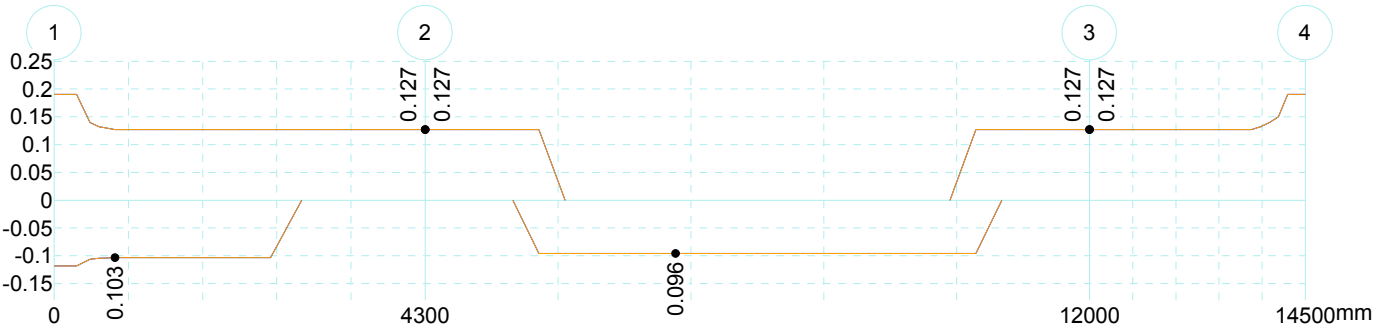
Ultimate



Reinforcement Top Total Bottom Total Top Ultimate Bottom Ultimate Min Top Min Bot



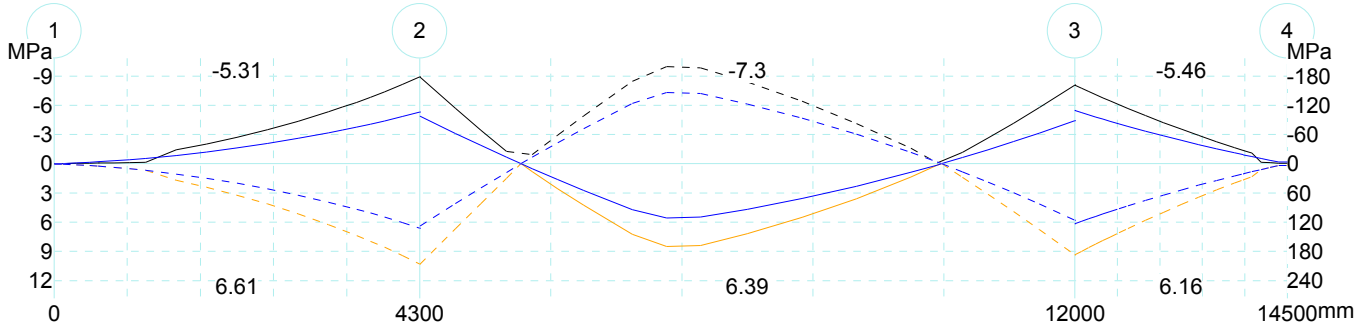
Capacity Minimum Ultimate Design Initial Final



Neutral Axis Depth Initial Final

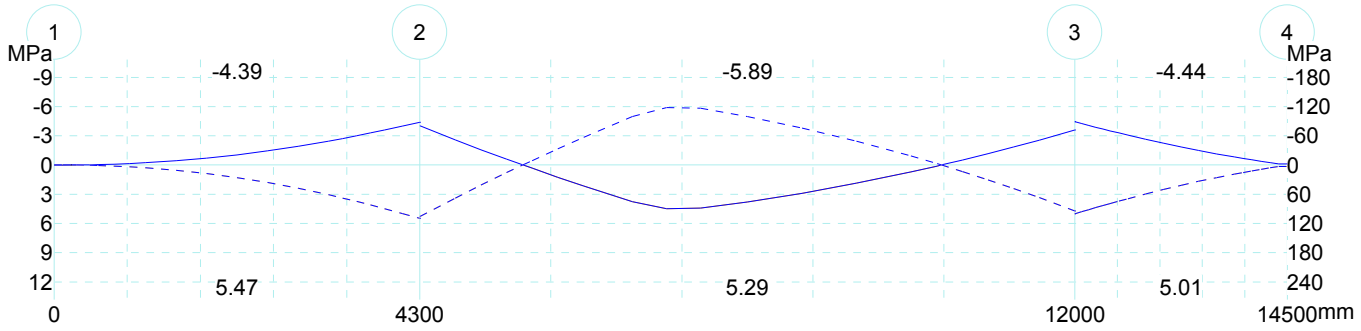
Service

Maximum Moment Condition



Gross Stress Top | Gross Stress Bottom | Cracked Compression | Reinforcement Tension

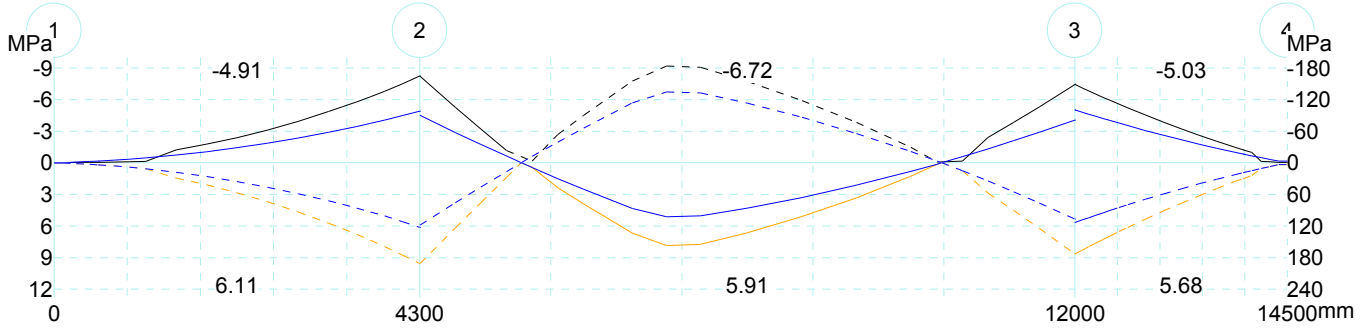
Reversal Moment Condition



Gross Stress Top | Gross Stress Bottom | Cracked Compression | Reinforcement Tension

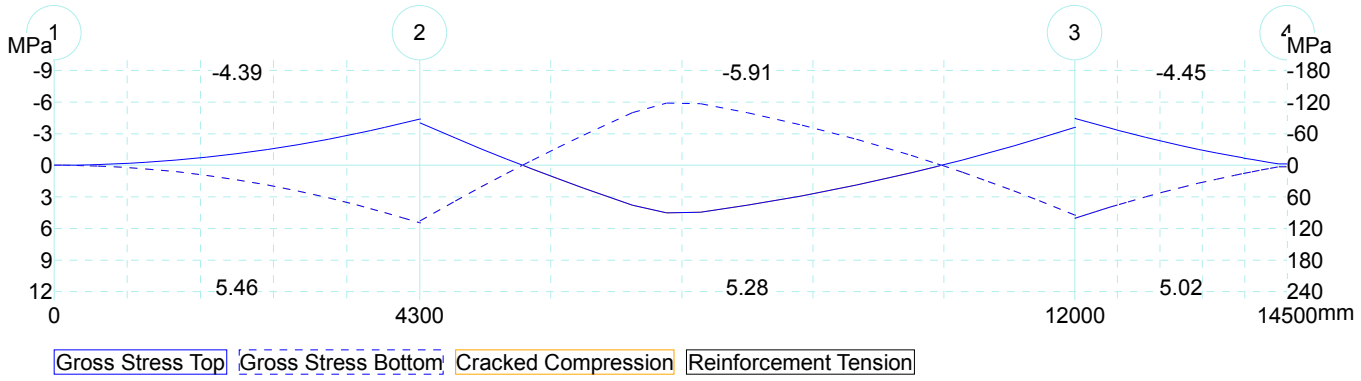
Permanent

Maximum Moment Condition



Gross Stress Top | Gross Stress Bottom | Cracked Compression | Reinforcement Tension

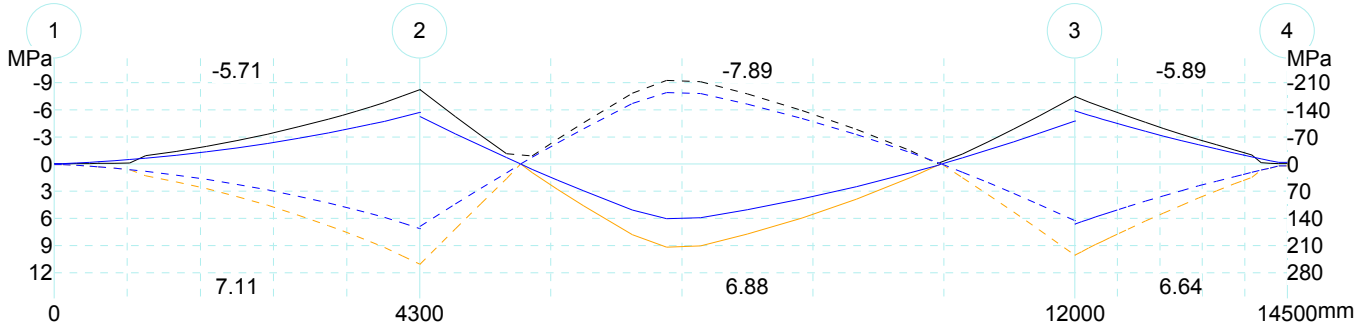
Reversal Moment Condition



Gross Stress Top | Gross Stress Bottom | Cracked Compression | Reinforcement Tension

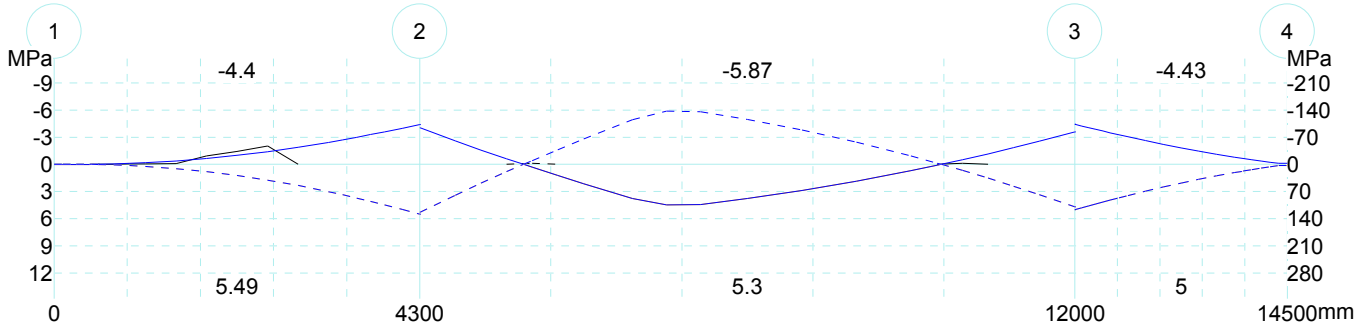
Characteristic Service

Maximum Moment Condition



Gross Stress Top | Gross Stress Bottom | Cracked Compression | Reinforcement Tension

Reversal Moment Condition



Gross Stress Top | Gross Stress Bottom | Cracked Compression | Reinforcement Tension

Shear Design

Beam

Span 1

Locat	V*	Mv*	Mdec	d	Ast	bv	phi Vuc	phi Vut	phi Vu	Phi Vumax	phi VuMin	phi Vus	Theta	Asv/s
mm	kN	kNm	kNm	mm	mm2	mm	kN	kN	kN	kN	kN	kN	#.#	mm2/mm
100	-51.5	-4.92	0	476	0	1200	0	0	0	3198.72	0	0	0	0
416	-66.32	-23.53	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
519	-71.44	-28.95	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
521	-71.56	-29.09	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
705	-80.41	-43.09	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
889	-89.04	-58.68	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
1075	-99.4	-71.96	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
1433	-116.46	-104.88	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
1791	-135.67	-150.23	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
2150	-156.22	-196.29	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
2509	-175.31	-249.76	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
2867	-195.21	-311.47	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
3225	-216.83	-385.22	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
3392	-225.97	-419.07	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
3556	-235.87	-456.94	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
3720	-245.78	-496.44	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
3884	-255.4	-536.45	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0

Locat	V*	Mv*	Mdec	d	Ast	bv	phi Vuc	phi Vut	phi Vu	Phi Vumax	phi VuMin	phi Vus	Theta	Asv/s
mm	kN	kNm	kNm	mm	mm2	mm	kN	kN	kN	kN	kN	kN	#.#	mm2/mm
4299	-280.46	-647.64	0	476	0	1200	0	0	0	3198.72	0	0	0	0

Spacing of Sets				Minimum Legs	Shear Comments
2 legs N12	4 legs N12	6 legs N12	Min legs N12		
mm	mm	mm	mm	#	A
0	0	0	0	0	
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel

