



**Job Number**  
*2109031*  
**DATE**  
*15/ 06/2022*

# **ENGINEERING COMPUTATION**



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

Page:  
Project No.: 2109031  
Designed: BE

1200x200x80 Concrete Sleeper 5 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (1200x200x80 Concrete Sleeper 5 KPa): Concrete simple beam

Description =	77mm (D) x 200mm (W) beam	ix =	7.608883333 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	1190 mm	Ag =	15400 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	7.04			Dead load (pdl) =			
Live load (wll) =	0.40			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	1190			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	9.05	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 595 mm

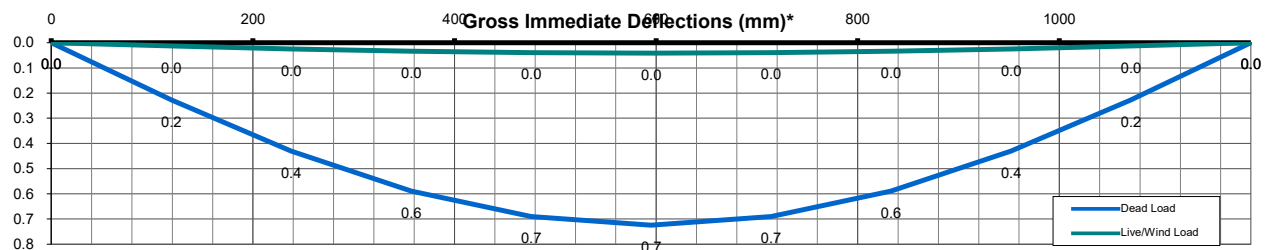
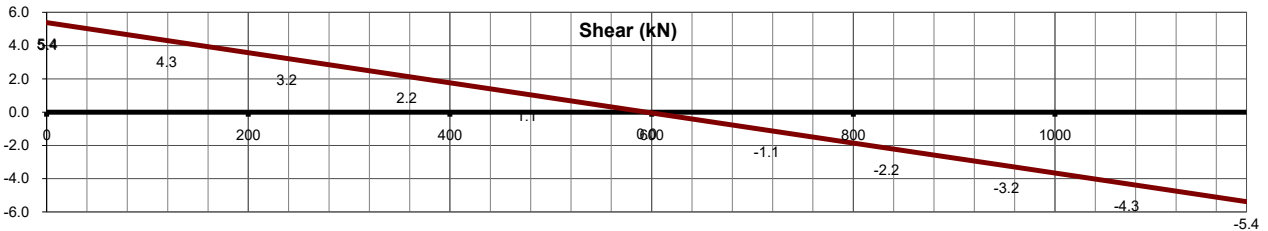
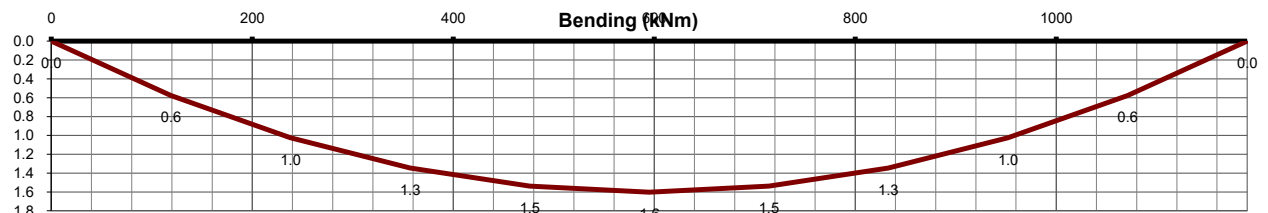
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	4.19		4.19					kN	
Rll	0.24		0.24					kN	
R*	5.38		5.38					kN	
M*	0.00	1.60	0.00	1.60	595	0.00	0	kNm	
V*	5.38	0.00	-5.38	5.38	0			kN	Span /
δdl	0.00	0.72	0.00	0.72	595	0.00	0	mm	1643
δll	0.00	0.04	0.00	0.04	595	0.00	0	mm	28913
δdl+Ψs*δll	0.00	0.77	0.00	0.77	595	0.00	0	mm	1554

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

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1200x200x80 Concrete Sleeper 5 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (1200x200x80 Concrete Sleeper 5 KPa) 77mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.53 > 0.36 - Non ductile  
 Strength: (+ve M) M\* = 1.6kNm < øMuo = 2.3kNm OK (0.70)  
 Cracking: fscr = 166MPa < Fscr = 330MPa & fscr1 = 166MPa < Fscr1 = 400MPa OK (0.41,0.50)  
 Ast.min: Ast.min = 44mm² < Ast = 226mm² (Minimum of Deemed and actual) OK (0.19)

Geometry S.Wt = 0.39 kN/m L/D ratio = 15.5

Concrete strength (f'c) = 40 MPa

Depth (D) = 77 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard), (R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes), (N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 15400 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual), (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	1.6	0.0	kNm
Ms1*	0.0	1.3	0.0	kNm
Ms*	0.0	1.3	0.0	kNm
Ast req'd	0	109	0	mm²
Ast	226	226	226	mm²
Reinf't req'd	-	1.0-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm²  
 Ductility class = N (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to bottom steel layer (ds.max) = 41 mm  
 Depth to bottom steel (ds) = 41 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 21 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm  
 Tensile steel area (As) = 226 mm²  
 Comp. steel area (Ac) = 0 mm²  
 Ultimate Moment (Mu) = 3.7 kNm  
 Design capacity (øMuo) = 2.3 kNm

Design flange (bef) = 200 mm  
 ds = 41 mm  
 dc = 56 mm  
 ku = 0.527 Warning - ku > 0.36 - Cl 8.1.5  
 ø = 0.619 Table 2.2.2  
 Ast.min = 44 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 166 MPa Max. stress (Fscr) = 330 MPa OK (0.50)  
 Steel stress (fscr1) = 166 MPa Max. stress (Fscr1) = 400 MPa OK (0.41)



Geometry for (1200x200x80 Concrete Sleeper 10 KPa): Concrete Simple Beam

Description =	77mm (D) x 200mm (W) beam	ix =	7.608883333 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	1190 mm	Ag =	15400 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	6.40			Dead load (pdl) =			
Live load (wll) =	0.80			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	1190			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	8.88	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 595 mm

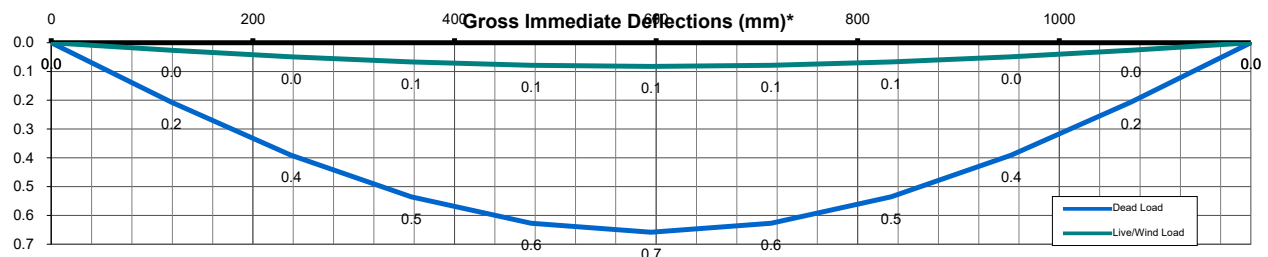
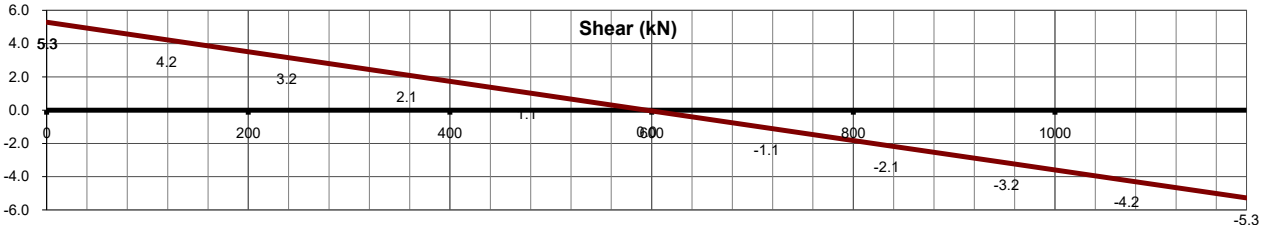
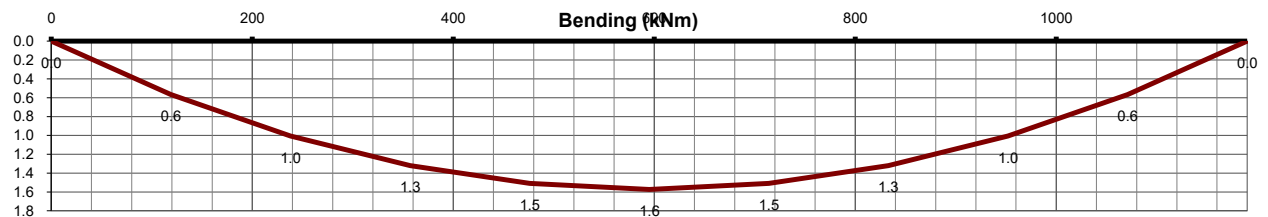
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	3.81		3.81					kN	
Rll	0.48		0.48					kN	
R*	5.28		5.28					kN	
M*	0.00	1.57	0.00	1.57	595	0.00	0	kNm	
V*	5.28	0.00	-5.28	5.28	0			kN	Span /
δdl	0.00	0.66	0.00	0.66	595	0.00	0	mm	1807
δll	0.00	0.08	0.00	0.08	595	0.00	0	mm	14456
δdl+Ψs*δll	0.00	0.74	0.00	0.74	595	0.00	0	mm	1606

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered





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1200x200x80 Concrete Sleeper 10 KPa

CONCRETE MEMBER V5.03

Barrasons Engineers

Section: (1200x200x80 Concrete Sleeper 10 KPa) 77mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.53 > 0.36 - Non ductile  
 Strength: (+ve M) M\* = 1.6kNm < øMuo = 2.3kNm OK (0.69)  
 Cracking: fscr = 161MPa < Fscr = 330MPa & fscr1 = 161MPa < Fscr1 = 400MPa OK (0.40,0.49)  
 Ast.min: Ast.min = 44mm² < Ast = 226mm² (Minimum of Deemed and actual) OK (0.19)

Geometry S.Wt = 0.39 kN/m L/D ratio = 15.5

Concrete strength (f'c) = 40 MPa

Depth (D) = 77 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard), (R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes), (N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 15400 mm² Side = B1 Tab 4.10.3.2

Analysis: Simple Beam at midspan (Max +ve M)

Analysis values = X (Manual), (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	1.6	0.0	kNm
Ms1*	0.0	1.3	0.0	kNm
Ms*	0.0	1.3	0.0	kNm
Ast req'd	0	107	0	mm²
Ast	226	226	226	mm²
Reinf't req'd	-	0.9-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm²  
 Ductility class = N (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to bottom steel layer (ds.max) = 41 mm  
 Depth to bottom steel (ds) = 41 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsyc) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 21 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm  
 Tensile steel area (As) = 226 mm²  
 Comp. steel area (Ac) = 0 mm²  
 Ultimate Moment (Mu) = 3.7 kNm  
 Design capacity (øMuo) = 2.3 kNm

Design flange (bef) = 200 mm  
 ds = 41 mm  
 dc = 56 mm  
 ku = 0.527 Warning - ku > 0.36 - Cl 8.1.5  
 ø = 0.619 Table 2.2.2  
 Ast.min = 44 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 161 MPa Max. stress (Fscr) = 330 MPa OK (0.49)  
 Steel stress (fscr1) = 161 MPa Max. stress (Fscr1) = 400 MPa OK (0.40)



Concrete Sleeper Retaining Wall

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1200x200x100 Concrete Sleeper 5 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (1200x200x100 Concrete Sleeper 5 KPa): Concrete simple beam

Description =	100mm (D) x 200mm (W) beam	lx =	16.66666667 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	1190 mm	Ag =	20000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	7.56			Dead load (pdl) =			
Live load (wll) =	0.35			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	1190			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	9.60	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 595 mm

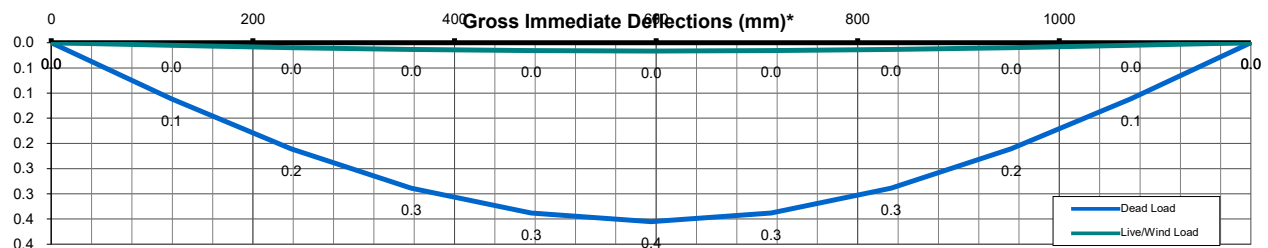
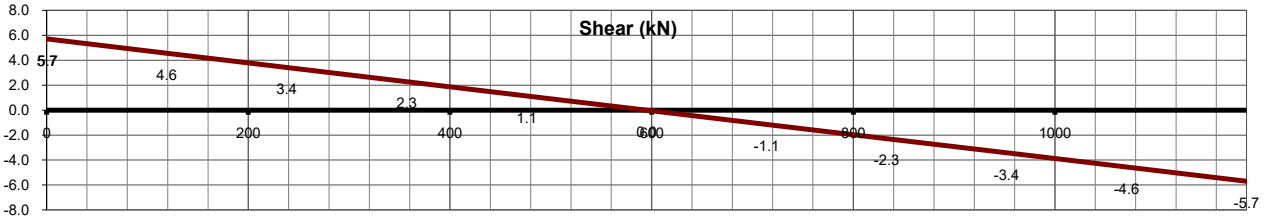
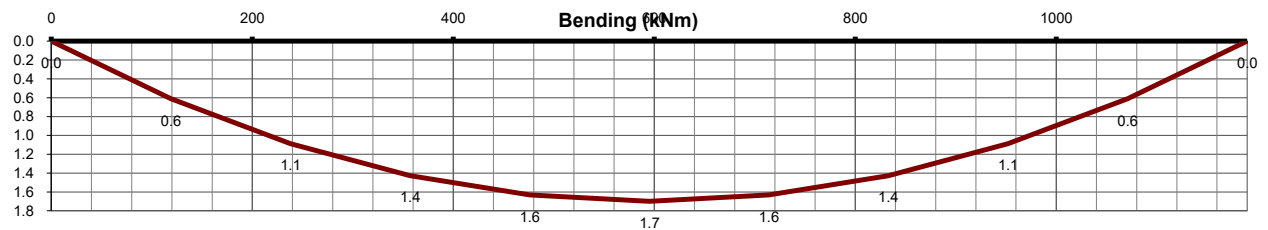
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	4.50		4.50					kN	
Rll	0.21		0.21					kN	
R*	5.71		5.71					kN	
M*	0.00	1.70	0.00	1.70	595	0.00	0	kNm	
V*	5.71	0.00	-5.71	5.71	0			kN	Span /
δdl	0.00	0.36	0.00	0.36	595	0.00	0	mm	3351
δll	0.00	0.02	0.00	0.02	595	0.00	0	mm	72379
δdl+Ψs*δll	0.00	0.37	0.00	0.37	595	0.00	0	mm	3203