Span 2

Locat	V*	Mv*	Mdec	d	Ast	bv	phi Vuc	phi Vut	phi Vu	Phi Vumax	phi VuMin	phi Vus	Theta	Asv/s
mm	kN	kNm	kNm	mm	mm2	mm	kN	kN	kN	kN	kN	kN	#.#	mm2/mm
1	574.37	-647.35	0	476	0	1200	0	0	0	3198.72	0	0	0	0
416	552.6	-413.5	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	179.06	30	0.84
717	536.8	-249.55	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	163.27	30	0.84
1018	521.57	-92.94	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	148.03	30	0.84
1319	505.77	61.67	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	132.24	30	0.84
1620	489.98	211.53	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	116.45	30	0.84
1925	475.96	350.94	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	102.43	30	0.84
2500	445.79	615.95	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	72.26	30	0.84
2900	164.27	637.83	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
3300	-195.72	714.73	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
3850	-224.58	599.15	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
4493	-253.1	459.79	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
5134	-283.43	298.42	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
5775	-317.06	105.97	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
6080	-331.41	14.02	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
6381	-347.2	-88.11	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
6682	-363	-194.99	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
6983	-378.36	-304.4	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	4.82	30	0.84
7284	-394.15	-420.66	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	20.62	30	0.84
7699	-415.93	-588.75	0	476	0	1200	0	0	0	3198.72	0	0	0	0

Spacing of Sets				Minimum Legs	Shear Comments
2 legs N12	4 legs N12	6 legs N12	Min legs N12		
mm	mm	mm	mm	#	A
0	0	0	0	0	
269	390	390	390	4	Minimum Steel
269	390	390	390	4	Minimum Steel
269	390	390	390	4	Minimum Steel
269	390	390	390	4	Minimum Steel
269	390	390	390	4	Minimum Steel
269	390	390	390	4	Minimum Steel
269	390	390	390	4	Minimum Steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel

Spacing of Sets				Minimum Legs	Shear Comments
2 legs N12	4 legs N12	6 legs N12	Min legs N12		
mm	mm	mm	mm	#	A
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
269	390	390	390	4	Minimum Steel
269	390	390	390	4	Minimum Steel
0	0	0	0	0	

Span 3

Locat	V*	Mv*	Mdec	d	Ast	bv	phi Vuc	phi Vut	phi Vu	Phi Vumax	phi VuMin	phi Vus	Theta	Asv/s
mm	kN	kNm	kNm	mm	mm2	mm	kN	kN	kN	kN	kN	kN	#.#	mm2/mm
1	301.2	-588.86	0	476	0	1200	0	0	0	3198.72	0	0	0	0
416	279.62	-468.78	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
520	274.16	-439.99	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
625	269.26	-412.64	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
833	258.35	-357.77	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
1041	248.52	-306.75	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
1250	239.15	-257.95	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
1459	228.93	-211.27	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
1667	219.42	-164.57	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
1875	211.22	-121.76	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
1979	206.26	-101.51	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
1981	206.18	-101.1	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
2084	202.17	-80.07	0	476	0	1200	373.53	99999	373.53	3198.72	636.34	0	30	0
2400	189.55	-18.76	0	476	0	1200	0	0	0	3198.72	0	0	0	0

Spacing of Sets				Minimum Legs	Shear Comments
2 legs N12	4 legs N12	6 legs N12	Min legs N12		
mm	mm	mm	mm	#	A
0	0	0	0	0	
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	No shear steel
0	0	0	0	0	

Punching

Column Head Critical Section

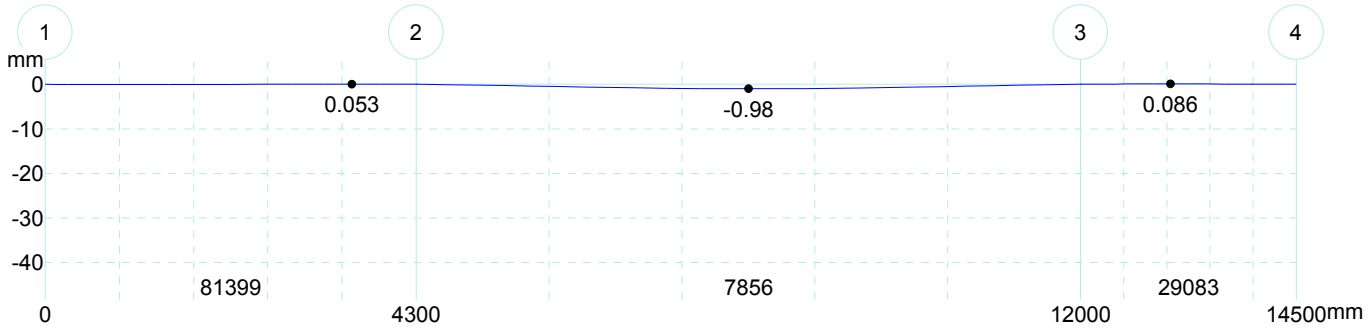
Column No.	Bh	a	at	u	d	fcv	P/A	Asw/s min	V*	Mv*	phi Vuo	phi Vu	phi VuMin	phi Vumax	side beam	Moment Transfer	Asw/s reqd
A	#.#	mm	mm	mm	mm	MPa	MPa	mm2/mm	kN	kNm	kN	kN	kN	kN	A	A	mm2/mm
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0

result
A
Check Not Carried Out!
Check Not Carried Out!
Check Not Carried Out!
Check Not Carried Out!

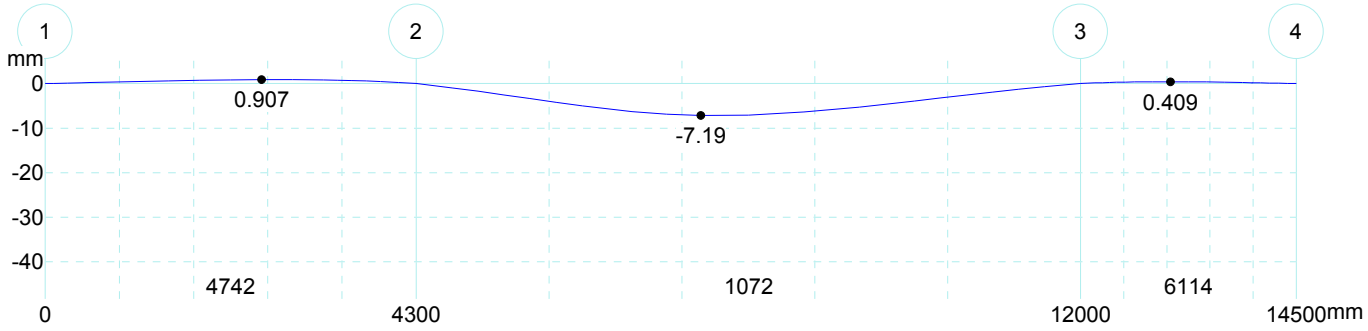
Deflections

All Spans Loaded

Transfer

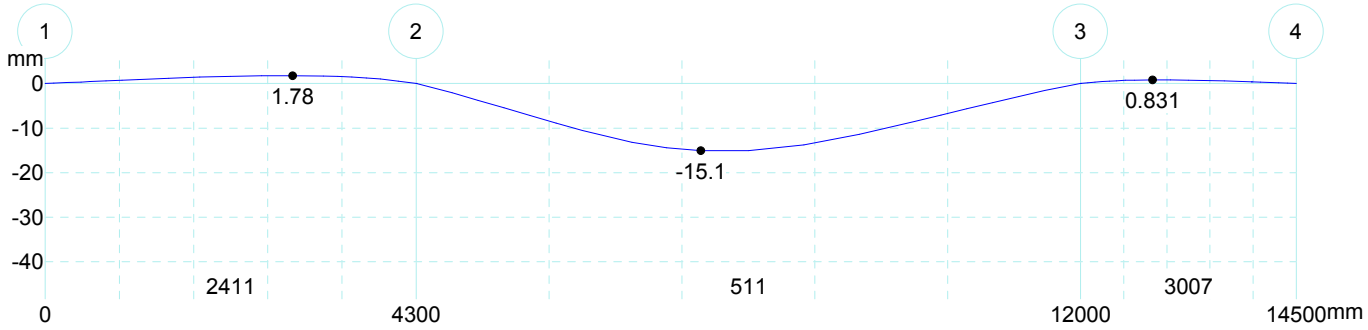


Short Term



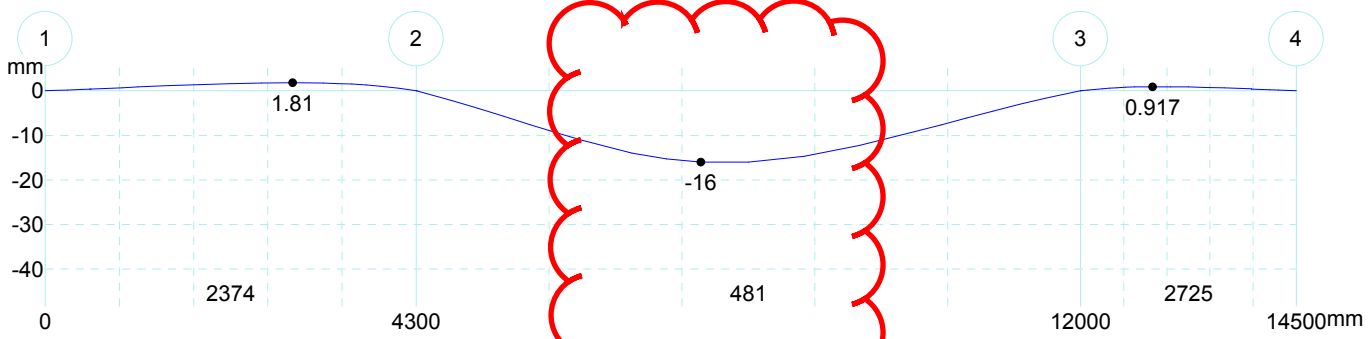
Even Spans Loaded | Odd Spans Loaded | All Spans Loaded