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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1200x200x100 Concrete Sleeper 5 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (1200x200x100 Concrete Sleeper 5 KPa) 100mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.34  
 Strength: (+ve M) M\* = 1.7kNm < øMuo = 5.0kNm OK (0.34)  
 Cracking: fscr = 110MPa < Fscr = 330MPa & fscr1 = 110MPa < Fscr1 = 400MPa OK (0.28,0.33)  
 Ast.min: Ast.min = 47mm² < Ast = 226mm² (Minimum of Deemed and actual) OK (0.21)

Geometry S.Wt = 0.50 kN/m L/D ratio = 11.9

Concrete strength (f'c) = 40 MPa

Depth (D) = 100 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 20000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	1.7	0.0	kNm
Ms1*	0.0	1.4	0.0	kNm
Ms*	0.0	1.4	0.0	kNm
Ast req'd	0	69	0	mm²
Ast	226	226	226	mm²
Reinf't req'd	-	0.6-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm²  
 Ductility class = N (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 64 mm  
 Depth to bottom steel (ds) = 64 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 44 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 226 mm² ds = 64 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 6.3 kNm ku = 0.337  
 Design capacity (øMuo) = 5.0 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 47 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 110 MPa Max. stress (Fscr) = 330 MPa OK (0.33)  
 Steel stress (fscr1) = 110 MPa Max. stress (Fscr1) = 400 MPa OK (0.28)



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1200x200x100 Concrete Sleeper 10 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (1200x200x100 Concrete Sleeper 10 KPa): Concrete simple beam

Description =	100mm (D) x 200mm (W) beam	lx =	16.66666667 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	1190 mm	Ag =	20000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	15.20			Dead load (pdl) =			
Live load (wll) =	0.80			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	1190			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	19.44	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 595 mm

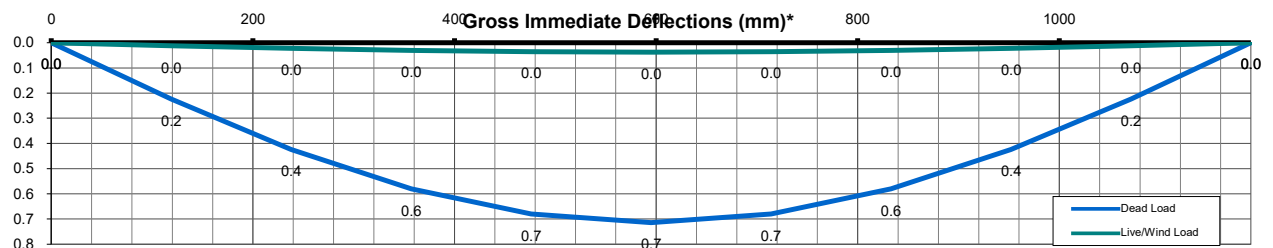
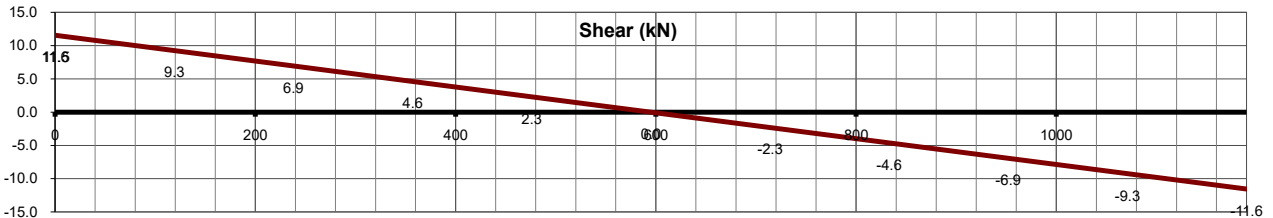
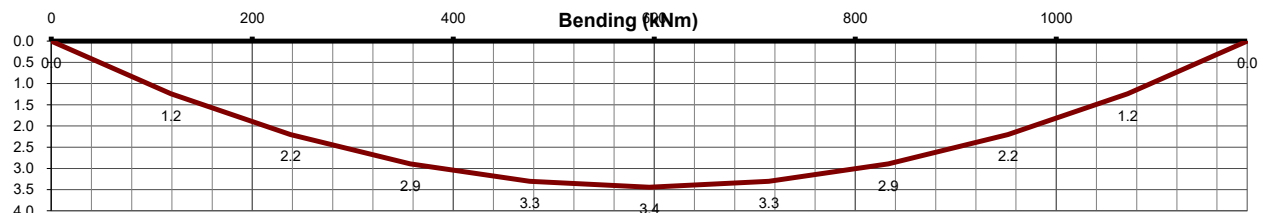
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	9.04		9.04					kN	
Rll	0.48		0.48					kN	
R*	11.57		11.57					kN	
M*	0.00	3.44	0.00	3.44	595	0.00	0	kNm	
V*	11.57	0.00	-11.57	11.57	0			kN	Span /
δdl	0.00	0.71	0.00	0.71	595	0.00	0	mm	1667
δll	0.00	0.04	0.00	0.04	595	0.00	0	mm	31666
δdl+Ψs*δll	0.00	0.75	0.00	0.75	595	0.00	0	mm	1583

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

Page:  
Project No.: 2109031  
Designed: BE

1200x200x100 Concrete Sleeper 10 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (1200x200x100 Concrete Sleeper 10 KPa) 100mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.34  
 Strength: (+ve M) M\* = 3.4kNm < øMu0 = 5.0kNm OK (0.68)  
 Cracking: fscr = 223MPa < Fscr = 330MPa & fscr1 = 223MPa < Fscr1 = 400MPa OK (0.56,0.68)  
 Ast.min: Ast.min = 47mm<sup>2</sup> < Ast = 226mm<sup>2</sup> (Minimum of Deemed and actual) OK (0.21)

Geometry S.Wt = 0.50 kN/m L/D ratio = 11.9

Concrete strength (f'c) = 40 MPa

Depth (D) = 100 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m<sup>3</sup> Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 20000 mm<sup>2</sup> Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	3.4	0.0	kNm
Ms1*	0.0	2.8	0.0	kNm
Ms*	0.0	2.8	0.0	kNm
Ast req'd	0	148	0	mm <sup>2</sup>
Ast	226	226	226	mm <sup>2</sup>
Reinf't req'd	-	1.3-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm<sup>2</sup> = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm<sup>2</sup>  
 Ductility class = N (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 64 mm  
 Depth to bottom steel (ds) = 64 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm<sup>2</sup> = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm<sup>2</sup>  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 44 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 226 mm<sup>2</sup> ds = 64 mm  
 Comp. steel area (Ac) = 0 mm<sup>2</sup> dc = 56 mm  
 Ultimate Moment (Mu) = 6.3 kNm ku = 0.337  
 Design capacity (øMu0) = 5.0 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 47 mm<sup>2</sup>

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 223 MPa Max. stress (Fscr) = 330 MPa OK (0.68)  
 Steel stress (fscr1) = 223 MPa Max. stress (Fscr1) = 400 MPa OK (0.56)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

Page:  
Project No.: 2109031  
Designed: BE

1200x200x120 Concrete Sleeper 5 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (1200x200x120 Concrete Sleeper 5 KPa): Concrete simple beam

Description =	120mm (D) x 200mm (W) beam	lx =	28.8 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	1190 mm	Ag =	24000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	22.40			Dead load (pdl) =			
Live load (wll) =	0.40			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	1190			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	27.48	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 595 mm

1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units
Rdl	13.33		13.33					kN
Rll	0.24		0.24					kN
R*	16.35		16.35					kN
M*	0.00	4.86	0.00	4.86	595	0.00	0	kNm
V*	16.35	0.00	-16.35	16.35	0			kN
δdl	0.00	0.61	0.00	0.61	595	0.00	0	mm
δll	0.00	0.01	0.00	0.01	595	0.00	0	mm
δdl+Ψs*δll	0.00	0.62	0.00	0.62	595	0.00	0	mm

Span / 1954

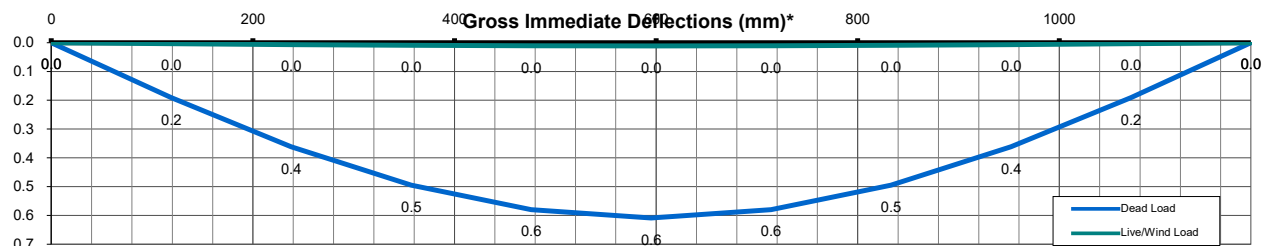
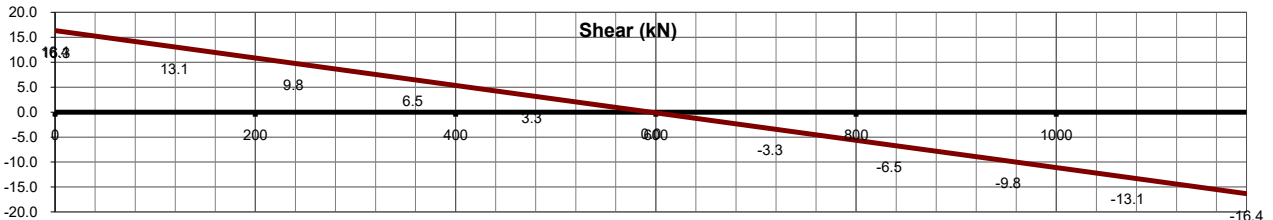
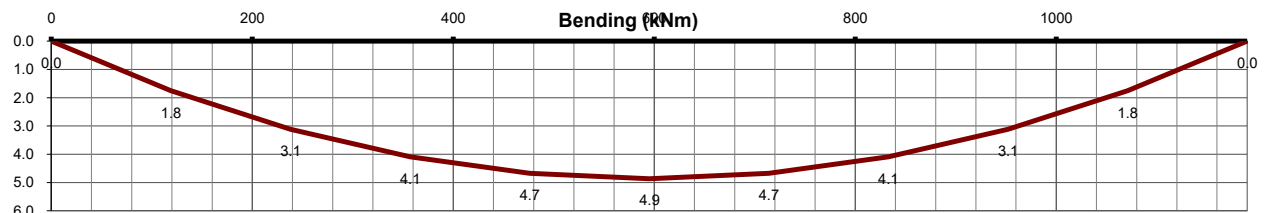
109437

1920

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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Designed: BE

1200x200x120 Concrete Sleeper 5 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (1200x200x120 Concrete Sleeper 5 KPa) 120mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.26  
 Strength: (+ve M) M\* = 4.9kNm < øMuo = 6.8kNm OK (0.71)  
 Cracking: fscr = 239MPa < Fscr = 330MPa & fscr1 = 239MPa < Fscr1 = 400MPa OK (0.60,0.72)  
 Ast.min: Ast.min = 52mm² < Ast = 226mm² (Minimum of Deemed and actual) OK (0.23)

Geometry S.Wt = 0.60 kN/m L/D ratio = 9.9

Concrete strength (f'c) = 40 MPa

Depth (D) = 120 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard), (R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes), (N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 24000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual), (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	4.9	0.0	kNm
Ms1*	0.0	4.0	0.0	kNm
Ms*	0.0	4.0	0.0	kNm
Ast req'd	0	156	0	mm²
Ast	226	226	226	mm²
Reinf't req'd	-	1.4-N12	-	

Reinforcement Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm²  
 Ductility class = N (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to bottom steel layer (ds.max) = 84 mm  
 Depth to bottom steel (ds) = 84 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 64 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 226 mm² ds = 84 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 8.6 kNm ku = 0.257  
 Design capacity (øMuo) = 6.8 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 52 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 239 MPa Max. stress (Fscr) = 330 MPa OK (0.72)  
 Steel stress (fscr1) = 239 MPa Max. stress (Fscr1) = 400 MPa OK (0.60)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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1200x200x120 Concrete Sleeper 10 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (1200x200x120 Concrete Sleeper 10 KPa): Concrete simple beam

Description =	120mm (D) x 200mm (W) beam	lx =	28.8 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	1190 mm	Ag =	24000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	21.60			Dead load (pdl) =			
Live load (wll) =	0.80			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	1190			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	27.12	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 595 mm

1.20\*G+1.50\*Q analysed

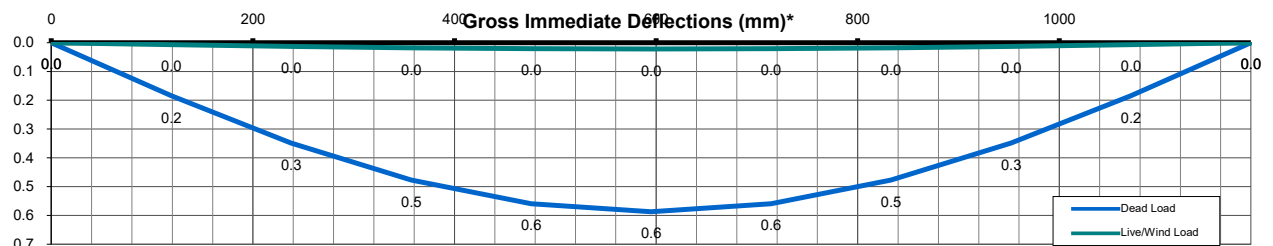
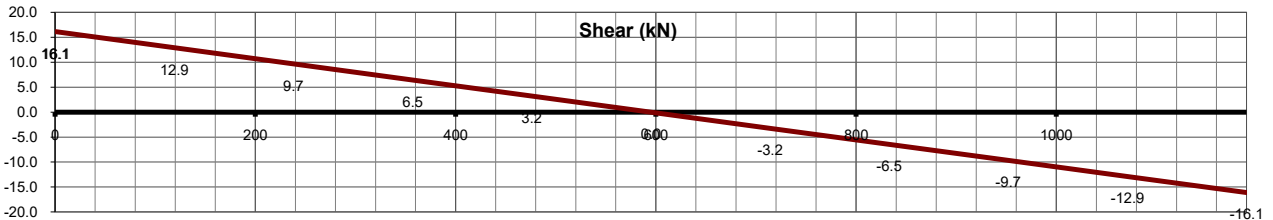
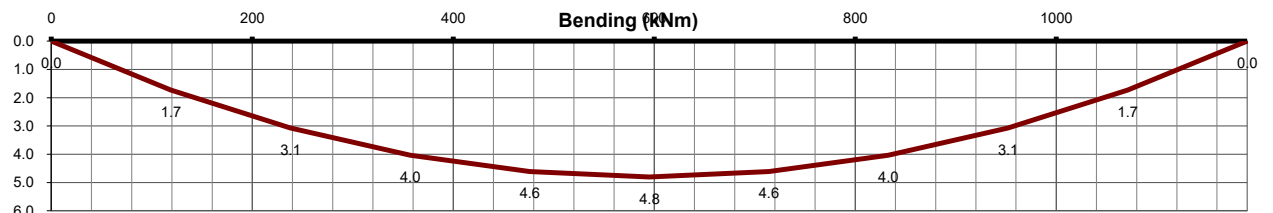
	Left	At x	Right	Max	At	Min	At	Units
Rdl	12.85		12.85					kN
Rll	0.48		0.48					kN
R*	16.14		16.14					kN
M*	0.00	4.80	0.00	4.80	595	0.00	0	kNm
V*	16.14	0.00	-16.14	16.14	0			kN
δdl	0.00	0.59	0.00	0.59	595	0.00	0	mm
δll	0.00	0.02	0.00	0.02	595	0.00	0	mm
δdl+Ψs*δll	0.00	0.61	0.00	0.61	595	0.00	0	mm

Span / 2027  
54718  
1954

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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Project No.: 2109031  
Designed: BE

1200x200x120 Concrete Sleeper 10 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (1200x200x120 Concrete Sleeper 10 KPa) 120mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.26  
 Strength: (+ve M) M\* = 4.8kNm < øMuo = 6.8kNm OK (0.70)  
 Cracking: fscr = 234MPa < Fscr = 330MPa & fscr1 = 234MPa < Fscr1 = 400MPa OK (0.59,0.71)  
 Ast.min: Ast.min = 52mm² < Ast = 226mm² (Minimum of Deemed and actual) OK (0.23)

Geometry S.Wt = 0.60 kN/m L/D ratio = 9.9

Concrete strength (f'c) = 40 MPa

Depth (D) = 120 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 24000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	4.8	0.0	kNm
Ms1*	0.0	4.0	0.0	kNm
Ms*	0.0	4.0	0.0	kNm
Ast req'd	0	154	0	mm²
Ast	226	226	226	mm²
Reinf't req'd	-	1.4-N12	-	

Reinforcement Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm²  
 Ductility class = N (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 84 mm  
 Depth to bottom steel (ds) = 84 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 64 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm	Design flange (bef) = 200 mm
Tensile steel area (As) = 226 mm²	ds = 84 mm
Comp. steel area (Ac) = 0 mm²	dc = 56 mm
Ultimate Moment (Mu) = 8.6 kNm	ku = 0.257
Design capacity (øMuo) = 6.8 kNm	ø = 0.800 Table 2.2.2
	Ast.min = 52 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 234 MPa	Max. stress (Fscr) = 330 MPa	OK (0.71)
Steel stress (fscr1) = 234 MPa	Max. stress (Fscr1) = 400 MPa	OK (0.59)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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Designed: BE

1200x200x80 Concrete Sleeper 10 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (1200x200x80 Concrete Sleeper 10 KPa 2N10): Concrete simple beam

Description =	77mm (D) x 200mm (W) beam	ix =	7.608883333 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	1190 mm	Ag =	15400 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	6.40			Dead load (pdl) =			
Live load (wll) =	0.80			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	1190			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	8.88	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 595 mm

**1.20\*G+1.50\*Q analysed**

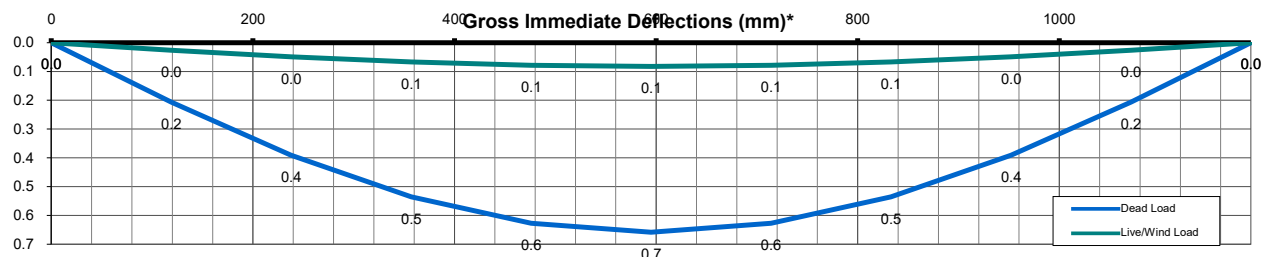
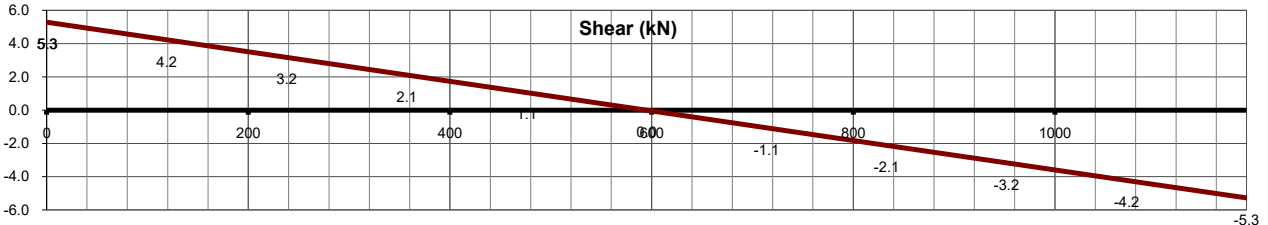
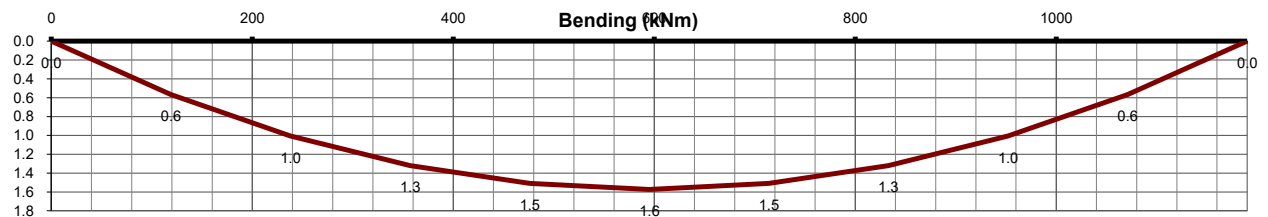
	Left	At x	Right	Max	At	Min	At	Units
<b>Rdl</b>	3.81		3.81					kN
<b>Rll</b>	0.48		0.48					kN
<b>R*</b>	5.28		5.28					kN
<b>M*</b>	0.00	1.57	0.00	1.57	595	0.00	0	kNm
<b>V*</b>	5.28	0.00	-5.28	5.28	0			kN
<b>δdl</b>	0.00	0.66	0.00	0.66	595	0.00	0	mm
<b>δll</b>	0.00	0.08	0.00	0.08	595	0.00	0	mm
<b>δdl+Ψs*δll</b>	0.00	0.74	0.00	0.74	595	0.00	0	mm

**Span /**  
1807  
14456  
1606

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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Project No.: 2109031  
Designed: BE

1200x200x80 Concrete Sleeper 10 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (1200x200x80 Concrete Sleeper 10 KPa 2N10) 77mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.36  
 Strength: (+ve M) M\* = 1.6kNm < øMuo = 2.3kNm OK (0.69)  
 Cracking: fscr = 221MPa < Fscr = 362MPa & fscr1 = 221MPa < Fscr1 = 400MPa OK (0.55,0.61)  
 Ast.min: Ast.min = 43mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.27)

Geometry S.Wt = 0.39 kN/m L/D ratio = 15.5

Concrete strength (f'c) = 40 MPa

Depth (D) = 77 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard), (R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes), (N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 15400 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual), (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	1.6	0.0	kNm
Ms1*	0.0	1.3	0.0	kNm
Ms*	0.0	1.3	0.0	kNm
Ast req'd	0	104	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.3-N10	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to bottom steel layer (ds.max) = 42 mm  
 Depth to bottom steel (ds) = 42 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 21 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm  
 Tensile steel area (As) = 157 mm²  
 Comp. steel area (Ac) = 0 mm²  
 Ultimate Moment (Mu) = 2.8 kNm  
 Design capacity (øMuo) = 2.3 kNm

Design flange (bef) = 200 mm  
 ds = 42 mm  
 dc = 56 mm  
 ku = 0.357  
 ø = 0.800 Table 2.2.2  
 Ast.min = 43 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 221 MPa Max. stress (Fscr) = 362 MPa OK (0.61)  
 Steel stress (fscr1) = 221 MPa Max. stress (Fscr1) = 400 MPa OK (0.55)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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1200x200x100 Concrete Sleeper 5 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (1200x200x100 Concrete Sleeper 5 KPa 2N10): Concrete simple beam

Description =	100mm (D) x 200mm (W) beam	lx =	16.66666667 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	1190 mm	Ag =	20000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	12.00			Dead load (pdl) =			
Live load (wll) =	0.40			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	1190			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	15.00	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 595 mm

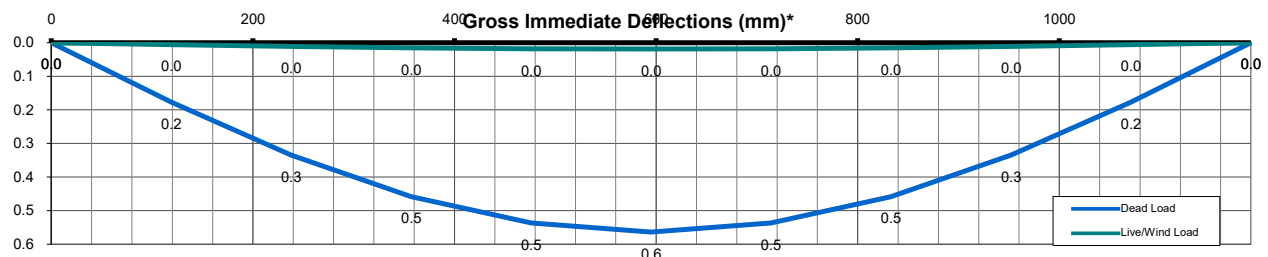
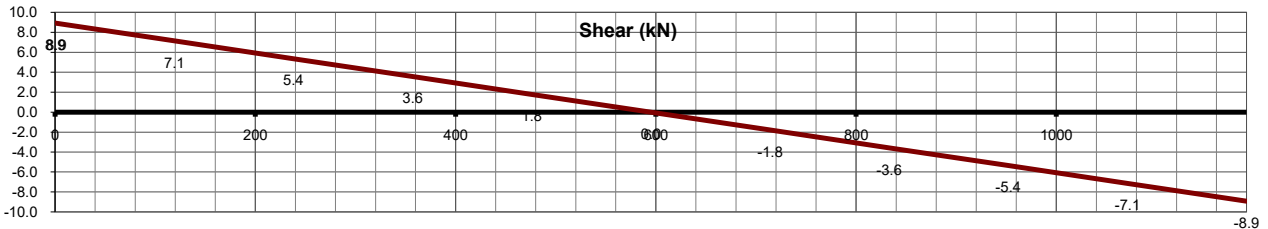
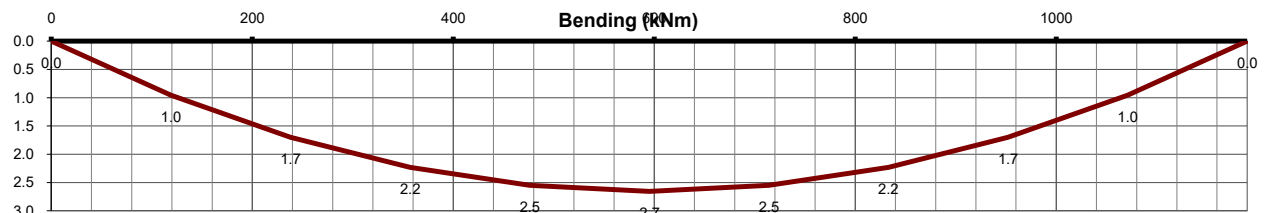
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	7.14		7.14					kN	
Rll	0.24		0.24					kN	
R*	8.93		8.93					kN	
M*	0.00	2.66	0.00	2.66	595	0.00	0	kNm	
V*	8.93	0.00	-8.93	8.93	0			kN	Span /
δdl	0.00	0.56	0.00	0.56	595	0.00	0	mm	2111
δll	0.00	0.02	0.00	0.02	595	0.00	0	mm	63331
δdl+Ψs*δll	0.00	0.58	0.00	0.58	595	0.00	0	mm	2043