Incremental



Even Spans Loaded | Odd Spans Loaded | All Spans Loaded

Total Long Term



Even Spans Loaded | Odd Spans Loaded | All Spans Loaded

Span 2

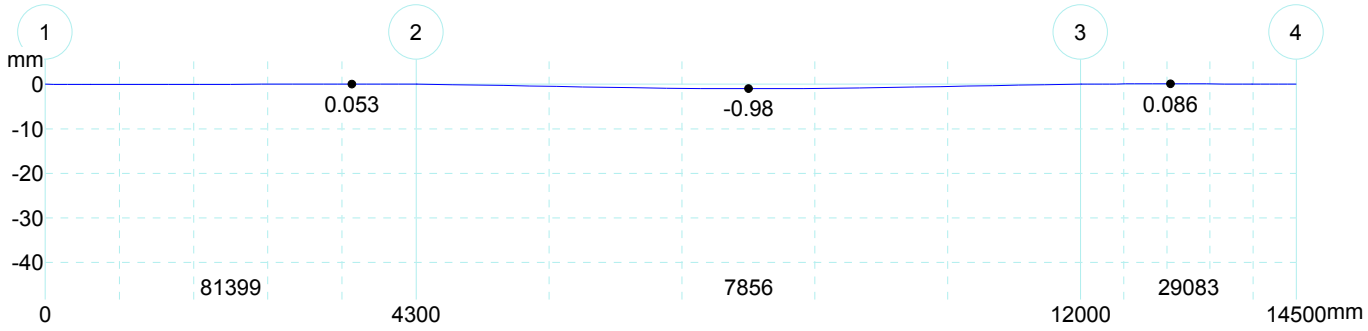
Design Comments:-

- Total Span/Deflection ratio less than user defined limit = 481

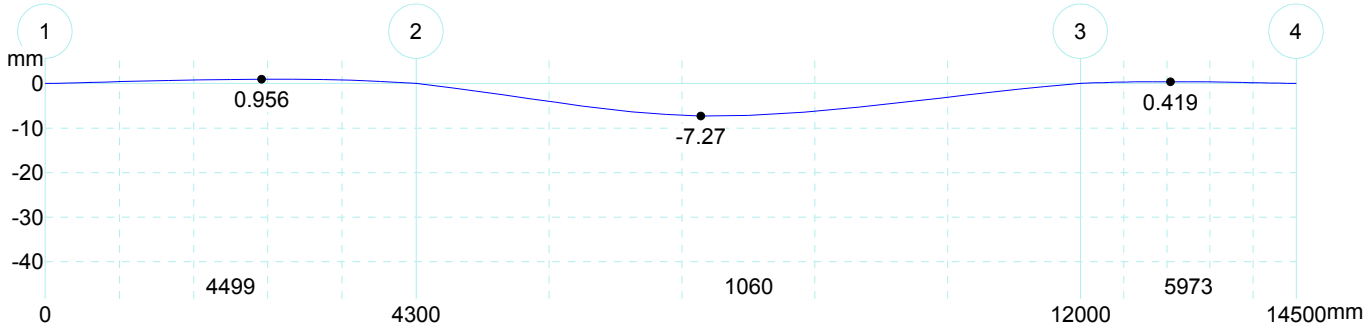
SHORT OF LESS THAN 5%, ACCEPATBLE

Even Spans Loaded

Transfer

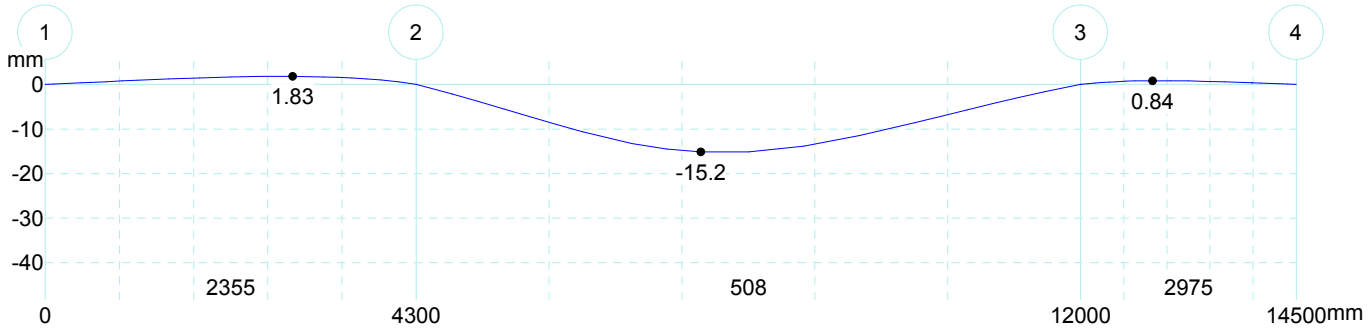


Short Term



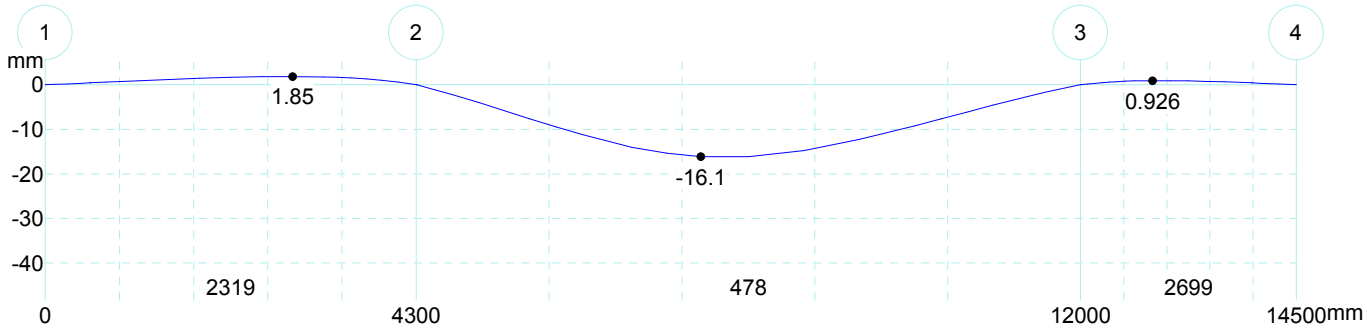
All Spans Loaded | Odd Spans Loaded | Even Spans Loaded

Incremental



All Spans Loaded | Odd Spans Loaded | Even Spans Loaded

Total Long Term



All Spans Loaded | Odd Spans Loaded | Even Spans Loaded

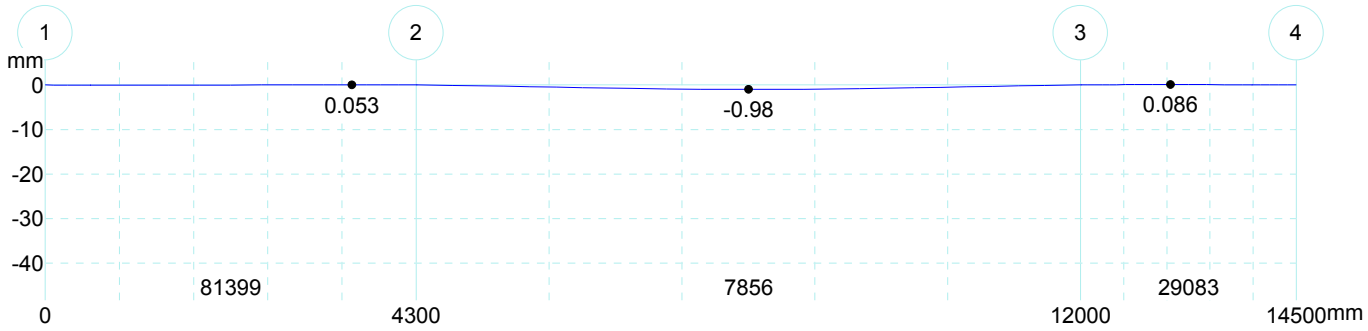
Span 2

Design Comments:-

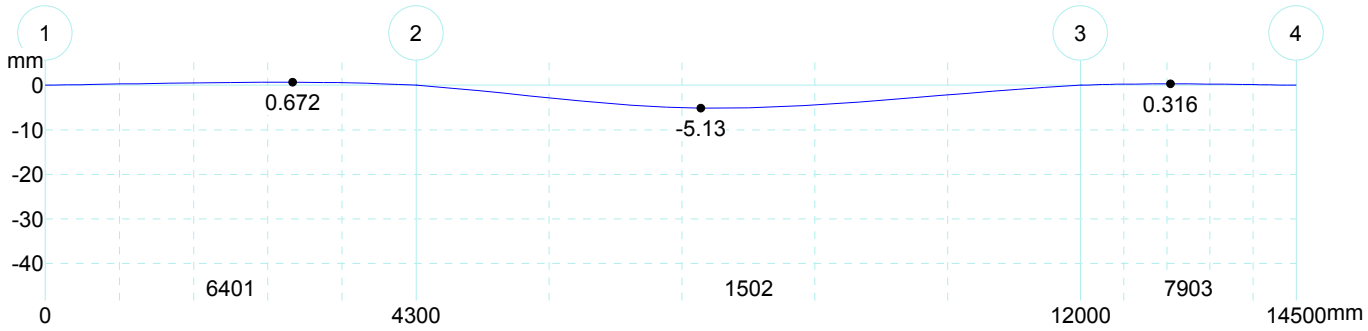
- Total Span/Deflection ratio less than user defined limit = 478

Odd Spans Loaded

Transfer

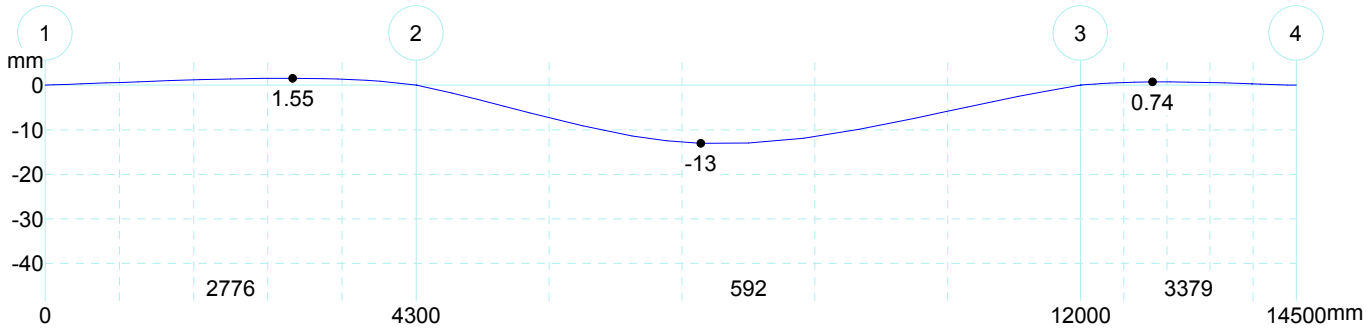


Short Term



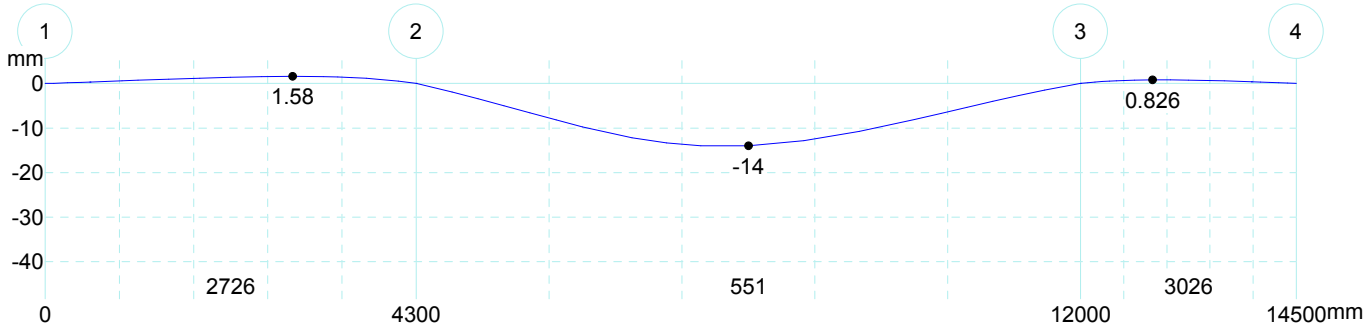
All Spans Loaded | Even Spans Loaded | Odd Spans Loaded

Incremental



All Spans Loaded | Even Spans Loaded | Odd Spans Loaded

Total Long Term



All Spans Loaded | Even Spans Loaded | Odd Spans Loaded

Detailed Reinforcement

Span 1

	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
100	40	300	0	44	1931	No Steel Added	40	300	0	476	1200	No Steel Added
258	40	300	0	44	1931	No Steel Added	0	0	0	476	1200	No Steel Added
416	40	300	0	44	1931	No Steel Added	0	0	0	476	1200	No Steel Added
519	40	300	0	44	1931	No Steel Added	0	0	0	476	1200	No Steel Added

	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
521	40	300	0	44	1931	No Steel Added	0	0	0	476	1200	No Steel Added
705	40	300	0	44	1931	No Steel Added	0	0	0	476	1200	No Steel Added
889	40	300	0	44	1931	No Steel Added	0	0	0	476	1200	No Steel Added
1075	40	300	0	44	1931	No Steel Added	0	0	0	476	1200	No Steel Added
1433	40	300	0	44	1931	No Steel Added	0	0	0	476	1200	No Steel Added
1791	40	300	0	44	1931	No Steel Added	0	0	0	476	1200	No Steel Added
2150	40	300	0	44	1931	No Steel Added	0	0	0	476	1200	No Steel Added
2509	40	300	0	44	1931	No Steel Added	0	0	0	476	1200	No Steel Added
2867	40	300	0	44	1931	No Steel Added	0	0	0	476	1200	No Steel Added
3225	40	300	0	44	1931	No Steel Added	0	0	0	476	1200	No Steel Added
3392	40	300	0	44	1931	No Steel Added	0	0	0	476	1200	No Steel Added
3556	36	300	0	44	1931	No Steel Added	0	0	0	476	1200	No Steel Added
3720	36	300	0	44	1931	No Steel Added	0	0	0	476	1200	No Steel Added
3884	32	300	0	44	1931	No Steel Added	0	0	0	476	1200	No Steel Added
4092	28	297	0	44	1931	No Steel Added	0	0	0	476	1200	No Steel Added
4299	28	278	0	44	1931	No Steel Added	0	0	0	476	1200	No Steel Added

Shear Reinforcement				
	Spacing of Sets			
Area	2 legs N12	4 legs N12	6 legs N12	Shear Comments
mm2/mm	mm	mm	mm	A
0	0	0	0	
0	0	0	0	
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	
0	0	0	0	

Design Comments:-
- - Column Grid 1 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Column Grid 2 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 1 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

Span 2

	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
1	28	278	0	44	2278	No Steel Added	0	0	0	476	1200	No Steel Added
416	40	300	0	44	2278	No Steel Added	0	0	0	476	1200	No Steel Added
717	40	300	0	44	2278	No Steel Added	0	0	0	476	1200	No Steel Added
1018	40	300	0	44	2278	No Steel Added	0	0	0	476	1200	No Steel Added
1319	0	0	0	44	2278	No Steel Added	40	300	0	476	1200	No Steel Added
1620	0	0	0	44	2278	No Steel Added	40	300	0	476	1200	No Steel Added
1925	0	0	0	44	2278	No Steel Added	40	300	0	476	1200	No Steel Added
2500	0	0	0	44	2278	No Steel Added	28	289	0	476	1200	No Steel Added
2900	0	0	0	44	2278	No Steel Added	24	251	0	476	1200	No Steel Added
3300	0	0	0	44	2278	No Steel Added	24	254	0	476	1200	No Steel Added
3850	0	0	0	44	2278	No Steel Added	28	291	0	476	1200	No Steel Added
4493	0	0	0	44	2278	No Steel Added	36	300	0	476	1200	No Steel Added
5134	0	0	0	44	2278	No Steel Added	40	300	0	476	1200	No Steel Added

	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
5775	0	0	0	44	2278	No Steel Added	40	300	0	476	1200	No Steel Added
6080	0	0	0	44	2278	No Steel Added	40	300	0	476	1200	No Steel Added
6381	40	300	0	44	2278	No Steel Added	0	0	0	476	1200	No Steel Added
6682	40	300	0	44	2278	No Steel Added	0	0	0	476	1200	No Steel Added
6983	40	300	0	44	2278	No Steel Added	0	0	0	476	1200	No Steel Added
7284	40	300	0	44	2278	No Steel Added	0	0	0	476	1200	No Steel Added
7699	28	299	0	44	2278	No Steel Added	0	0	0	476	1200	No Steel Added

Shear Reinforcement				
	Spacing of Sets			
Area	2 legs N12	4 legs N12	6 legs N12	Shear Comments
mm2/mm	mm	mm	mm	A
0	0	0	0	
0.84	269	390	390	Minimum Steel
0.84	269	390	390	Minimum Steel
0.84	269	390	390	Minimum Steel
0.84	269	390	390	Minimum Steel
0.84	269	390	390	Minimum Steel
0.84	269	390	390	Minimum Steel
0.84	269	390	390	Minimum Steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0.84	269	390	390	Minimum Steel
0.84	269	390	390	Minimum Steel
0	0	0	0	

Design Comments:-
- - Column Grid 2 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Column Grid 3 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 2 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

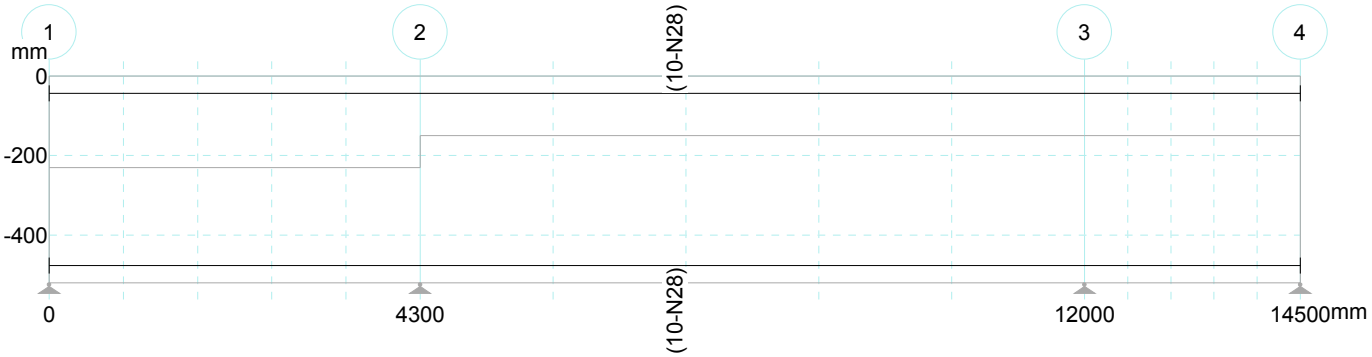
Span 3

	Top Reinforcement						Bottom Reinforcement					
Locat	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd	Max Size	Max Space	Area	Depth	Section Width	Rebar Reqd
mm	mm	mm	mm2	mm	mm	A	mm	mm	mm2	mm	mm	A
1	28	298	0	44	1625	No Steel Added	0	0	0	476	1200	No Steel Added
84	32	300	0	44	1625	No Steel Added	0	0	0	476	1200	No Steel Added
167	32	300	0	44	1625	No Steel Added	0	0	0	476	1200	No Steel Added
250	32	300	0	44	1625	No Steel Added	0	0	0	476	1200	No Steel Added
333	36	300	0	44	1625	No Steel Added	0	0	0	476	1200	No Steel Added
416	36	300	0	44	1625	No Steel Added	0	0	0	476	1200	No Steel Added
520	40	300	0	44	1625	No Steel Added	0	0	0	476	1200	No Steel Added
625	40	300	0	44	1625	No Steel Added	0	0	0	476	1200	No Steel Added
833	40	300	0	44	1625	No Steel Added	0	0	0	476	1200	No Steel Added
1041	40	300	0	44	1625	No Steel Added	0	0	0	476	1200	No Steel Added
1250	40	300	0	44	1625	No Steel Added	0	0	0	476	1200	No Steel Added
1459	40	300	0	44	1625	No Steel Added	0	0	0	476	1200	No Steel Added
1667	40	300	0	44	1625	No Steel Added	0	0	0	476	1200	No Steel Added
1875	40	300	0	44	1625	No Steel Added	0	0	0	476	1200	No Steel Added
1979	40	300	0	44	1625	No Steel Added	0	0	0	476	1200	No Steel Added
1981	40	300	0	44	1625	No Steel Added	0	0	0	476	1200	No Steel Added
2084	40	300	0	44	1625	No Steel Added	0	0	0	476	1200	No Steel Added
2190	40	300	0	44	1625	No Steel Added	0	0	0	476	1200	No Steel Added
2295	40	300	0	44	1625	No Steel Added	0	0	0	476	1200	No Steel Added
2400	40	300	0	44	1625	No Steel Added	0	0	0	476	1200	No Steel Added

Shear Reinforcement				
	Spacing of Sets			
Area	2 legs N12	4 legs N12	6 legs N12	Shear Comments
mm2/mm	mm	mm	mm	A
0	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	No shear steel
0	0	0	0	
0	0	0	0	
0	0	0	0	

Design Comments:-
- - Column Grid 3 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 3 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

Reinforcement Layout



- - Column Grid 1 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Column Grid 2 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 1 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

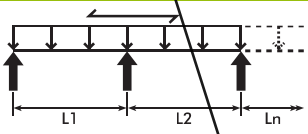
- - Column Grid 2 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Column Grid 3 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 2 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

- - Column Grid 3 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.
- - Span 3 - Required Bar Size is smaller than the Preferred Bar Size. Maintaining the same cover will require slightly less reinforcement than calculated.

SLAB

PROVIDE N16-200 FIRE REO BTM FOR ALL BONDEK/KINGFLOR SLABS AS PER SPECIFICATIONS TO ACHIEVE 120 MIN FRP. STRUCTURAL PLAN REVISED.

RF55® Fire Resistance
Continuous Span - Floor Live Load 3.0kPa



3.0kPa

Span (mm)	60 minutes				90 minutes				180 minutes			
	Dcs	Mesh	Bars	Fire Reo	Dcs	Mesh	Bars	Fire Reo	Dcs	Mesh	Bars	Fire Reo
1,000	105	SL72	N10@400	-	105	SL72	N10@400	-	140	SL102	N10@400	-
1,500	105	SL72	N10@400	-	105	SL72	N10@400	-	140	SL102	N10@400	-
2,000	105	SL72	N10@400	-	105	SL72	N10@400	-	140	SL102	N10@400	-
2,500	105	SL72	N10@400	-	105	SL72	N10@400	1xN10/600✦	140	SL102	N10@400	-
3,000	105	SL72	N10@400	1xN10/600✦	105	SL72	N10@400	1xN10/400✦	140	SL102	N10@400	1xN10/400✶
3,500	105	SL72	N10@325	1xN10/600✦	105	SL72	N10@325	1xN10/200✦	140	SL102	N10@400	1xN10/200✶
4,000	110	SL82	N10@250	1xN10/600✦	110	SL82	N10@250	1xN10/200✦	140	SL102	N10@400	1xN12/200✶
4,500	125	SL92	N10@250	1xN10/600✦	125	SL92	N10@250	1xN10/200✦	145	SL102	N10@400	1xN16/200✶
5,000	140	SL102	N10@250	1xN10/600✦	140	SL102	N10@250	1xN10/200✦	150	SL102	N10@300	1xN16/200✶
5,500	160	SL81	N10@250	1xN10/600✦	160	SL81	N10@300	1xN10/200✦	160	SL81	N10@300	1xN16/200✶
6,000	180	SL81	N10@250	1xN10/400✦	180	SL81	N10@250	1xN10/200✦	180	SL81	N10@250	1xN16/200✶
6,500	215	RL918T	N12@200	1xN10/400✦	215	RL918T	N12@200	1xN10/200✶	215	RL918T	N12@200	1xN16/200✶
7,000	235	RL1018T	N16@300	1xN10/400✦	235	RL1018T	N16@300	1xN10/200✶	235	RL1018T	N16@300	1xN16/200✶

Table 3.11.H RF55® Fire Resistance - Continuous Span - Floor Live Load 3.0kPa

The bottom cover for fire reinforcement shall be determined in accordance to Clause 5.5.3 and Table 5.5.3(A) of AS 3600:2001. The marked reinforcements require additional thickness for the bottom cover approximately within the following ranges:

✦ 20mm
✶ 40mm
† 60mm

Shaded cells denote that internal span fire reinforcement is required.

Refer to the start of this section for additional parameters used to calculate the above table.

DELTACORE

DELTA CORPORATION LIMITED
THE STRENGTH

Deltacore

Fire Rating

Fire Rating

The fire rating or fire resistance level (FRL) of a floor is specified in the building code as the period in minutes during which the floor must retain its structural adequacy, integrity and insulation when subjected to the standard fire test and is expressed as 180/90/90 for example (i.e. 180 minutes structural adequacy / 90 minutes integrity / 90 minutes insulation).

The Concrete Structures Code, AS3600, specifies that fire resistance be met either by testing or calculation or by proportioning members to comply with certain rules. In practice the deemed-to-comply rules are adopted as a convenient method of compliance. Two criteria must be satisfied.

- Insulation requires a minimum effective thickness of concrete and a minimum thickness of concrete between adjacent cores and between a core and an exposed surface.
- Structural adequacy requires a minimum concrete cover to the strands.

The deemed-to-comply requirements are summarised below.

The effective thickness of a Deltacore plank is taken as the nett cross-sectional area divided by its width. If the effective thickness is not sufficient to achieve the required fire rating, this can be increased by providing a concrete topping or an insulating layer to the soffit.

Grouted joints of untopped planks have been shown by fire tests to provide a fire resistance level at least equal to that of the plank section. However untopped planks should be generally restricted to lower fire resistance levels unless adequate restraint or tie reinforcement at the ends of the planks can be provided to stop spreading.

If the required cover to the strand results in an inefficient design for the specified load capacity, the cover can be increased by applying an appropriate thickness of insulating material to the soffit. Continuity can also be used to increase the structural adequacy for a given cover as per AS3600, Clause 5.5.4.

Section Dimensions for Deemed-to-Comply Fire Resistance Periods

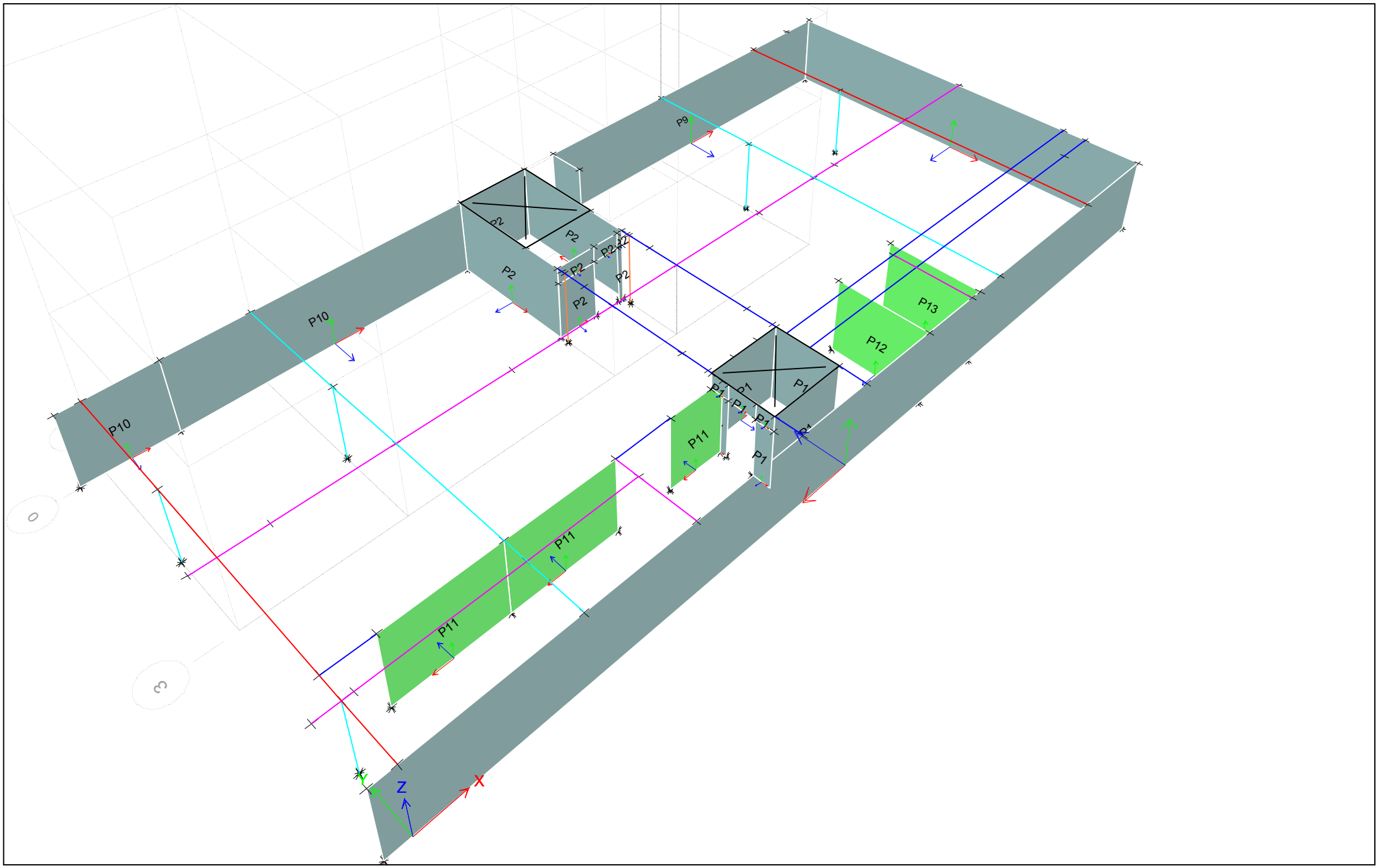
	Fire Resistance Period (minutes)					
Section Dimensions	30	60	90	120	180	240
Effective thickness (mm)	60	80	100	120	150	170
Concrete thickness between cores and between cores and exposed surfaces (mm)	25	25	25	25	30	34
Required cover to strand (mm)						
Simply-supported span	20	25	35	40	55	65
Continuous span	15	20	25	25	35	45

Deltacore floor plank	Fire Resistance Level (FRL) *	
	Simply-supported span	Continuous span
DC150	75 / 75 / 75	150 / 150 / 150
DC200	120 / 120 / 120	210 / 210 / 210
DC250	120 / 120 / 120	210 / 210 / 210
DC300	120 / 120 / 120	210 / 210 / 210
DC350	120 / 120 / 120	210 / 210 / 210
DC400	120 / 120 / 120	210 / 210 / 210

* Values based on a typical concrete topping being applied.