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

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1200x200x100 Concrete Sleeper 5 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (1200x200x100 Concrete Sleeper 5 KPa 2N10) 100mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.23  
 Strength: (+ve M) M\* = 2.7kNm < øMu0 = 3.7kNm OK (0.71)  
 Cracking: fscr = 240MPa < Fscr = 362MPa & fscr1 = 240MPa < Fscr1 = 400MPa OK (0.60,0.66)  
 Ast.min: Ast.min = 47mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.30)

Geometry S.Wt = 0.50 kN/m L/D ratio = 11.9

Concrete strength (f'c) = 40 MPa

Depth (D) = 100 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 20000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	2.7	0.0	kNm
Ms1*	0.0	2.2	0.0	kNm
Ms*	0.0	2.2	0.0	kNm
Ast req'd	0	109	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.4-N10	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 65 mm  
 Depth to bottom steel (ds) = 65 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 44 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 157 mm² ds = 65 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 4.7 kNm ku = 0.231  
 Design capacity (øMu0) = 3.7 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 47 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 240 MPa Max. stress (Fscr) = 362 MPa OK (0.66)  
 Steel stress (fscr1) = 240 MPa Max. stress (Fscr1) = 400 MPa OK (0.60)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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1200x200x120 Concrete Sleeper 10 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (1200x200x120 Concrete Sleeper 10 KPa 2N10): Concrete simple beam

Description = 120mm (D) x 200mm (W) beam	lx = 28.8 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) = 1190 mm	
Span type = S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Ag = 24000 mm <sup>2</sup>
Material type = C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	Density = 25 kN/m <sup>3</sup>
	E = 33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	15.20			Dead load (pdl) =			
Live load (wll) =	0.80			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	1190			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m					
Ultimate load (w*) =	19.44	0.00	0.00	Include S.Wt =	N (Y)es,(N)o		
				Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 595 mm

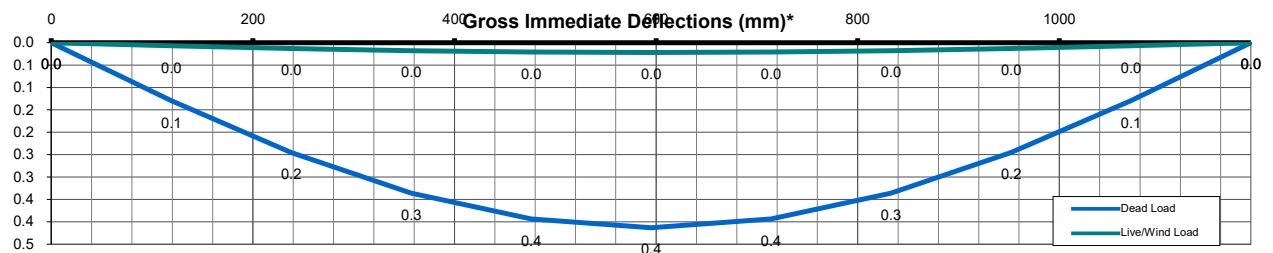
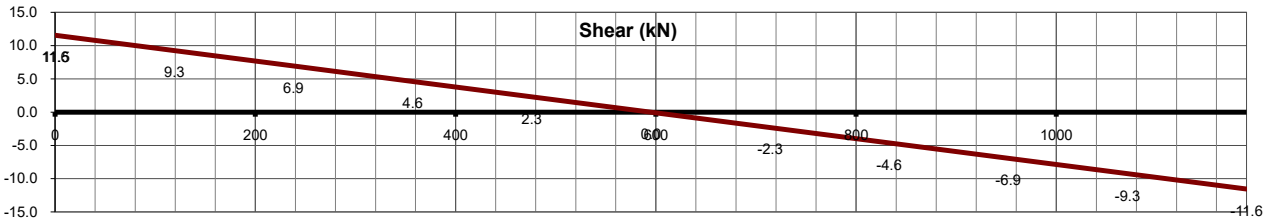
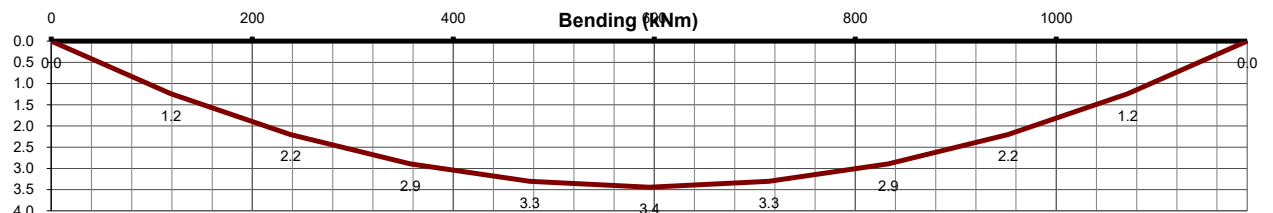
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	9.04		9.04					kN	
Rll	0.48		0.48					kN	
R*	11.57		11.57					kN	
M*	0.00	3.44	0.00	3.44	595	0.00	0	kNm	
V*	11.57	0.00	-11.57	11.57	0			kN	Span /
δdl	0.00	0.41	0.00	0.41	595	0.00	0	mm	2880
δll	0.00	0.02	0.00	0.02	595	0.00	0	mm	54718
δdl+Ψs*δll	0.00	0.43	0.00	0.43	595	0.00	0	mm	2736

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
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1200x200x120 Concrete Sleeper 10 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (1200x200x120 Concrete Sleeper 10 KPa 2N10) 120mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.18  
 Strength: (+ve M) M\* = 3.4kNm < øMu0 = 5.0kNm OK (0.69)  
 Cracking: fscr = 234MPa < Fscr = 362MPa & fscr1 = 234MPa < Fscr1 = 400MPa OK (0.59,0.65)  
 Ast.min: Ast.min = 51mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.33)

Geometry S.Wt = 0.60 kN/m L/D ratio = 9.9

Concrete strength (f'c) = 40 MPa

Depth (D) = 120 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard), (R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes), (N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 24000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual), (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	3.4	0.0	kNm
Ms1*	0.0	2.8	0.0	kNm
Ms*	0.0	2.8	0.0	kNm
Ast req'd	0	106	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.4-N10	-	

Reinforcement Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to bottom steel layer (ds.max) = 85 mm  
 Depth to bottom steel (ds) = 85 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 64 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 157 mm² ds = 85 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 6.2 kNm ku = 0.176  
 Design capacity (øMu0) = 5.0 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 51 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 234 MPa Max. stress (Fscr) = 362 MPa OK (0.65)  
 Steel stress (fscr1) = 234 MPa Max. stress (Fscr1) = 400 MPa OK (0.59)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
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1200x200x120 Concrete Sleeper 5 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (1200x200x120 Concrete Sleeper 5 KPa 2N10): Concrete simple beam

Description =	120mm (D) x 200mm (W) beam	lx =	28.8 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	1190 mm	Ag =	24000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	16.00			Dead load (pdl) =			
Live load (wll) =	0.40			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	1190			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	19.80	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 595 mm

1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units
Rdl	9.52		9.52					kN
Rll	0.24		0.24					kN
R*	11.78		11.78					kN
M*	0.00	3.50	0.00	3.50	595	0.00	0	kNm
V*	11.78	0.00	-11.78	11.78	0			kN
δdl	0.00	0.43	0.00	0.43	595	0.00	0	mm
δll	0.00	0.01	0.00	0.01	595	0.00	0	mm
δdl+Ψs*δll	0.00	0.45	0.00	0.45	595	0.00	0	mm

Span / 2736

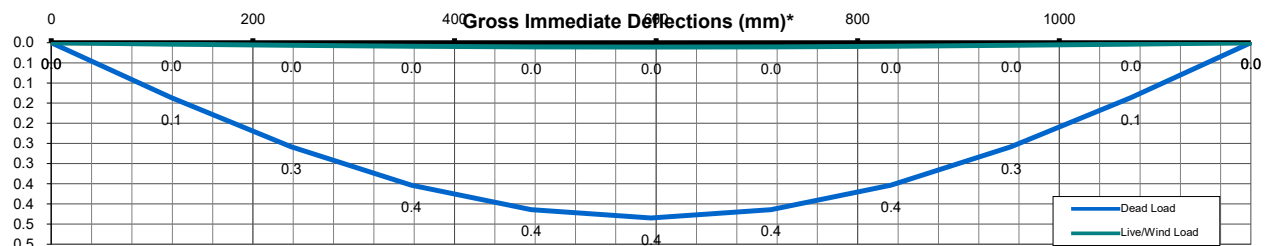
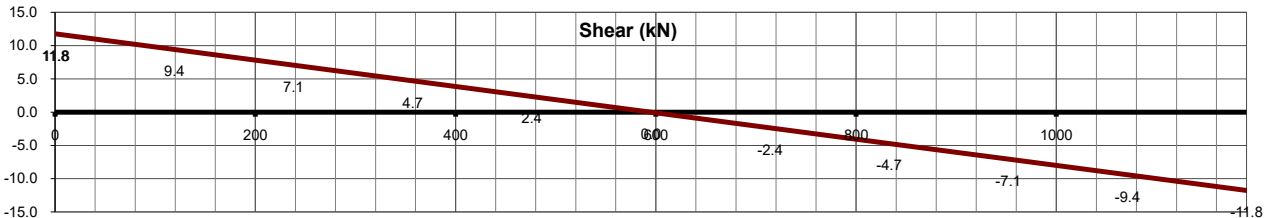
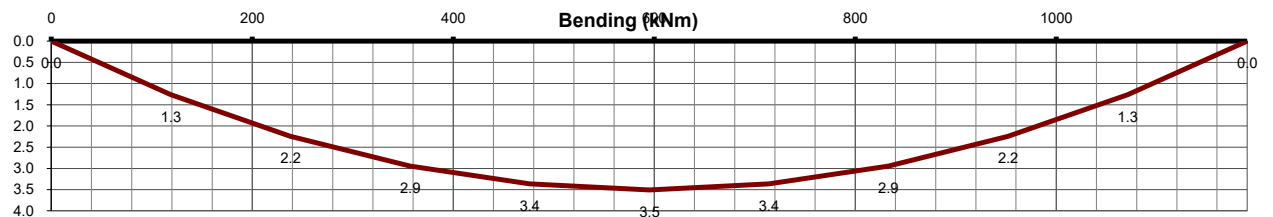
109437

2669

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
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1200x200x120 Concrete Sleeper 5 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (1200x200x120 Concrete Sleeper 5 KPa 2N10) 120mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.18  
 Strength: (+ve M) M\* = 3.5kNm < øMuo = 5.0kNm OK (0.70)  
 Cracking: fscr = 240MPa < Fscr = 362MPa & fscr1 = 240MPa < Fscr1 = 400MPa OK (0.60,0.66)  
 Ast.min: Ast.min = 51mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.33)

Geometry S.Wt = 0.60 kN/m L/D ratio = 9.9

Concrete strength (f'c) = 40 MPa

Depth (D) = 120 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 24000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	3.5	0.0	kNm
Ms1*	0.0	2.9	0.0	kNm
Ms*	0.0	2.9	0.0	kNm
Ast req'd	0	108	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.4-N10	-	

Reinforcement Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 85 mm  
 Depth to bottom steel (ds) = 85 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 64 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 157 mm² ds = 85 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 6.2 kNm ku = 0.176  
 Design capacity (øMuo) = 5.0 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 51 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 240 MPa Max. stress (Fscr) = 362 MPa OK (0.66)  
 Steel stress (fscr1) = 240 MPa Max. stress (Fscr1) = 400 MPa OK (0.60)



Concrete Sleeper Retaining Wall

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Barrason's Engineers

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1200x200x100 Concrete Sleeper 10 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (1200x200x100 Concrete Sleeper 10 KPa 2N10) 100mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.23  
 Strength: (+ve M) M\* = 2.6kNm < øMu0 = 3.7kNm OK (0.70)  
 Cracking: fscr = 232MPa < Fscr = 362MPa & fscr1 = 232MPa < Fscr1 = 400MPa OK (0.58,0.64)  
 Ast.min: Ast.min = 47mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.30)

Geometry S.Wt = 0.50 kN/m L/D ratio = 11.9

Concrete strength (f'c) = 40 MPa

Depth (D) = 100 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard),(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes),(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 20000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual, (L)eft, Position (X) from analysis, (R)ight)

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	2.6	0.0	kNm
Ms1*	0.0	2.1	0.0	kNm
Ms*	0.0	2.1	0.0	kNm
Ast req'd	0	106	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.4-N10	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (Normal),(L)ow,(A)uto  
 Reinf't ductility class = N (Normal),(L)ow  
 Depth to bottom steel layer (ds.max) = 65 mm  
 Depth to bottom steel (ds) = 65 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal),(L)ow,(A)uto  
 Reinf't ductility class = N (Normal),(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 44 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 157 mm² ds = 65 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 4.7 kNm ku = 0.231  
 Design capacity (øMu0) = 3.7 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 47 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 232 MPa Max. stress (Fscr) = 362 MPa OK (0.64)  
 Steel stress (fscr1) = 232 MPa Max. stress (Fscr1) = 400 MPa OK (0.58)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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1200x200x100 Concrete Sleeper 10 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (1200x200x100 Concrete Sleeper 10 KPa 2N10): Concrete simple beam

Description =	100mm (D) x 200mm (W) beam	lx =	16.66666667 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	1190 mm	Ag =	20000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	11.20			Dead load (pdl) =			
Live load (wll) =	0.80			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	1190			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	14.64	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 595 mm

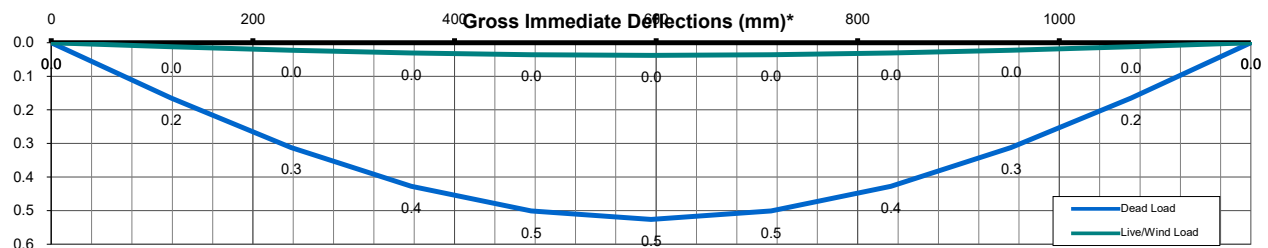
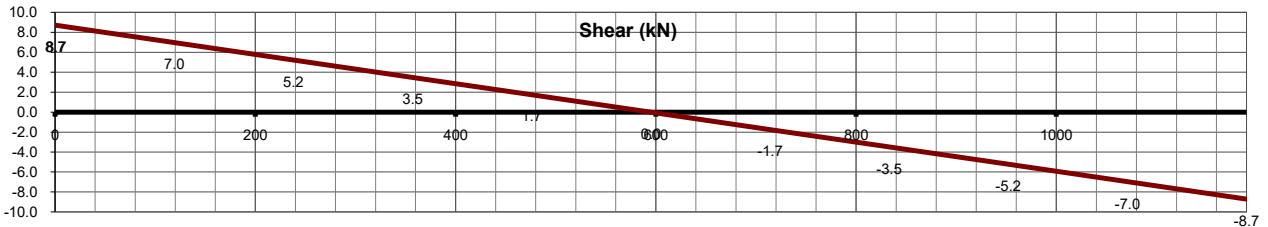
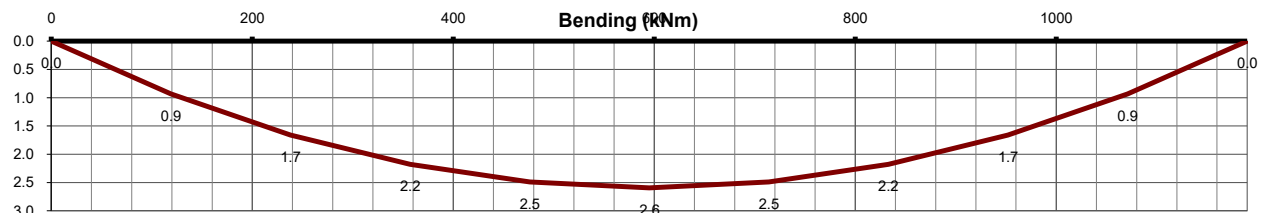
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	6.66		6.66					kN	
Rll	0.48		0.48					kN	
R*	8.71		8.71					kN	
M*	0.00	2.59	0.00	2.59	595	0.00	0	kNm	
V*	8.71	0.00	-8.71	8.71	0			kN	Span /
δdl	0.00	0.53	0.00	0.53	595	0.00	0	mm	2262
δll	0.00	0.04	0.00	0.04	595	0.00	0	mm	31666
δdl+Ψs*δll	0.00	0.56	0.00	0.56	595	0.00	0	mm	2111

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

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1200x200x80 Concrete Sleeper 5 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (1200x200x80 Concrete Sleeper 5 KPa 2N10): Concrete simple beam

Description =	77mm (D) x 200mm (W) beam	Ix =	7.608883333 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	1190 mm	Ag =	15400 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	7.04			Dead load (pdl) =			
Live load (wll) =	0.40			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	1190			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	9.05	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 595 mm

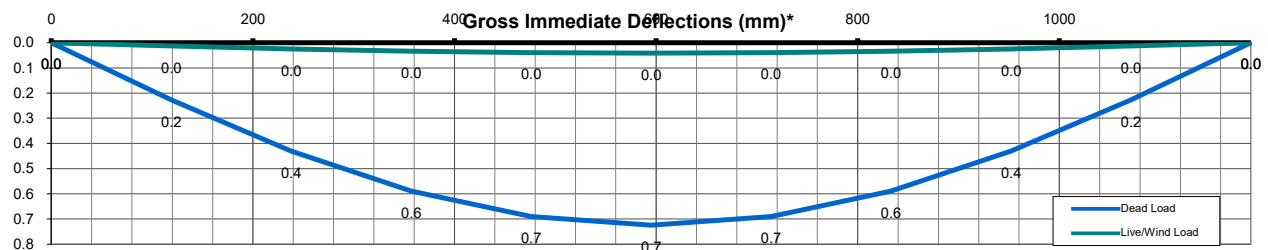
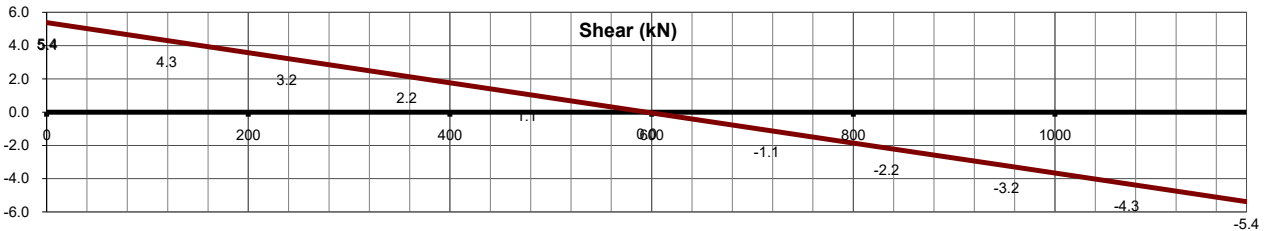
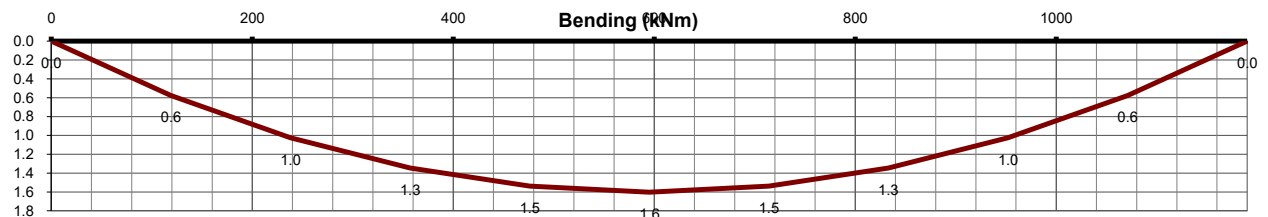
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	4.19		4.19					kN	
Rll	0.24		0.24					kN	
R*	5.38		5.38					kN	
M*	0.00	1.60	0.00	1.60	595	0.00	0	kNm	
V*	5.38	0.00	-5.38	5.38	0			kN	Span /
δdl	0.00	0.72	0.00	0.72	595	0.00	0	mm	1643
δll	0.00	0.04	0.00	0.04	595	0.00	0	mm	28913
δdl+Ψs*δll	0.00	0.77	0.00	0.77	595	0.00	0	mm	1554

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

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1200x200x80 Concrete Sleeper 5 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (1200x200x80 Concrete Sleeper 5 KPa 2N10) 77mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.36  
 Strength: (+ve M) M\* = 1.6kNm < øMuo = 2.3kNm OK (0.70)  
 Cracking: fscr = 228MPa < Fscr = 362MPa & fscr1 = 228MPa < Fscr1 = 400MPa OK (0.57,0.63)  
 Ast.min: Ast.min = 43mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.27)

Geometry S.Wt = 0.39 kN/m L/D ratio = 15.5

Concrete strength (f'c) = 40 MPa

Depth (D) = 77 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard),(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes),(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 15400 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual, (L)eft, Position (X) from analysis, (R)ight)

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	1.6	0.0	kNm
Ms1*	0.0	1.3	0.0	kNm
Ms*	0.0	1.3	0.0	kNm
Ast req'd	0	106	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.3-N10	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (Normal),(L)ow,(A)uto  
 Reinf't ductility class = N (Normal),(L)ow  
 Depth to bottom steel layer (ds.max) = 42 mm  
 Depth to bottom steel (ds) = 42 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal),(L)ow,(A)uto  
 Reinf't ductility class = N (Normal),(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 21 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm	Design flange (bef) = 200 mm
Tensile steel area (As) = 157 mm²	ds = 42 mm
Comp. steel area (Ac) = 0 mm²	dc = 56 mm
Ultimate Moment (Mu) = 2.8 kNm	ku = 0.357
Design capacity (øMuo) = 2.3 kNm	ø = 0.800 Table 2.2.2
	Ast.min = 43 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 228 MPa	Max. stress (Fscr) = 362 MPa	OK (0.63)
Steel stress (fscr1) = 228 MPa	Max. stress (Fscr1) = 400 MPa	OK (0.57)



Geometry for (1800x200x80 Concrete Sleeper 5 KPa): Concrete simple beam

Description =	77mm (D) x 200mm (W) beam	lx =	7.608883333 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	1800 mm		
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Ag =	15400 mm <sup>2</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	Density =	25 kN/m <sup>3</sup>
		E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	3.53			Dead load (pdl) =			
Live load (wll) =	0.35			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	1800			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	4.76	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 900 mm

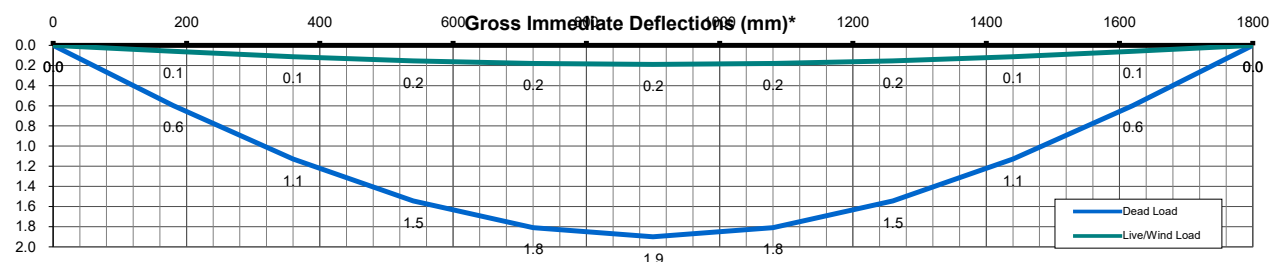
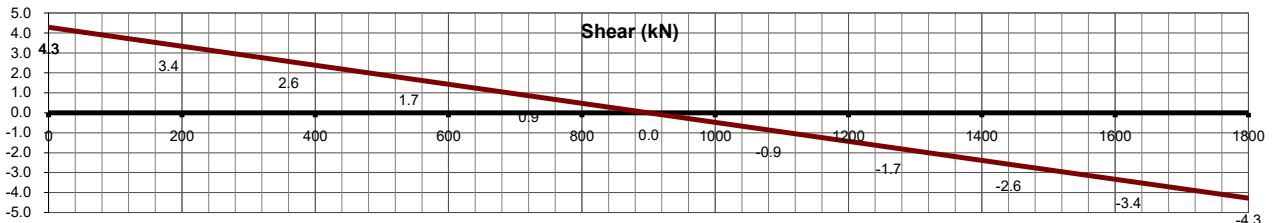
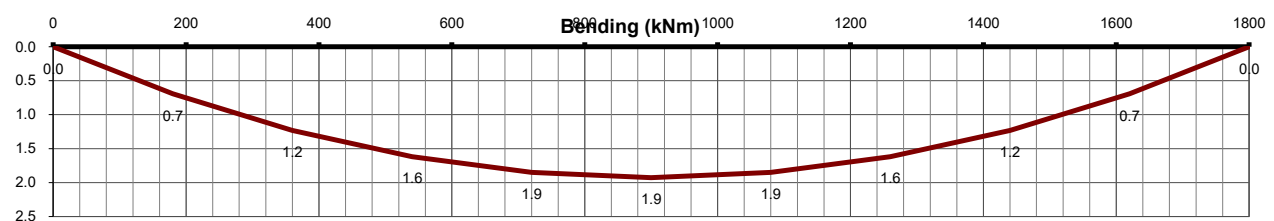
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	3.18		3.18					kN	
Rll	0.32		0.32					kN	
R*	4.28		4.28					kN	
M*	0.00	1.93	0.00	1.93	900	0.00	0	kNm	
V*	4.28	0.00	-4.28	4.28	0			kN	Span /
δdl	0.00	1.90	0.00	1.90	900	0.00	0	mm	947
δll	0.00	0.19	0.00	0.19	900	0.00	0	mm	9548
δdl+Ψs*δll	0.00	2.09	0.00	2.09	900	0.00	0	mm	862

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered





Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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1800x200x80 Concrete Sleeper 5 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (1800x200x80 Concrete Sleeper 5 KPa) 77mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.53 > 0.36 - Non ductile  
 Strength: (+ve M) M\* = 1.9kNm < øMuo = 2.3kNm OK (0.84)  
 Cracking: fscr = 198MPa < Fscr = 330MPa & fscr1 = 198MPa < Fscr1 = 400MPa OK (0.49,0.60)  
 Ast.min: Ast.min = 44mm² < Ast = 226mm² (Minimum of Deemed and actual) OK (0.19)