COMPLY WITH 90/90/90 FRL REQUIRMENT FOR APARTMENTS

PRECAST PANEL


P9
P10
P10
P2
P2
P2
P2
P2
P2
P2
P2
P2
P2
P1
P1
P1
P1
P1
P1
P1
P11
P11
P11
P12
P13
Z
X

ETABS Shear Wall Design

AS 3600-09 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (mm)	Centroid Y (mm)	Length (mm)	Thickness (mm)	LLRF
Story1	P10	6010	14500	13500	150	0.579

Material Properties

E_c (MPa)	f'_c (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
31939	40	1	500	500

Design Code Parameters

Φ_t	Φ_c	Φ_v	IP_{MAX}	IP_{MIN}	P_{MAX}
0.75	0.6	0.7	0.02	0.002	0.8

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 mm	Left Y_1 mm	Right X_2 mm	Right Y_2 mm	Length mm	Thickness mm
Top	Leg 1	-740	14500	12760	14500	13500	150
Bottom	Leg 1	-740	14500	12760	14500	13500	150

Flexural Design for N*, M^*_2 and M^*_3

Station Location	Required Rebar Area (mm²)	Required Reinf Ratio	Current Reinf Ratio	FlexuralCombo	N* kN	M^*_2 kN-m	M^*_3 kN-m	Pier A_g mm²
Top	4050	0.002	0.0027	Ult 05 (G+EQ+0.3Q)	-97.9	-10.3	-42.5	2025000
Bottom	4050	0.002	0.0027	Ult 05 (G+EQ+0.3Q)	-139.2	53.8	590.2	2025000

Shear Design

Station Location	ID	Rebar mm²/m	Shear Combo	N* kN	M* kN-m	V* kN	ΦV_c kN	ΦV_n kN
Top	Leg 1	375	Ult 05 (G+EQ+0.3Q)	-97.9	-42.5	356	4421.2	5838.7
Bottom	Leg 1	375	Ult 05 (G+EQ+0.3Q)	-139.2	590.2	433.6	4421.2	5838.7

Boundary Element Check

Station Location	ID	Edge Length (mm)	Governing Combo	N* kN	M* kN-m	Stress Comp MPa	Stress Limit MPa	C Depth mm	C Limit mm
Top–Left	Leg 1	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed
Top–Right	Leg 1	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed
Bottom–Left	Leg 1	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed
Botttom–Right	Leg 1	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed

ETABS Shear Wall Design

AS 3600-09 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (mm)	Centroid Y (mm)	Length (mm)	Thickness (mm)	LLRF
Story1	P2	14063.6	12271.4	9200	150	0.52

Material Properties

E_c (MPa)	f'_c (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
31939	40	1	500	500

Design Code Parameters

Φ_t	Φ_c	Φ_v	IP_{MAX}	IP_{MIN}	P_{MAX}
0.75	0.6	0.7	0.02	0.002	0.8

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 mm	Left Y_1 mm	Right X_2 mm	Right Y_2 mm	Length mm	Thickness mm
Top	Leg 1	12760	9700	15460	9700	2700	150
Top	Leg 2	15460	9700	15460	14500	4800	150
Top	Leg 3	12760	14500	15460	14500	2700	150
Top	Leg 4	12760	9700	12760	14500	4800	150
Bottom	Leg 1	12760	9700	14260	9700	1500	150
Bottom	Leg 2	15260	9700	15460	9700	200	150
Bottom	Leg 3	15460	9700	15460	14500	4800	150
Bottom	Leg 4	12760	14500	15460	14500	2700	150
Bottom	Leg 5	12760	9700	12760	14500	4800	150

Flexural Design for N*, M^*_2 and M^*_3

Station Location	Required Rebar Area (mm^2)	Required Reinf Ratio	Current Reinf Ratio	FlexuralCombo	N* kN	M^*_2 kN-m	M^*_3 kN-m	Pier A_g mm^2
Top	4500	0.002	0.0064	Ult 05 (G+EQ+0.3Q)	36.4	85.5	632.9	2250000
Bottom	4200	0.002	0.0063	Ult 05 (G+EQ+0.3Q)	61.6	-43.5	468.2	2100000

Shear Design

Station Location	ID	Rebar mm^2/m	Shear Combo	N* kN	M* kN-m	V* kN	ΦV_c kN	ΦV_n kN
Top	Leg 1	375	Ult 05 (G+EQ+0.3Q)	-58.5	35.1	13	634.3	917.8
Top	Leg 2	375	Ult 05 (G+EQ+0.3Q)	-18.2	106.4	53	1370.7	1874.7
Top	Leg 3	375	Ult 05 (G+EQ+0.3Q)	-15.9	6.1	119.9	634.3	917.8
Top	Leg 4	375	Ult 05 (G+EQ+0.3Q)	-66.7	99.8	173.8	1370.7	1874.7
Bottom	Leg 1	375	Ult 05 (G+EQ+0.3Q)	-108.1	0	7.6	135.5	293
Bottom	Leg 2	0	Ult 05 (G+EQ+0.3Q)	0	0	0	0	0
Bottom	Leg 3	375	Ult 05 (G+EQ+0.3Q)	75.7	118.1	22	1370.7	1874.7
Bottom	Leg 4	375	Ult 05 (G+EQ+0.3Q)	4.2	0.8	64.6	634.3	917.8
Bottom	Leg 5	375	Ult 05 (G+EQ+0.3Q)	-27	59.7	123	1370.7	1874.7

Boundary Element Check

Station Location	ID	Edge Length (mm)	Governing Combo	N* kN	M* kN-m	Stress Comp MPa	Stress Limit MPa	C Depth mm	C Limit mm
Top–Left	Leg 1	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed
Top–Right	Leg 1	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed
Top–Left	Leg 2	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed
Top–Right	Leg 2	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed
Top–Left	Leg 3	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed
Top–Right	Leg 3	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed
Top–Left	Leg 4	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed
Top–Right	Leg 4	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed
Bottom–Left	Leg 1	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed
Botttom–Right	Leg 1	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed
Bottom–Left	Leg 3	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed
Botttom–Right	Leg 3	0	Ult 01 (1.35G)	75.7	118.1	0.3	8	Not Required	Not Required
Bottom–Left	Leg 4	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed
Botttom–Right	Leg 4	0	Ult 01 (1.35G)	4.2	0.8	1.489E-02	8	Not Required	Not Required
Bottom–Left	Leg 5	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed
Botttom–Right	Leg 5	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed

ETABS Shear Wall Design

AS 3600-09 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (mm)	Centroid Y (mm)	Length (mm)	Thickness (mm)	LLRF
Story1	P9	23630	14500	13740	150	0.586

Material Properties

E_c (MPa)	f'_c (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
31939	40	1	500	500

Design Code Parameters

Φ_t	Φ_c	Φ_v	IP_{MAX}	IP_{MIN}	P_{MAX}
0.75	0.6	0.7	0.02	0.002	0.8

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 mm	Left Y_1 mm	Right X_2 mm	Right Y_2 mm	Length mm	Thickness mm
Top	Leg 1	16760	14500	30500	14500	13740	150
Bottom	Leg 1	16760	14500	30500	14500	13740	150

Flexural Design for N*, M^*_2 and M^*_3

Station Location	Required Rebar Area (mm²)	Required Reinf Ratio	Current Reinf Ratio	FlexuralCombo	N* kN	M^*_2 kN-m	M^*_3 kN-m	Pier A_g mm²
Top	4122	0.002	0.0027	Ult 05 (G+EQ+0.3Q)	155.6	0	-419.5	2061000
Bottom	4122	0.002	0.0027	Ult 05 (G+EQ+0.3Q)	195.4	0	312.2	2061000

Shear Design

Station Location	ID	Rebar mm²/m	Shear Combo	N* kN	M* kN-m	V* kN	ΦV_c kN	ΦV_n kN
Top	Leg 1	375	Ult 05 (G+EQ+0.3Q)	155.6	-419.5	472.9	4505.3	5948
Bottom	Leg 1	375	Ult 05 (G+EQ+0.3Q)	195.4	312.2	547.7	4505.3	5948

Boundary Element Check (Part 1 of 2)

Station Location	ID	Edge Length (mm)	Governing Combo	N* kN	M* kN-m	Stress Comp MPa	Stress Limit MPa
Top–Left	Leg 1	0	Ult 05 (G+EQ+0.3Q)	155.6	-419.5	0.2	8
Top–Right	Leg 1	0	Ult 05 (G+EQ+0.3Q)	0	0	0	0
Bottom–Left	Leg 1	0	Ult 01 (1.35G)	0	0	0	0
Botttom–Right	Leg 1	0	Ult 01 (1.35G)	195.4	312.2	0.2	8

Boundary Element Check (Part 2 of 2)

C Depth mm	C Limit mm
Not Required	Not Required
Not Needed	Not Needed
Not Needed	Not Needed
Not Required	Not Required

ETABS Shear Wall Design

AS 3600-09 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (mm)	Centroid Y (mm)	Length (mm)	Thickness (mm)	LLRF
Story1	P13	20940	1650	3300	200	0.6

Material Properties

E_c (MPa)	f'_c (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
31939	40	1	500	500

Design Code Parameters

Φ_t	Φ_c	Φ_v	IP_{MAX}	IP_{MIN}	P_{MAX}
0.75	0.6	0.7	0.02	0.002	0.8

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 mm	Left Y_1 mm	Right X_2 mm	Right Y_2 mm	Length mm	Thickness mm
Top	Leg 1	20940	0	20940	3300	3300	200
Bottom	Leg 1	20940	0	20940	3300	3300	200

Flexural Design for N*, M^*_2 and M^*_3

Station Location	Required Rebar Area (mm²)	Required Reinf Ratio	Current Reinf Ratio	FlexuralCombo	N* kN	M^*_2 kN-m	M^*_3 kN-m	Pier A_g mm²
Top	1320	0.002	0.0021	Ult 05 (G+EQ+0.3Q)	79.1	0	72	660000
Bottom	1320	0.002	0.0021	Ult 05 (G+EQ+0.3Q)	-90.9	0	30.1	660000

Shear Design

Station Location	ID	Rebar mm²/m	Shear Combo	N* kN	M* kN-m	V* kN	ΦV_c kN	ΦV_n kN
Top	Leg 1	500	Ult 05 (G+EQ+0.3Q)	79.1	72	46.7	1126.3	1588.3
Bottom	Leg 1	500	Ult 05 (G+EQ+0.3Q)	-90.9	30.1	39.8	1126.3	1588.3

Boundary Element Check

Station Location	ID	Edge Length (mm)	Governing Combo	N* kN	M* kN-m	Stress Comp MPa	Stress Limit MPa	C Depth mm	C Limit mm
Top–Left	Leg 1	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed
Top–Right	Leg 1	0	Ult 01 (1.35G)	79.1	72	0.3	8	Not Required	Not Required
Bottom–Left	Leg 1	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed
Botttom–Right	Leg 1	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed

ETABS Shear Wall Design

AS 3600-09 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (mm)	Centroid Y (mm)	Length (mm)	Thickness (mm)	LLRF
Story1	P1	14260	2110	6300	150	0.542

Material Properties

E_c (MPa)	f'_c (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
31939	40	1	500	500

Design Code Parameters

Φ_t	Φ_c	Φ_v	IP_{MAX}	IP_{MIN}	P_{MAX}
0.75	0.6	0.7	0.02	0.002	0.8

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 mm	Left Y_1 mm	Right X_2 mm	Right Y_2 mm	Length mm	Thickness mm
Top	Leg 1	12760	960	12760	3260	2300	150
Top	Leg 2	12760	960	15460	960	2700	150
Top	Leg 3	15460	960	15460	3260	2300	150
Top	Leg 4	12760	3260	15460	3260	2700	150
Bottom	Leg 1	12760	2610	12760	3260	650	150
Bottom	Leg 2	12760	960	12760	1610	650	150
Bottom	Leg 3	12760	960	15460	960	2700	150
Bottom	Leg 4	15460	960	15460	3260	2300	150
Bottom	Leg 5	12760	3260	15460	3260	2700	150