Geometry S.Wt = 0.39 kN/m L/D ratio = 23.4

Concrete strength (f'c) = 40 MPa

Depth (D) = 77 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 15400 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	1.9	0.0	kNm
Ms1*	0.0	1.6	0.0	kNm
Ms*	0.0	1.6	0.0	kNm
Ast req'd	0	135	0	mm²
Ast	226	226	226	mm²
Reinf't req'd	-	1.2-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm²  
 Ductility class = N (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 41 mm  
 Depth to bottom steel (ds) = 41 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 21 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm  
 Tensile steel area (As) = 226 mm²  
 Comp. steel area (Ac) = 0 mm²  
 Ultimate Moment (Mu) = 3.7 kNm  
 Design capacity (øMuo) = 2.3 kNm

Design flange (bef) = 200 mm  
 ds = 41 mm  
 dc = 56 mm  
 ku = 0.527 Warning - ku > 0.36 - Cl 8.1.5  
 ø = 0.619 Table 2.2.2  
 Ast.min = 44 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 198 MPa Max. stress (Fscr) = 330 MPa OK (0.60)  
 Steel stress (fscr1) = 198 MPa Max. stress (Fscr1) = 400 MPa OK (0.49)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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1800x200x80 Concrete Sleeper 10 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (1800x200x80 Concrete Sleeper 10 KPa): Concrete simple beam

Description =	77mm (D) x 200mm (W) beam	ix =	7.608883333 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	1800 mm	Ag =	15400 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	3.02			Dead load (pdl) =			
Live load (wll) =	0.70			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	1800			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	4.68	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 900 mm

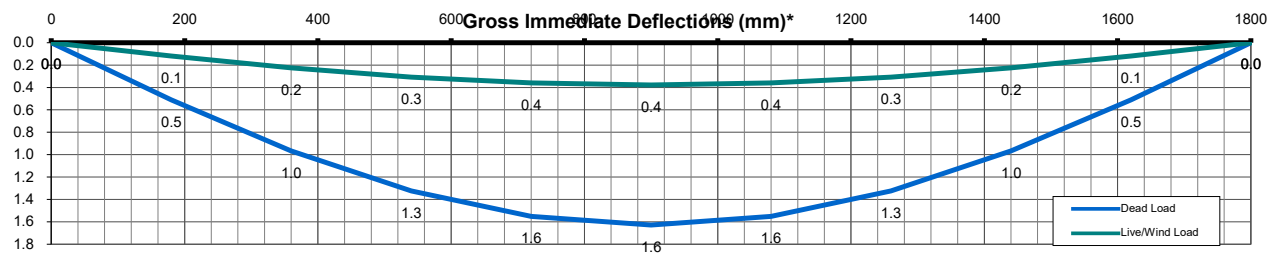
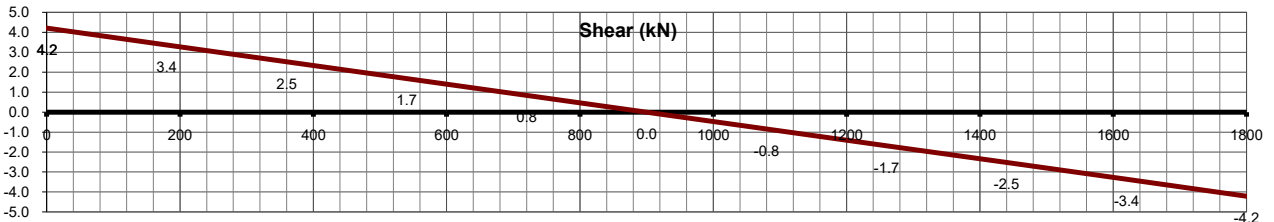
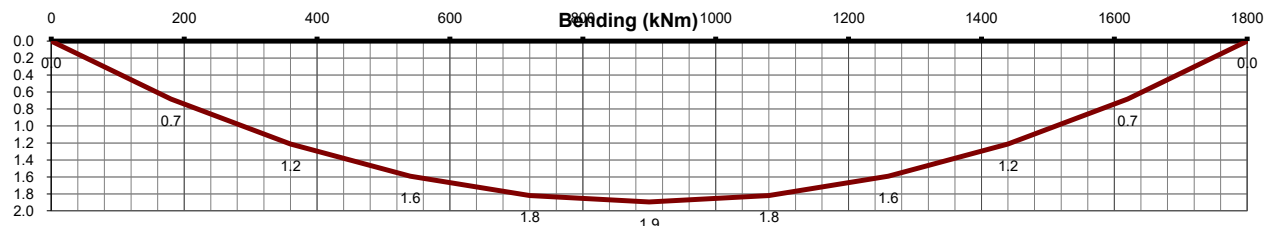
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	2.72		2.72					kN	
Rll	0.63		0.63					kN	
R*	4.21		4.21					kN	
M*	0.00	1.89	0.00	1.89	900	0.00	0	kNm	
V*	4.21	0.00	-4.21	4.21	0			kN	Span /
δdl	0.00	1.63	0.00	1.63	900	0.00	0	mm	1105
δll	0.00	0.38	0.00	0.38	900	0.00	0	mm	4774
δdl+Ψs*δll	0.00	2.01	0.00	2.01	900	0.00	0	mm	897

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

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1800x200x80 Concrete Sleeper 10 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (1800x200x80 Concrete Sleeper 10 KPa) 77mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.53 > 0.36 - Non ductile  
 Strength: (+ve M) M\* = 1.9kNm < øMuo = 2.3kNm OK (0.83)  
 Cracking: fscr = 190MPa < Fscr = 330MPa & fscr1 = 190MPa < Fscr1 = 400MPa OK (0.48,0.58)  
 Ast.min: Ast.min = 44mm² < Ast = 226mm² (Minimum of Deemed and actual) OK (0.19)

Geometry S.Wt = 0.39 kN/m L/D ratio = 23.4

Concrete strength (f'c) = 40 MPa

Depth (D) = 77 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard), (R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes), (N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 15400 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual), (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	1.9	0.0	kNm
Ms1*	0.0	1.5	0.0	kNm
Ms*	0.0	1.5	0.0	kNm
Ast req'd	0	132	0	mm²
Ast	226	226	226	mm²
Reinf't req'd	-	1.2-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm²  
 Ductility class = N (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to bottom steel layer (ds.max) = 41 mm  
 Depth to bottom steel (ds) = 41 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 21 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm  
 Tensile steel area (As) = 226 mm²  
 Comp. steel area (Ac) = 0 mm²  
 Ultimate Moment (Mu) = 3.7 kNm  
 Design capacity (øMuo) = 2.3 kNm

Design flange (bef) = 200 mm  
 ds = 41 mm  
 dc = 56 mm  
 ku = 0.527 Warning - ku > 0.36 - Cl 8.1.5  
 ø = 0.619 Table 2.2.2  
 Ast.min = 44 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 190 MPa Max. stress (Fscr) = 330 MPa OK (0.58)  
 Steel stress (fscr1) = 190 MPa Max. stress (Fscr1) = 400 MPa OK (0.48)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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1800x200x100 Concrete Sleeper 5 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (1800x200x100 Concrete Sleeper 5 KPa): Concrete simple beam

Description =	100mm (D) x 200mm (W) beam	lx =	16.66666667 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	1800 mm	Ag =	20000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	6.30			Dead load (pdl) =			
Live load (wll) =	0.35			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	1800			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	8.09	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 900 mm

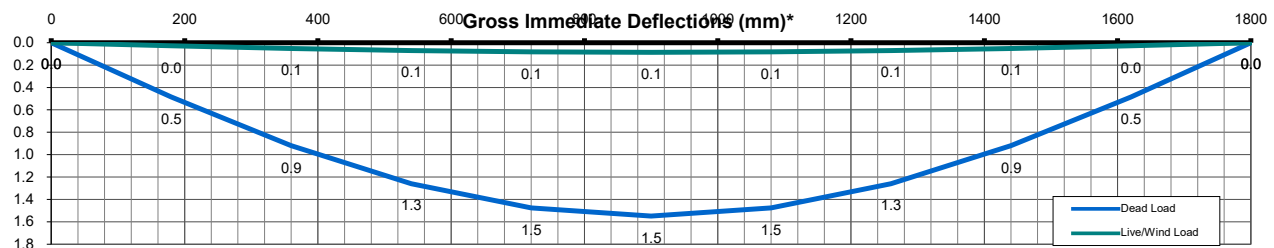
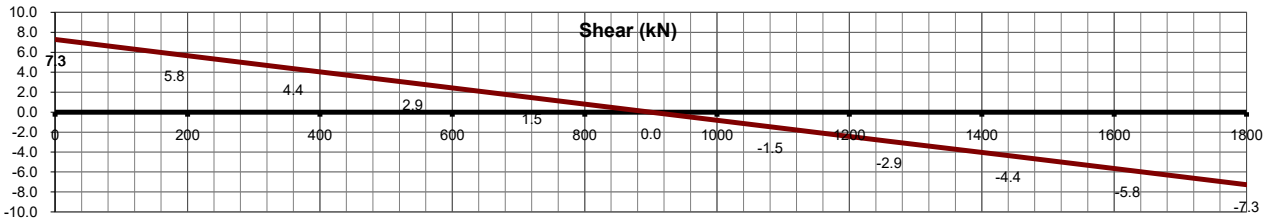
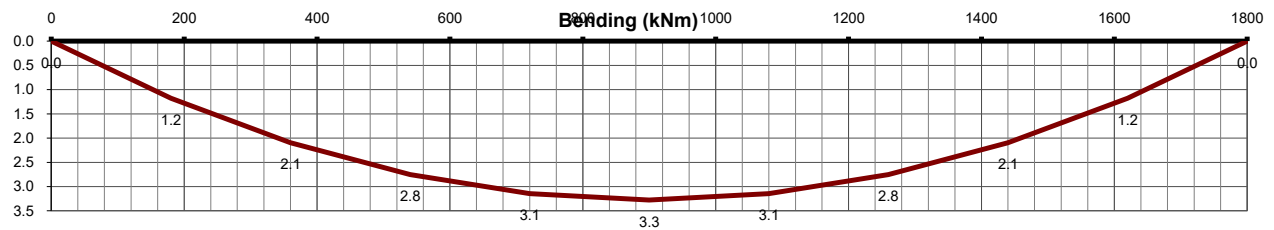
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	5.67		5.67					kN	
Rll	0.32		0.32					kN	
R*	7.28		7.28					kN	
M*	0.00	3.27	0.00	3.27	900	0.00	0	kNm	
V*	7.28	0.00	-7.28	7.28	0			kN	Span /
δdl	0.00	1.55	0.00	1.55	900	0.00	0	mm	1162
δll	0.00	0.09	0.00	0.09	900	0.00	0	mm	20914
δdl+Ψs*δll	0.00	1.64	0.00	1.64	900	0.00	0	mm	1101

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

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1800x200x100 Concrete Sleeper 5 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (1800x200x100 Concrete Sleeper 5 KPa) 100mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.34  
 Strength: (+ve M) M\* = 3.3kNm < øMu0 = 5.0kNm OK (0.65)  
 Cracking: fscr = 212MPa < Fscr = 330MPa & fscr1 = 212MPa < Fscr1 = 400MPa OK (0.53,0.64)  
 Ast.min: Ast.min = 47mm² < Ast = 226mm² (Minimum of Deemed and actual) OK (0.21)

Geometry S.Wt = 0.50 kN/m L/D ratio = 18.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 100 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 20000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	3.3	0.0	kNm
Ms1*	0.0	2.7	0.0	kNm
Ms*	0.0	2.7	0.0	kNm
Ast req'd	0	140	0	mm²
Ast	226	226	226	mm²
Reinf't req'd	-	1.2-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm²  
 Ductility class = N (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 64 mm  
 Depth to bottom steel (ds) = 64 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsyc) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 44 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 226 mm² ds = 64 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 6.3 kNm ku = 0.337  
 Design capacity (øMu0) = 5.0 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 47 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 212 MPa Max. stress (Fscr) = 330 MPa OK (0.64)  
 Steel stress (fscr1) = 212 MPa Max. stress (Fscr1) = 400 MPa OK (0.53)



Concrete Sleeper Retaining Wall

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1800x200x100 Concrete Sleeper 10 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (1800x200x100 Concrete Sleeper 10 KPa): Concrete simple beam

Description =	100mm (D) x 200mm (W) beam	lx =	16.66666667 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	1800 mm	Ag =	20000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	6.05			Dead load (pdl) =			
Live load (wll) =	0.70			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	1800			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	8.31	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 900 mm

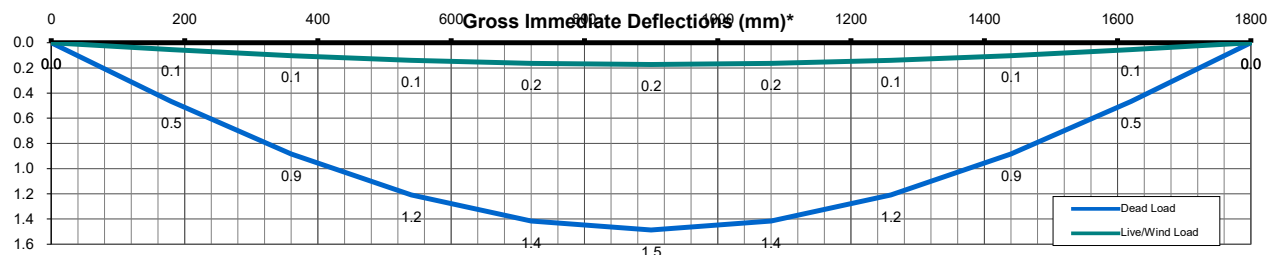
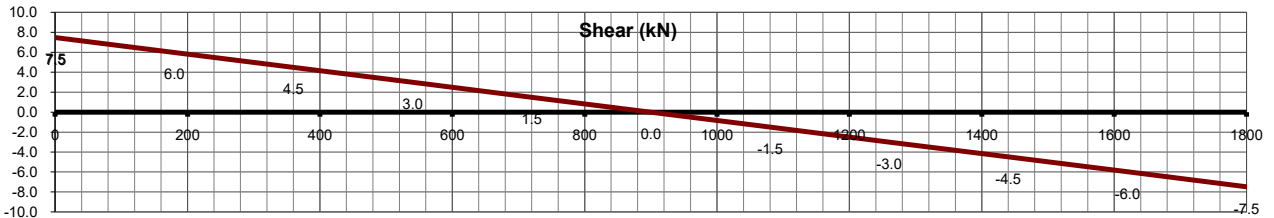
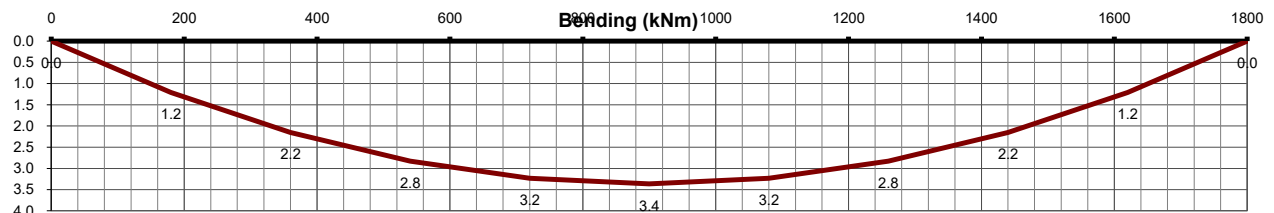
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	5.44		5.44					kN	
Rll	0.63		0.63					kN	
R*	7.48		7.48					kN	
M*	0.00	3.36	0.00	3.36	900	0.00	0	kNm	
V*	7.48	0.00	-7.48	7.48	0			kN	Span /
δdl	0.00	1.49	0.00	1.49	900	0.00	0	mm	1210
δll	0.00	0.17	0.00	0.17	900	0.00	0	mm	10457
δdl+Ψs*δll	0.00	1.66	0.00	1.66	900	0.00	0	mm	1085