Flexural Design for N*, M^*_2 and M^*_3

Station Location	Required Rebar Area (mm²)	Required Reinf Ratio	Current Reinf Ratio	FlexuralCombo	N* kN	M^*_2 kN-m	M^*_3 kN-m	Pier A_g mm²
Top	3000	0.002	0.0117	Ult 05 (G+EQ+0.3Q)	-66.1	235.4	86.6	1500000
Bottom	2700	0.002	0.0115	Ult 05 (G+EQ+0.3Q)	-82.7	274.4	41.9	1350000

Shear Design

Station Location	ID	Rebar mm²/m	Shear Combo	N* kN	M* kN-m	V* kN	ΦV_c kN	ΦV_n kN
Top	Leg 1	0	Ult 05 (G+EQ+0.3Q)	0	0	0	0	0
Top	Leg 2	375	Ult 05 (G+EQ+0.3Q)	-132.2	9	16.3	634.3	917.8
Top	Leg 3	375	Ult 05 (G+EQ+0.3Q)	6.5	30.2	7.7	494.1	735.6
Top	Leg 4	375	Ult 05 (G+EQ+0.3Q)	37.1	-15.9	17.6	634.3	917.8
Bottom	Leg 1	0	Ult 05 (G+EQ+0.3Q)	0	0	0	0	0
Bottom	Leg 2	0	Ult 05 (G+EQ+0.3Q)	0	0	0	0	0
Bottom	Leg 3	375	Ult 05 (G+EQ+0.3Q)	-110.4	7.5	1.9	634.3	917.8
Bottom	Leg 4	375	Ult 05 (G+EQ+0.3Q)	-102.3	0.2	4.3	494.1	735.6
Bottom	Leg 5	375	Ult 05 (G+EQ+0.3Q)	2.5	1.8	15.2	634.3	917.8

Boundary Element Check (Part 1 of 2)

Station Location	ID	Edge Length (mm)	Governing Combo	N* kN	M* kN-m	Stress Comp MPa	Stress Limit MPa
Top–Left	Leg 2	0	Ult 01 (1.35G)	0	0	0	0
Top–Right	Leg 2	0	Ult 01 (1.35G)	0	0	0	0
Top–Left	Leg 3	0	Ult 01 (1.35G)	0	0	0	0
Top–Right	Leg 3	0	Ult 01 (1.35G)	6.5	30.2	0.2	8
Top–Left	Leg 4	0	Ult 05 (G+EQ+0.3Q)	37.1	-15.9	0.2	8
Top–Right	Leg 4	0	Ult 05 (G+EQ+0.3Q)	0	0	0	0
Bottom–Left	Leg 3	0	Ult 01 (1.35G)	0	0	0	0
Botttom–Right	Leg 3	0	Ult 01 (1.35G)	0	0	0	0
Bottom–Left	Leg 4	0	Ult 01 (1.35G)	0	0	0	0
Botttom–Right	Leg 4	0	Ult 01 (1.35G)	0	0	0	0
Bottom–Left	Leg 5	0	Ult 01 (1.35G)	0	0	0	0
Botttom–Right	Leg 5	0	Ult 01 (1.35G)	2.5	1.8	1.615E-02	8

Boundary Element Check (Part 2 of 2)

C Depth mm	C Limit mm
Not Needed	Not Needed
Not Needed	Not Needed
Not Needed	Not Needed
Not Required	Not Required
Not Required	Not Required
Not Needed	Not Needed
Not Needed	Not Needed
Not Needed	Not Needed
Not Needed	Not Needed
Not Needed	Not Needed
Not Needed	Not Needed
Not Required	Not Required

ETABS Shear Wall Design

AS 3600-09 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (mm)	Centroid Y (mm)	Length (mm)	Thickness (mm)	LLRF
Story1	P11	6540.1	2860	9300	200	0.6

Material Properties

E_c (MPa)	f'_c (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
31939	40	1	500	500

Design Code Parameters

Φ_t	Φ_c	Φ_v	IP_{MAX}	IP_{MIN}	P_{MAX}
0.75	0.6	0.7	0.02	0.002	0.8

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 mm	Left Y_1 mm	Right X_2 mm	Right Y_2 mm	Length mm	Thickness mm
Top	Leg 1	1460	2860	8760	2860	7300	200
Top	Leg 2	10760	2860	12760	2860	2000	200
Bottom	Leg 1	1460	2860	8760	2860	7300	200
Bottom	Leg 2	10760	2860	12760	2860	2000	200

Flexural Design for N*, M^*_2 and M^*_3

Station Location	Required Rebar Area (mm²)	Required Reinf Ratio	Current Reinf Ratio	FlexuralCombo	N* kN	M^*_2 kN-m	M^*_3 kN-m	Pier A_g mm²
Top	3720	0.002	0.0021	Ult 05 (G+EQ+0.3Q)	-27.4	0	21.8	1860000
Bottom	3720	0.002	0.0021	Ult 05 (G+EQ+0.3Q)	-24.3	0	109	1860000

Shear Design

Station Location	ID	Rebar mm²/m	Shear Combo	N* kN	M* kN-m	V* kN	ΦV_c kN	ΦV_n kN
Top	Leg 1	500	Ult 05 (G+EQ+0.3Q)	-30.2	72.2	103.4	2996.3	4018.3
Top	Leg 2	500	Ult 05 (G+EQ+0.3Q)	-2.4	4.629E-06	14.1	425	705
Bottom	Leg 1	500	Ult 05 (G+EQ+0.3Q)	-46.9	82.4	89	2996.3	4018.3
Bottom	Leg 2	500	Ult 05 (G+EQ+0.3Q)	2.7	1.333E-06	15.5	425	705

Boundary Element Check

Station Location	ID	Edge Length (mm)	Governing Combo	N* kN	M* kN-m	Stress Comp MPa	Stress Limit MPa	C Depth mm	C Limit mm
Top–Left	Leg 1	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed
Top–Right	Leg 1	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed
Top–Left	Leg 2	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed
Top–Right	Leg 2	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed
Bottom–Left	Leg 1	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed

Boundary Element Check (continued)

Station Location	ID	Edge Length (mm)	Governing Combo	N* kN	M* kN-m	Stress Comp MPa	Stress Limit MPa	C Depth mm	C Limit mm
Botttom–Right	Leg 1	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed
Bottom–Left	Leg 2	0	Ult 01 (1.35G)	0	0	0	0	Not Needed	Not Needed
Botttom–Right	Leg 2	0	Ult 01 (1.35G)	2.7	1.333E-06	6.781E-03	8	Not Required	Not Required

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FRP for 250 Wall (Critical wall)

$\phi N_u = \phi (t_w - 1.2e - 2e_a) 0.6 f'_c$

$\phi = 0.65$

$t_w = 250 \text{ mm}$

$e = 0.05 \times 250 = 12.5 \text{ mm}$

$e_a = H_{we}^2 / (2500 \times t_w) = 2700^2 / (2500 \times 250 = 11.7 \text{ mm}$

$f'_c = 40$

$\phi N_u = 0.65(250 - 1.2 \times 12.5 - 2 \times 11.7) \times 0.6 \times 40$

$= 3300 \text{ N} = 3.3 \text{ kN/mm}$

$= 3300 \text{ kN/m}.$

$N_f^* = 955 \text{ kN} / 3.3 \text{ m} = 290 \text{ kN/m}$ (Etabs result)

$\frac{N_f^*}{\phi N_u} = 290 / 3300 = 0.09$

$a_s = 30$

$\Rightarrow$ FRP > 240 ok!

Checked : .....

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FRP for 200 PC Wall (Critical case)

$\phi N_u = \phi (t_w - 1.2e - 2e_a) 0.6 f'_c$

$\phi = 0.65$

$t_w = 200$ mm

$e = 0.05 \times 200 = 10$ mm

$e_a = 2700^2/(2500 \times 200) = 14.6$ mm

$f'_c = 40$

$\phi N_u = 0.65(200 - 1.2 \times 10 - 2 \times 14.6) \times 0.6 \times 40$

$= 2477$ N/mm

$= 2.477$ KN/mm

$= 2477$ kN/m.

$N_g^* = 487/9.4\text{m} = 52$ kN/m. (Etabs Result)

$\frac{N_g^*}{\phi N_u} = 52/2477 = 0.02$

$a_s = 30$

$\Rightarrow$ FRP > 180 ok!

Checked : .....

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FRP for 150 PC Wall (Critical case)

$\phi N_u = \phi (t_w - 1.2e - 2e_a) 0.6 f'_c$

$\phi = 0.65$

$t_w = 150$

$e = 1/3 \times 90 = 30$ mm

$e_a = 2700^2 / (2500 \times 150) = 19.44$ mm

$f'_c = 40$

$\phi N_u = 0.65(150 - 1.2 \times 30 - 2 \times 19.44) \times 0.6 \times 40$

$= 1172$ N/mm $= 1.172$ kN/mm $= 1172$ kN/m

$N_g^* = 1620/13$ m $= 124$ kN/m

$\frac{N_g^*}{\phi N_u} = 124/1172 = 0.01$

$a_s = 30$

⇒ FRP > 120

Ok!

Checked : .....

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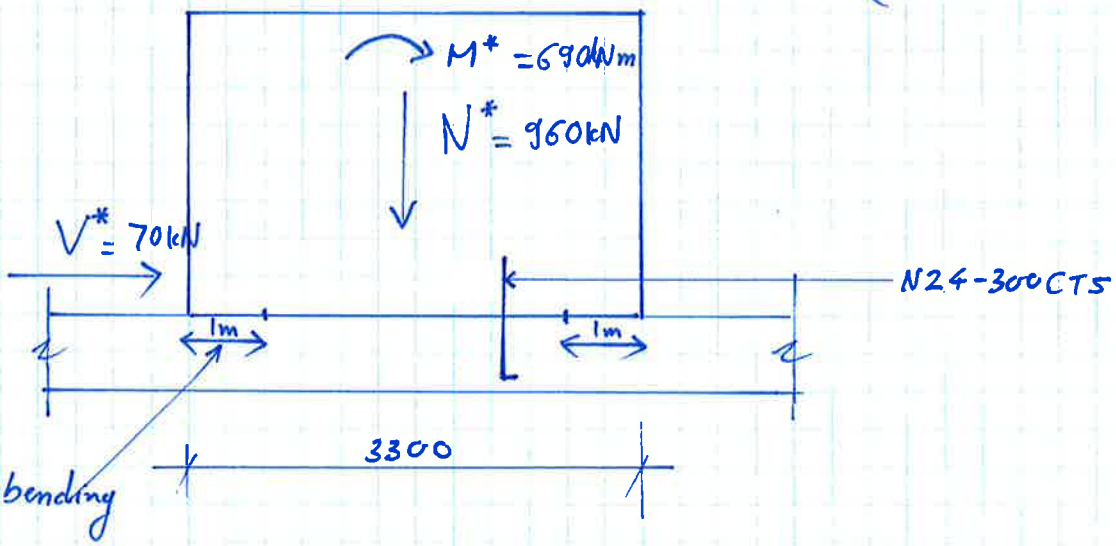
GF 250 PC Wall

(Case: G+EQ+0.3Q)



Bending

$T^* \times 2.3^m + N^* \times 1.8^m = M^*$

$\Rightarrow T^* = \dfrac{M^* - 1.8N^*}{2.3}$

$= \dfrac{690 - 1.8 \times 960}{2.3} \leq 0$ → Anchor for bending OK!

Shear

No of bars for shear $= \dfrac{3300 - 2000}{300} = 4$ bars

$\phi V = 4 \times 0.7 \times 0.6 \times 500 \times \dfrac{24^2}{4} \times \pi$

$= 380.1kN > V^*$ → Dowel shear OK!

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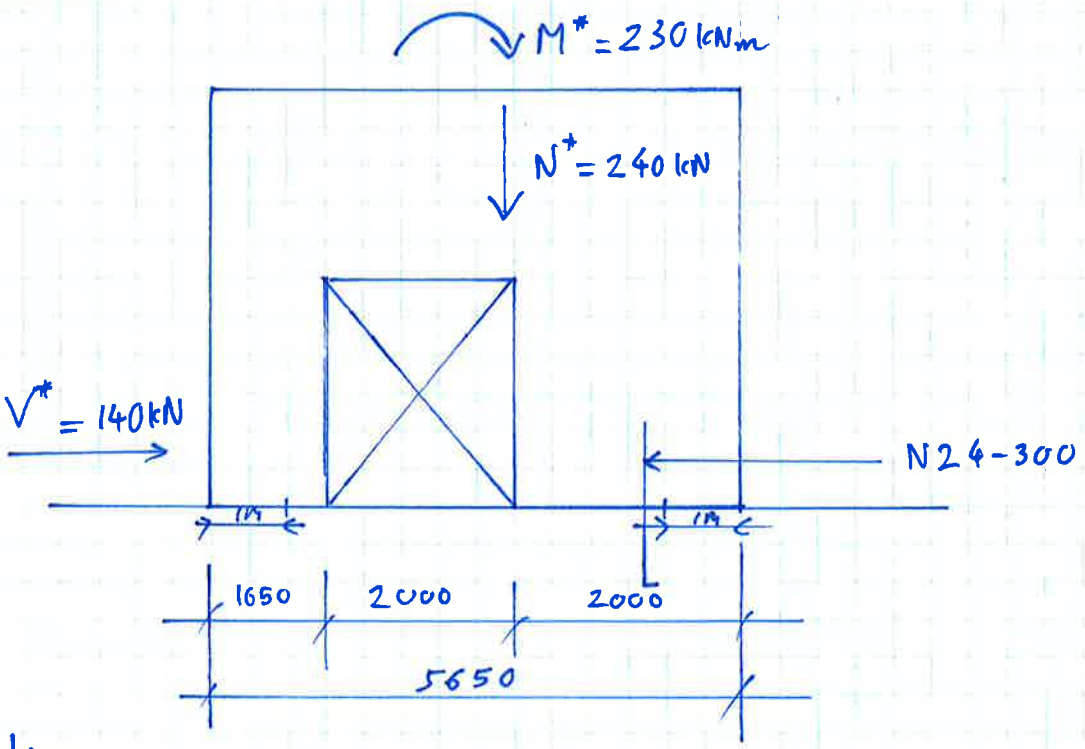
GF 200 PC Wall

Load case : G + EO + 0.3Q (Critical)



Bending

No tensioned anchor ⇒ ac.

Shear:

No of anchor per shear = $\frac{2000+1650-2000}{300}$ = 5 bars.

$\phi V = 5 \times 0.7 \times 0.6 \times 500 \times \frac{24^2}{4}\pi$

$= 475 > V^*$ OK !

Checked : .....
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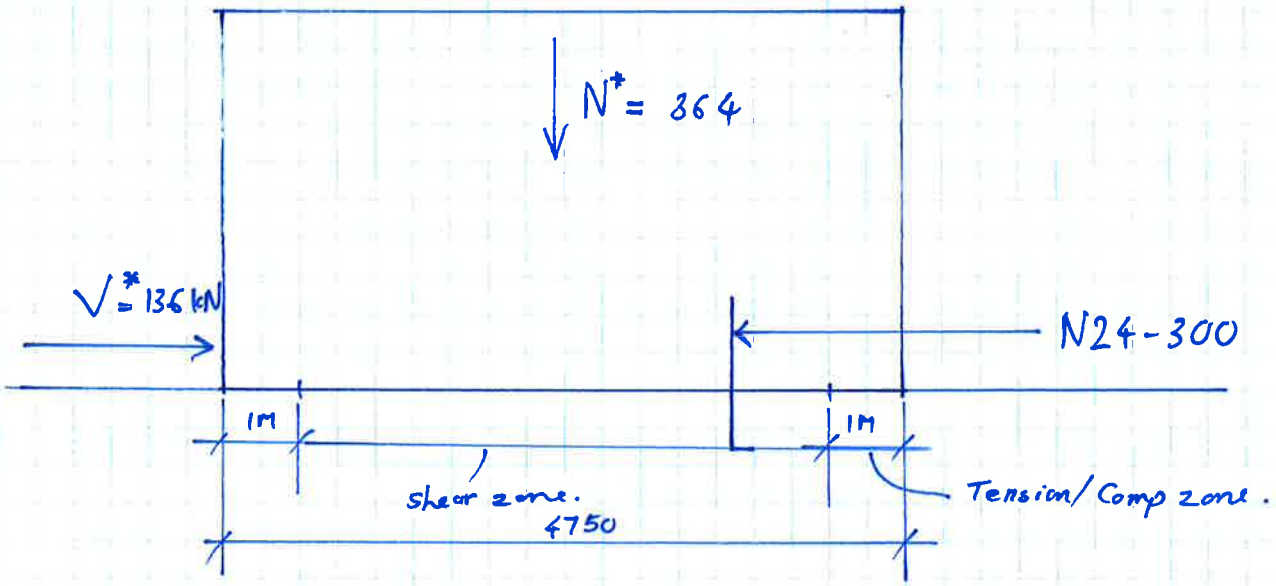
GF 150 PC Wall (Core wall).

Load case: G+EQ+0.3Q

$M^* = 160$ kNm



Bending:

No tensioned anchors → ok!

Shear:

No of dowels in shear $= \frac{4730-2000}{300} = 9$ bars

$\phi V = 9 \times 0.7 \times 0.6 \times 500 \times \frac{24^2}{4}\pi = 855$ kN $> V^*$ → ok!

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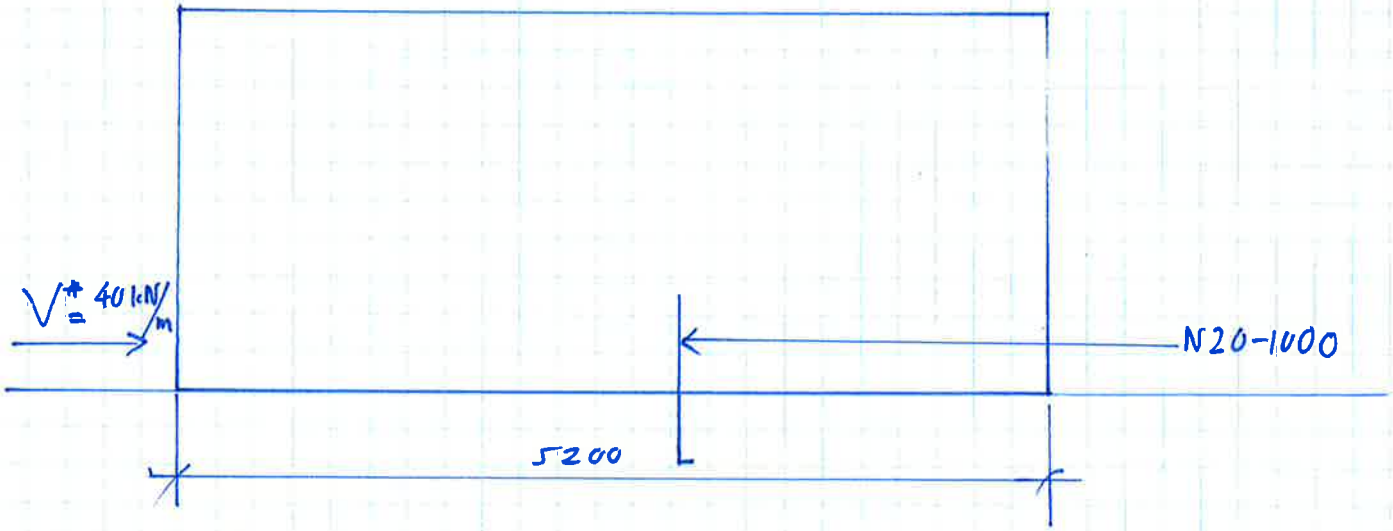
GF 150 RC Wall (Others)



Check dowel in shear:

Nos of dowels = $5200/1000$ = 5 nos.

Shear capacity

$\phi V = 5 \times 0.7 \times 0.6 \times 500 \times \frac{20^2}{4}\pi = 329\ kN > V^* = 40 \times 5.2 = 200\ kN$

OK!

Checked : .....
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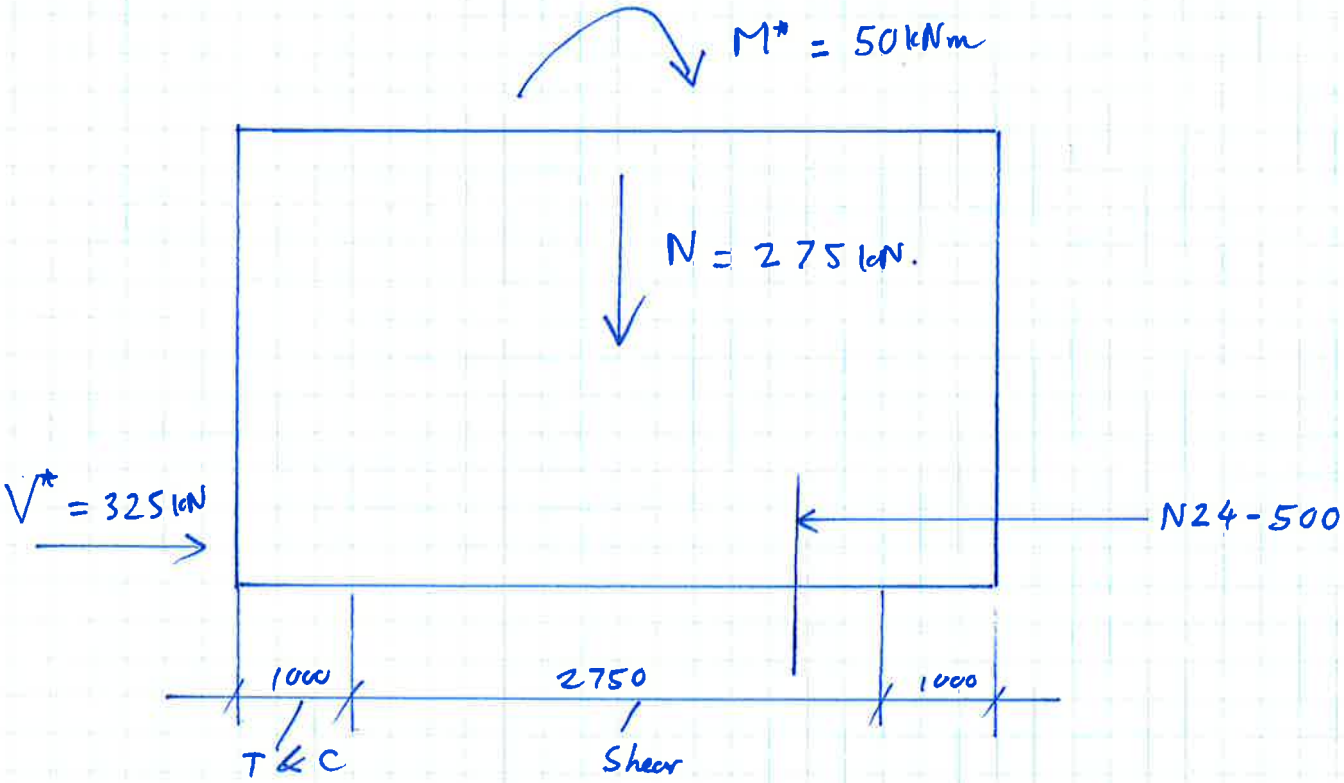
1ST FL 150 PC Wall (Critical)

Load case : G + EQ + 0.3Q.



No tensioned anchor → ok

Shear

Nos of dowel for shear = 2750 / 500 = 5 bars.

$\phi V = 5 \times 0.7 \times 0.6 \times 500 \times \frac{24^2}{4} \pi = 475$ kN > V* ok!

Checked : .....
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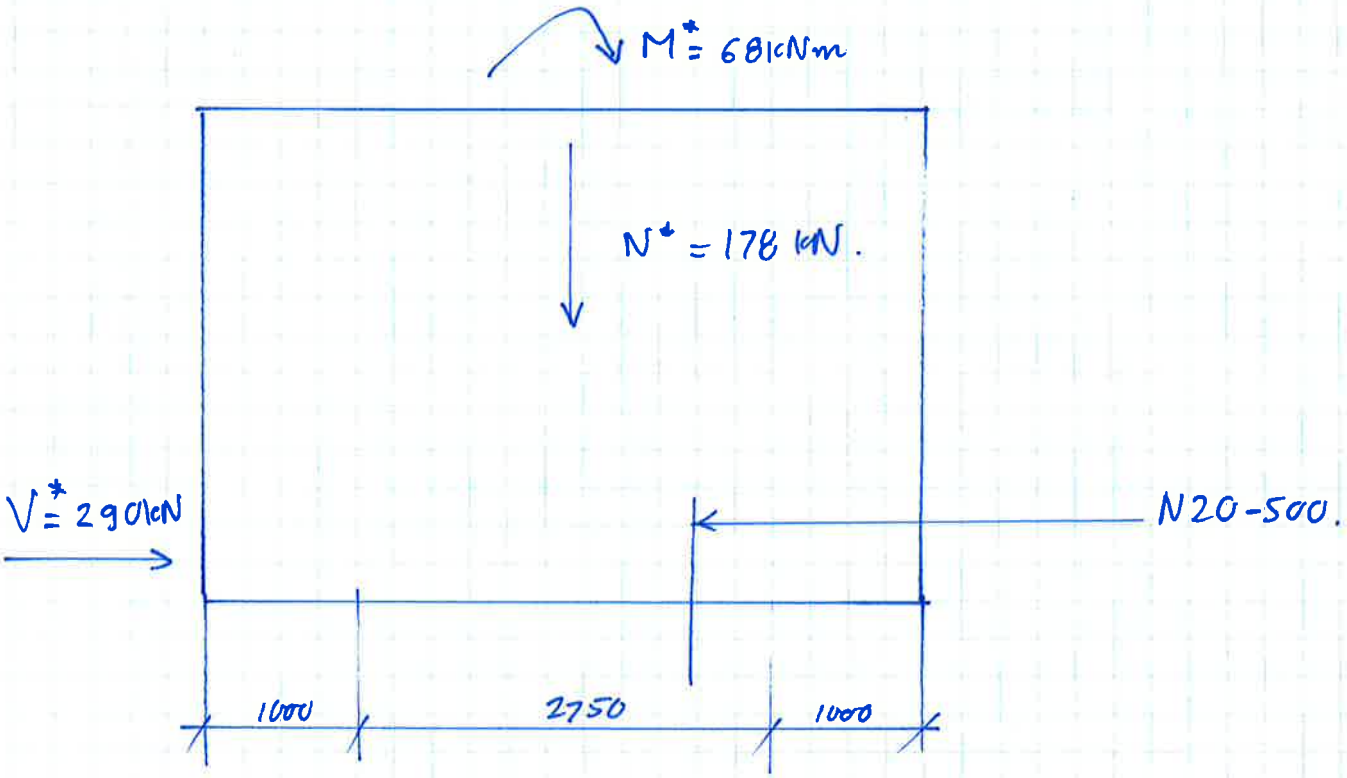
2ND FL 150 PC Wall (Critical)

Load case : G + EQ + 0.3Q.