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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### Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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### 1800x200x100 Concrete Sleeper 10 KPa

#### CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (1800x200x100 Concrete Sleeper 10 KPa) 100mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.34  
 Strength: (+ve M) M\* = 3.4kNm < øMuo = 5.0kNm OK (0.67)  
 Cracking: fscr = 215MPa < Fscr = 330MPa & fscr1 = 215MPa < Fscr1 = 400MPa OK (0.54,0.65)  
 Ast.min: Ast.min = 47mm<sup>2</sup> < Ast = 226mm<sup>2</sup> (Minimum of Deemed and actual) OK (0.21)

Geometry S.Wt = 0.50 kN/m L/D ratio = 18.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 100 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
 Tension

Side cover = 30 mm Formwork = S (Standard), (R)igid  
 Concrete weight = 25.0 kN/m<sup>3</sup> Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes), (N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 20000 mm<sup>2</sup> Side = B1 Tab 4.10.3.2

#### Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual), (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	3.4	0.0	kNm
Ms1*	0.0	2.7	0.0	kNm
Ms*	0.0	2.7	0.0	kNm
Ast req'd	0	144	0	mm <sup>2</sup>
Ast	226	226	226	mm <sup>2</sup>
Reinf't req'd	-	1.3-N12	-	

#### Reinforcement

Ligs = No ligs

##### Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm<sup>2</sup> = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm<sup>2</sup>  
 Ductility class = N (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to bottom steel layer (ds.max) = 64 mm  
 Depth to bottom steel (ds) = 64 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

##### Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm<sup>2</sup> = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm<sup>2</sup>  
 Ductility class = A (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 44 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

#### Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 226 mm<sup>2</sup> ds = 64 mm  
 Comp. steel area (Ac) = 0 mm<sup>2</sup> dc = 56 mm  
 Ultimate Moment (Mu) = 6.3 kNm ku = 0.337  
 Design capacity (øMuo) = 5.0 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 47 mm<sup>2</sup>

#### Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 215 MPa Max. stress (Fscr) = 330 MPa OK (0.65)  
 Steel stress (fscr1) = 215 MPa Max. stress (Fscr1) = 400 MPa OK (0.54)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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1800x200x120 Concrete Sleeper 5 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (1800x200x120 Concrete Sleeper 5 KPa): Concrete simple beam

Description =	120mm (D) x 200mm (W) beam	lx =	28.8 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	1800 mm	Ag =	24000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	8.19			Dead load (pdl) =			
Live load (wll) =	0.35			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	1800			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	10.35	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 900 mm

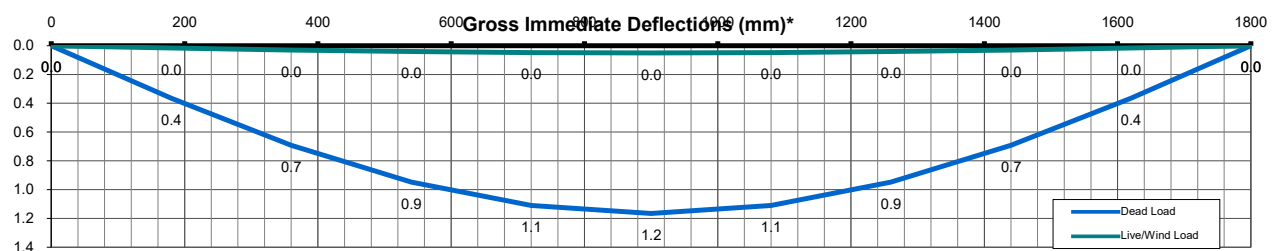
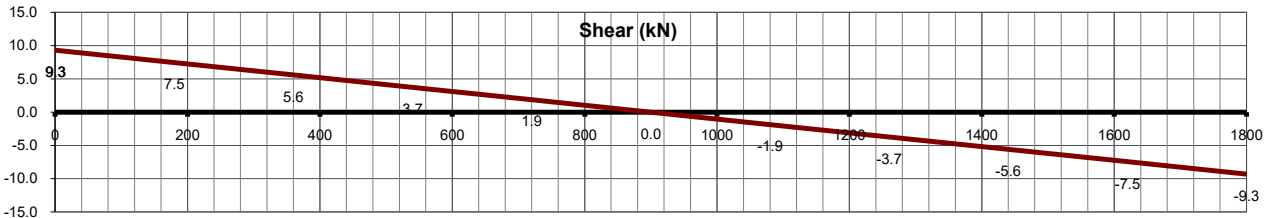
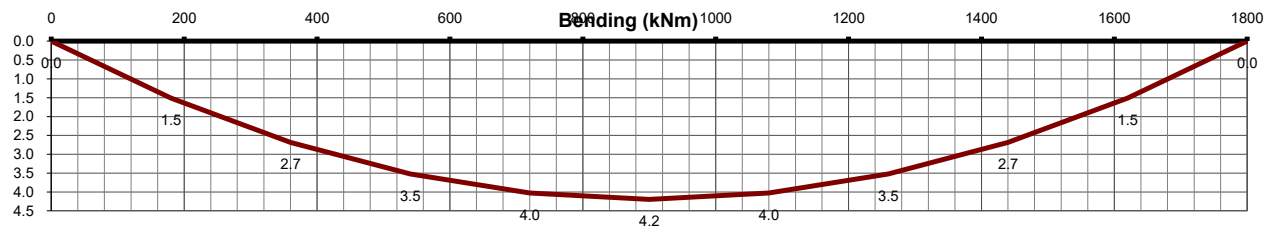
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	7.37		7.37					kN	
Rll	0.32		0.32					kN	
R*	9.32		9.32					kN	
M*	0.00	4.19	0.00	4.19	900	0.00	0	kNm	
V*	9.32	0.00	-9.32	9.32	0			kN	Span /
δdl	0.00	1.17	0.00	1.17	900	0.00	0	mm	1544
δll	0.00	0.05	0.00	0.05	900	0.00	0	mm	36139
δdl+Ψs*δll	0.00	1.22	0.00	1.22	900	0.00	0	mm	1481

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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1800x200x120 Concrete Sleeper 5 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (1800x200x120 Concrete Sleeper 5 KPa) 120mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.26  
 Strength: (+ve M) M\* = 4.2kNm < øMuo = 6.8kNm OK (0.61)  
 Cracking: fscr = 204MPa < Fscr = 330MPa & fscr1 = 204MPa < Fscr1 = 400MPa OK (0.51,0.62)  
 Ast.min: Ast.min = 52mm² < Ast = 226mm² (Minimum of Deemed and actual) OK (0.23)

Geometry S.Wt = 0.60 kN/m L/D ratio = 15.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 120 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard), (R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes), (N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 24000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual), (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	4.2	0.0	kNm
Ms1*	0.0	3.5	0.0	kNm
Ms*	0.0	3.5	0.0	kNm
Ast req'd	0	133	0	mm²
Ast	226	226	226	mm²
Reinf't req'd	-	1.2-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm²  
 Ductility class = N (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to bottom steel layer (ds.max) = 84 mm  
 Depth to bottom steel (ds) = 84 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 64 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm  
 Tensile steel area (As) = 226 mm²  
 Comp. steel area (Ac) = 0 mm²  
 Ultimate Moment (Mu) = 8.6 kNm  
 Design capacity (øMuo) = 6.8 kNm

Design flange (bef) = 200 mm  
 ds = 84 mm  
 dc = 56 mm  
 ku = 0.257  
 ø = 0.800 Table 2.2.2  
 Ast.min = 52 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 204 MPa Max. stress (Fscr) = 330 MPa OK (0.62)  
 Steel stress (fscr1) = 204 MPa Max. stress (Fscr1) = 400 MPa OK (0.51)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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1800x200x120 Concrete Sleeper 10 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (1800x200x120 Concrete Sleeper 10 KPa): Concrete simple beam

Description =	120mm (D) x 200mm (W) beam	lx =	28.8 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	1800 mm	Ag =	24000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	7.56			Dead load (pdl) =			
Live load (wll) =	0.70			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	1800			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	10.12	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 900 mm

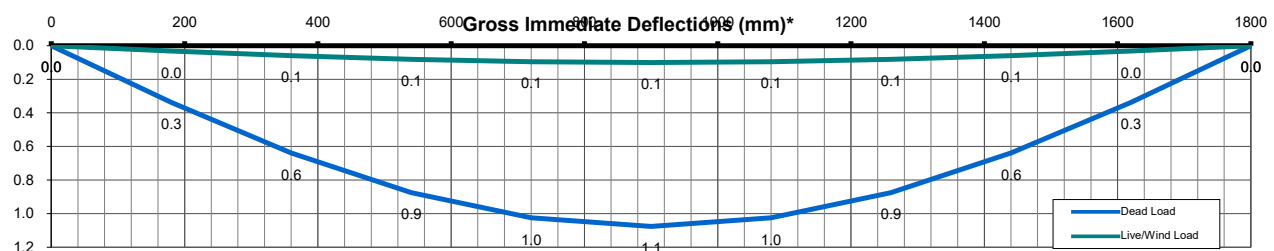
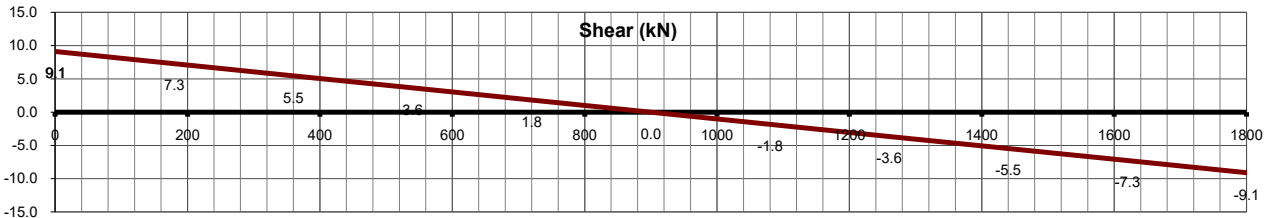
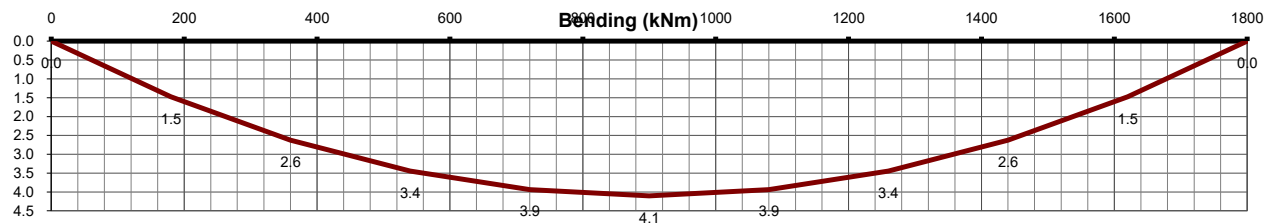
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	6.80		6.80					kN	
Rll	0.63		0.63					kN	
R*	9.11		9.11					kN	
M*	0.00	4.10	0.00	4.10	900	0.00	0	kNm	
V*	9.11	0.00	-9.11	9.11	0			kN	Span /
δdl	0.00	1.08	0.00	1.08	900	0.00	0	mm	1673
δll	0.00	0.10	0.00	0.10	900	0.00	0	mm	18070
δdl+Ψs*δll	0.00	1.18	0.00	1.18	900	0.00	0	mm	1531

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

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1800x200x120 Concrete Sleeper 10 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (1800x200x120 Concrete Sleeper 10 KPa) 120mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.26  
 Strength: (+ve M) M\* = 4.1kNm < øMu0 = 6.8kNm OK (0.60)  
 Cracking: fscr = 198MPa < Fscr = 330MPa & fscr1 = 198MPa < Fscr1 = 400MPa OK (0.49,0.60)  
 Ast.min: Ast.min = 52mm² < Ast = 226mm² (Minimum of Deemed and actual) OK (0.23)

Geometry S.Wt = 0.60 kN/m L/D ratio = 15.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 120 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard), (R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes), (N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 24000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual), (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	4.1	0.0	kNm
Ms1*	0.0	3.3	0.0	kNm
Ms*	0.0	3.3	0.0	kNm
Ast req'd	0	130	0	mm²
Ast	226	226	226	mm²
Reinf't req'd	-	1.1-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm²  
 Ductility class = N (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to bottom steel layer (ds.max) = 84 mm  
 Depth to bottom steel (ds) = 84 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 64 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm  
 Tensile steel area (As) = 226 mm²  
 Comp. steel area (Ac) = 0 mm²  
 Ultimate Moment (Mu) = 8.6 kNm  
 Design capacity (øMu0) = 6.8 kNm