No tensioned anchor → OK.

Shear

No of dowel for shear = 5bar.

$$\phi V = 5 \times 0.\ \times 0.6 \times 500 \times \frac{20^2}{4}\pi = 329\ kN > V^* \quad OK!$$

Checked : .....

Date : ...../...../.....

Your queries:

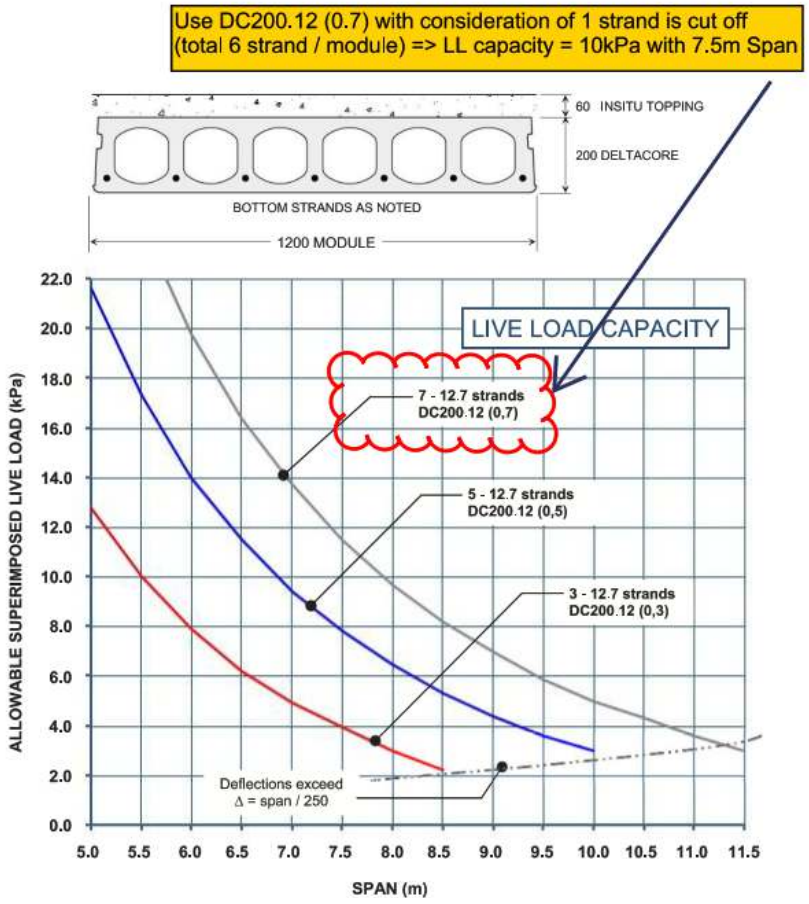
Deltacore Planks

b. Calc page 51 -Deltacore Span Table typical topping slab is 60mm, please check for 80mm topping as specified on drawing

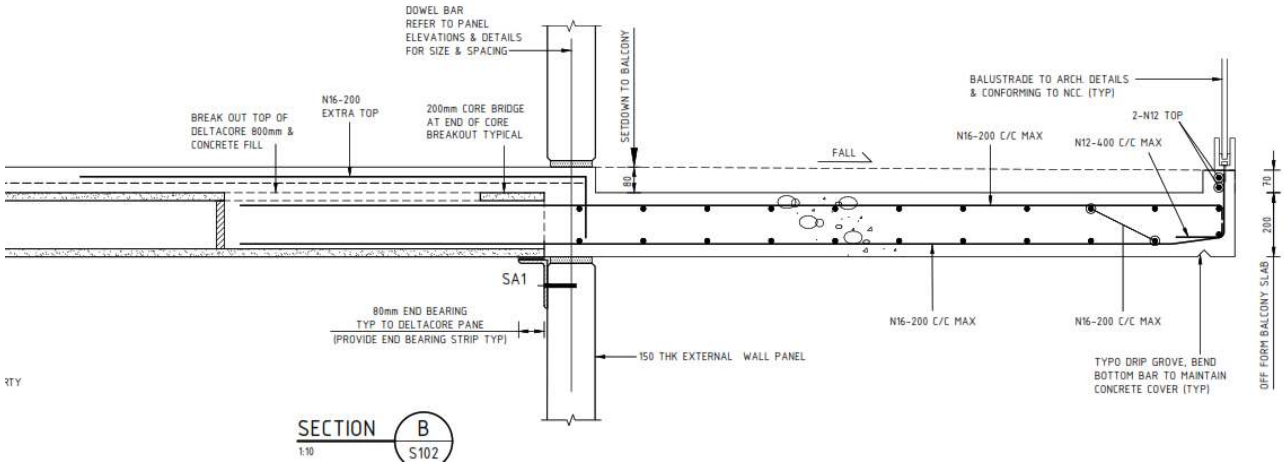
c. Drawing S201 Section B, clarify capacity of Deltacore planks to carry/support cantilever balcony slab (hogging)

Our replies:

b. The Deltacore has LL capacity of 10kPa while our design LL is 2.0kPa. The extra toping of 20mm (total 80 topping) will NOT affect the overall capacity of the element.



c. By breaking the Detacore to allow continuity of reo from balcony and providing extra reo, we have converted that section of Deltacore to a "conventional" slab with has the same capacity of the balcony slab.



ROOF STRUCTURE

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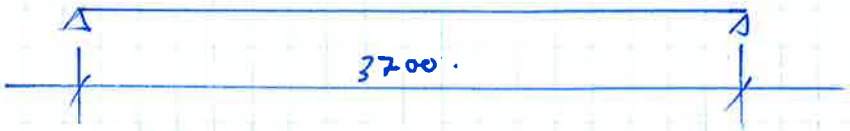
Tie beam TB1



Story force at roof: $V_x = 150$ kN (strength env.)

Max axial load at each beam = 150/4 = 37.5 kN max

Adop 125 PFC ⇒ Capacity $\phi N = 70$ kN $> N^*$ (max). ok!

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Strut S1

Span = 3.7m

Axial load = 37.5kN max

Member 76 x 3.2 CHS ; $\phi N = 55\ kN > N^*$ OK!

Checked : .....
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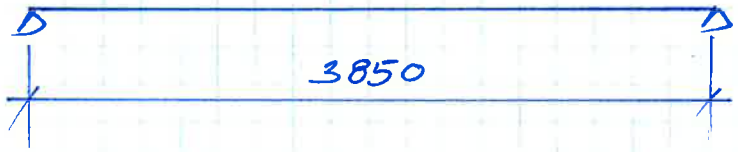
STEEL

Floor beam SB1

Coa dwidth = 6.5 m



DL 0.2 + 24 = 4.8 kPa
1.0 finishes.. = 1.0 kPa | 5.8 kPa

LL = 2.0 kPa.

$$M^* = \frac{(1.2 \times 5.8 + 1.5 \times 2.0) \times 6.5^m \times 3.85^2}{8}$$

$$= 120 \text{ kNm}.$$

$$W^* = (1.2 \times 5.8 + 1.5 \times 2.0) \times 6.5 \times 3.85 = 249 \text{ kN} < 300 \text{ kN}$$

Defl. L/250 limit for 300 PFC

OK!

Note: in the case of FIRE, capacity is 15% reduced, thus 0.85% of 300kN = 255 kN > W (OK)*

Checked : .....
Date : ..../...../.....

TMK CONSULTING ENGINEERS

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COLUMN DESIGN - SHS SECTIONS - PINNED TOP & PINNED BASE

These calculations comply with the requirements of AS 4100 - 1998 Steel Structures.

N^* =	590.0	kN	vertical compression load (strength factored load)
l_h =	3100	mm	column height
k_e =	1.00		effective length factor (Clause 4.6.3)
e =	15	mm	applied load eccentricity at the top of the column
$\Rightarrow M^*$=	8.85	kNm	

Column material yield stress ○ 350 MPa ◉ 450 MPa

Trial column size : 150x150x9.0 SHS (C450)

$A_n = A_g$ =	4800 mm^2	f_y =	450 MPa	k_f =	1.0
Z_e =	248.0E+3 mm^3	$r_x = r_y$ =	56.6 mm	S_x =	248.0E+0 mm^3
$I_x = I_y$ =	15.4E+6 mm^4	J =	26.1E+6 mm^4	b/t =	13.7

Check member capacity

Capacity factors

ϕ_b =	0.9	Table 3.4 - bending	ϕ_c =	0.9	Table 3.4 - compression
For cold-formed (non-stress relieved) SHS,			α_b =	-0.5	Table 6.3.3(2)

(a) Nominal section capacity in compression **Clause 6.1**

$N_s = k_f.A_n.f_y$ = 2160 kN
$\phi_c.N_s$ = 1944.0 kN
> 590 kN Required :.OK

(b) Nominal member capacity in compression **Clause 6.3**

λ_n =	73.5	α_a =	19.91	λ =	63.53	Clause 6.3.3
η =	0.163	ξ =	1.667	α_c =	0.788	

$N_c = \alpha_c.N_s \le N_s$ = 1702.7 kN
$\phi_c.N_c$ = 1532.5 kN
> 590 kN Required :.OK

(c) Nominal section capacity for combined bending and compression

$M_{sx} = f_y.Z_e$ = 111.6 kNm Clause 5.2.1
M_{rx} = 91.7 kNm Clause 8.3.2(a) and (b)
$\phi_b.M_{rx}$ = 82.5 kNm
> 8.85 kNm Required :.OK

(d) Nominal member capacity for combined bending and compression

M_i = 68.6 kNm Clause 8.4.2.2
$\phi_b.M_i$ = 61.8 kNm
> 8.85 kNm Required :.OK

$\Rightarrow$ Column is Satisfactory in Combined Bending and Compression

ADOPT **150x150x9.0 SHS (C450)**

Note: This column is designed for 115% Ultimate Load to cater for 15% capacity reduction in the event of fire

STAIR

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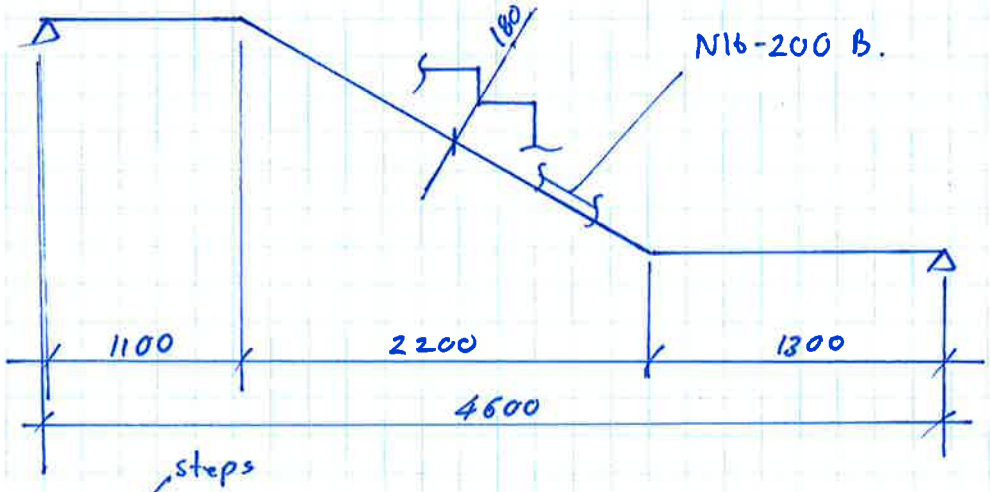
STAIR



steps

DL $(0.18+0.1)\times 25$ = 7.0

1 kPa finishes = 1.0

LL = 4.0

$M^* = [1.2\times(7+1)+1.5\times 4]\times\frac{4.6^2}{8}$ = 41.3 kNm/m

N16-200

$\phi M = 0.8\, A_{st} f_{sy} d$

$= 0.8 \times 1005 \times 500 \times 147$ = 60 kNm/m > Mu

$V^* = \frac{1}{2}(1.2\times 8+1.5\times 4)\times 5$ = 39 kN/m.

$\phi V = 0.7\times u\, d_{om} f_{cv}$

$= 0.7\times 1000\times 147\times 0.34\sqrt{32}$ = 197 kN/m > Vu

Design ok!

Checked : .....
Date : ...../...../.....