Design flange (bef) = 200 mm  
 ds = 84 mm  
 dc = 56 mm  
 ku = 0.257  
 ø = 0.800 Table 2.2.2  
 Ast.min = 52 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 198 MPa Max. stress (Fscr) = 330 MPa OK (0.60)  
 Steel stress (fscr1) = 198 MPa Max. stress (Fscr1) = 400 MPa OK (0.49)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
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1800x200x80 Concrete Sleeper 5 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (1800x200x80 Concrete Sleeper 5 KPa 2N10): Concrete simple beam

Description =	77mm (D) x 200mm (W) beam	lx =	7.608883333 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	1800 mm	Ag =	15400 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	2.27			Dead load (pdl) =			
Live load (wll) =	0.35			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	1800			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	3.25	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 900 mm

1.20\*G+1.50\*Q analysed

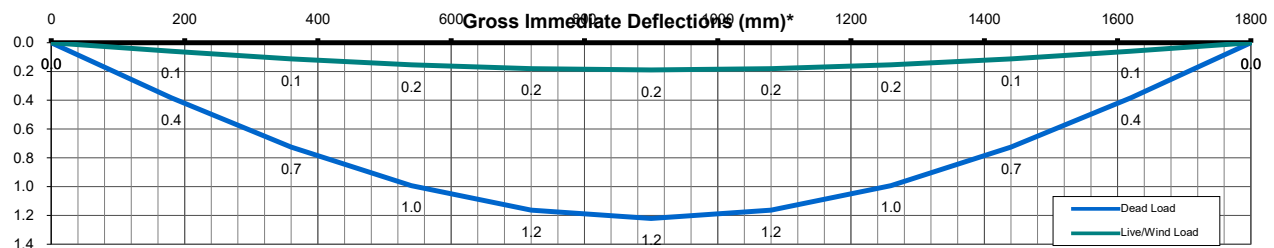
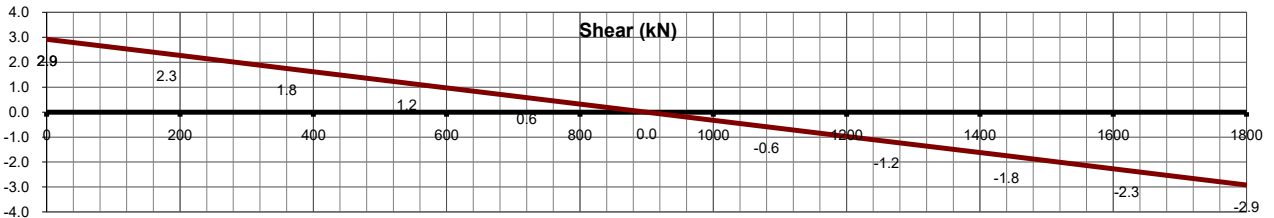
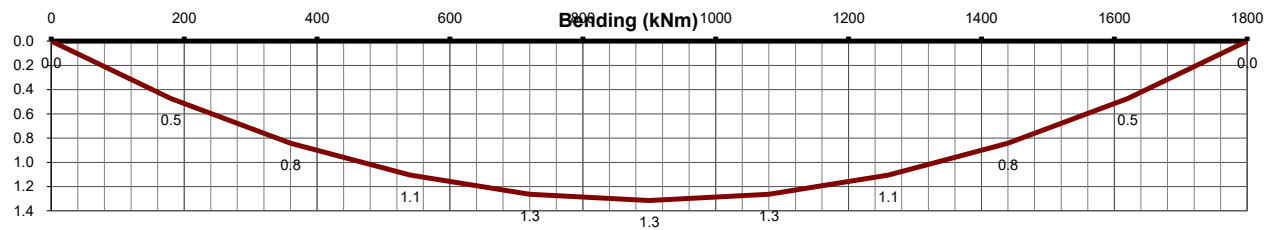
	Left	At x	Right	Max	At	Min	At	Units
Rdl	2.04		2.04					kN
Rll	0.32		0.32					kN
R*	2.92		2.92					kN
M*	0.00	1.31	0.00	1.31	900	0.00	0	kNm
V*	2.92	0.00	-2.92	2.92	0			kN
δdl	0.00	1.22	0.00	1.22	900	0.00	0	mm
δll	0.00	0.19	0.00	0.19	900	0.00	0	mm
δdl+Ψs*δll	0.00	1.41	0.00	1.41	900	0.00	0	mm

Span / 1473  
9548  
1276

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

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Barrason's Engineers

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1800x200x80 Concrete Sleeper 5 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (1800x200x80 Concrete Sleeper 5 KPa 2N10) 77mm (D) x 200mm (W) beam, f'c=40MPa
Reinf't: 2.0-N10 bottom, ku = 0.36
Strength: (+ve M) M\* = 1.3kNm < phiMu0 = 1.8kNm OK (0.72)
Cracking: fscr = 184MPa < Fscr = 362MPa & fscr1 = 184MPa < Fscr1 = 400MPa OK (0.46,0.51)
Ast.min: Ast.min = 43mm^2 < Ast = 157mm^2 (Minimum of Deemed and actual) OK (0.27)

Geometry S.Wt = 0.39 kN/m L/D ratio = 23.4

Concrete strength (f'c) = 40 MPa

Depth (D) = 77 mm
Web width (W) = 200 mm, (S)lab
Flange width (Bf) = 200 mm
Flange thickness (Tf) = 0 mm



Comp.
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid
Concrete weight = 25.0 kN/m^3 Exposure top = B2 Tab 4.10.3.2
Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2
Gross area (Ag) = 15400 mm^2 Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

Table with 5 columns: Parameter, Left, Max+, Right, Units. Rows include M\*, Ms1\*, Ms\*, Ast req'd, Ast, and Reinf't req'd.

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm
Bar cts/No/mm^2 = 2 No
Yield strength (fsy) = 500 MPa
Bottom cover to ligs = 30 mm
Steel area (Ast) = 157 mm^2
Ductility class = L (N)ormal,(L)ow,(A)uto
Reinf't ductility class = L (N)ormal,(L)ow
Depth to bottom steel layer (ds.max) = 42 mm
Depth to bottom steel (ds) = 42 mm
D-ds = 35 mm
No. bars = 2.0 No.
Bar centres = 130 mm
Max bars per layer = 4
Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm
Bar cts/No/mm^2 = 0 No
Yield strength (fsy) = 500 MPa
Top cover to ligs = 50 mm
Steel area (Asc) = 0 mm^2
Ductility class = A (N)ormal,(L)ow,(A)uto
Reinf't ductility class = N (N)ormal,(L)ow
Depth to top steel layer = 56 mm
Depth to top steel = 56 mm
D-ds = 21 mm
No. bars = 0.0 No.
Bar centres = 0 mm
Max bars per layer = 1
Max bars pers 2nd layer = 0
Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm
Tensile steel area (As) = 157 mm^2 ds = 42 mm
Comp. steel area (Ac) = 0 mm^2 dc = 56 mm
Ultimate Moment (Mu) = 2.8 kNm ku = 0.357
Design capacity (phiMu0) = 1.8 kNm phi = 0.640 Table 2.2.2
Ast.min = 43 mm^2

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 184 MPa Max. stress (Fscr) = 362 MPa OK (0.51)
Steel stress (fscr1) = 184 MPa Max. stress (Fscr1) = 400 MPa OK (0.46)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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1800x200x80 Concrete Sleeper 10 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (1800x200x80 Concrete Sleeper 10 KPa 2N10): Concrete simple beam

Description =	77mm (D) x 200mm (W) beam	ix =	7.608883333 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	1800 mm	Ag =	15400 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	1.76			Dead load (pdl) =			
Live load (wll) =	0.70			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	1800			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	3.17	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 900 mm

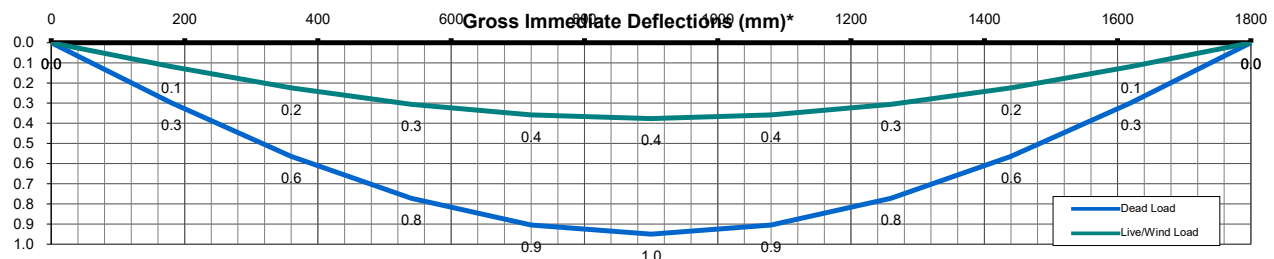
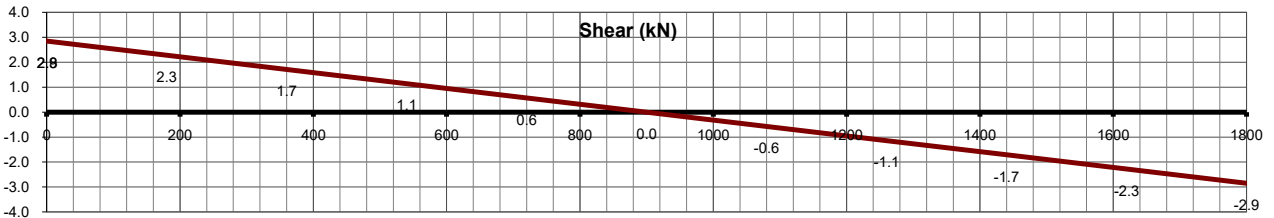
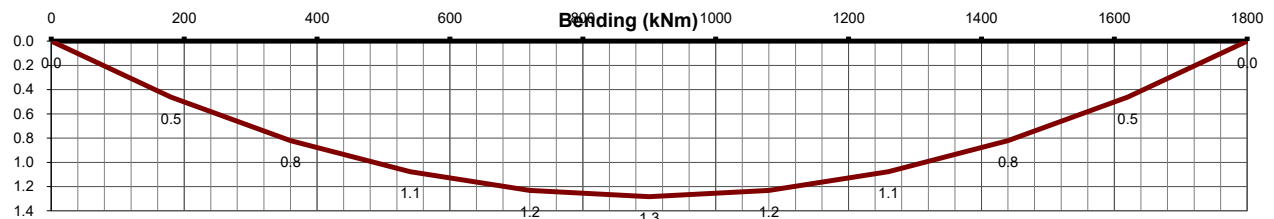
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	1.59		1.59					kN	
Rll	0.63		0.63					kN	
R*	2.85		2.85					kN	
M*	0.00	1.28	0.00	1.28	900	0.00	0	kNm	
V*	2.85	0.00	-2.85	2.85	0			kN	Span /
δdl	0.00	0.95	0.00	0.95	900	0.00	0	mm	1894
δll	0.00	0.38	0.00	0.38	900	0.00	0	mm	4774
δdl+Ψs*δll	0.00	1.33	0.00	1.33	900	0.00	0	mm	1356

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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1800x200x80 Concrete Sleeper 10 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (1800x200x80 Concrete Sleeper 10 KPa 2N10) 77mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.36  
 Strength: (+ve M) M\* = 1.3kNm < øMuo = 2.3kNm OK (0.56)  
 Cracking: fscr = 173MPa < Fscr = 362MPa & fscr1 = 173MPa < Fscr1 = 400MPa OK (0.43,0.48)  
 Ast.min: Ast.min = 43mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.27)

Geometry S.Wt = 0.39 kN/m L/D ratio = 23.4

Concrete strength (f'c) = 40 MPa

Depth (D) = 77 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard),(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes),(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 15400 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual, (L)eft, Position (X) from analysis, (R)ight)

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	1.3	0.0	kNm
Ms1*	0.0	1.0	0.0	kNm
Ms*	0.0	1.0	0.0	kNm
Ast req'd	0	83	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.1-N10	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (Normal),(L)ow,(A)uto  
 Reinf't ductility class = N (Normal),(L)ow  
 Depth to bottom steel layer (ds.max) = 42 mm  
 Depth to bottom steel (ds) = 42 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal),(L)ow,(A)uto  
 Reinf't ductility class = N (Normal),(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 21 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 157 mm² ds = 42 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 2.8 kNm ku = 0.357  
 Design capacity (øMuo) = 2.3 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 43 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 173 MPa Max. stress (Fscr) = 362 MPa OK (0.48)  
 Steel stress (fscr1) = 173 MPa Max. stress (Fscr1) = 400 MPa OK (0.43)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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1800x200x100 Concrete Sleeper 5 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (1800x200x100 Concrete Sleeper 5 KPa 2N10): Concrete simple beam

Description =	100mm (D) x 200mm (W) beam	Ix =	16.66666667 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	1800 mm	Ag =	20000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	4.41			Dead load (pdl) =			
Live load (wll) =	0.35			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	1800			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	5.82	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 900 mm

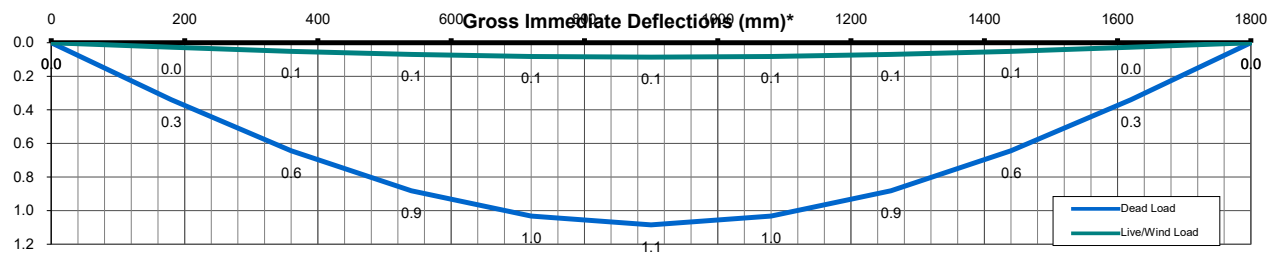
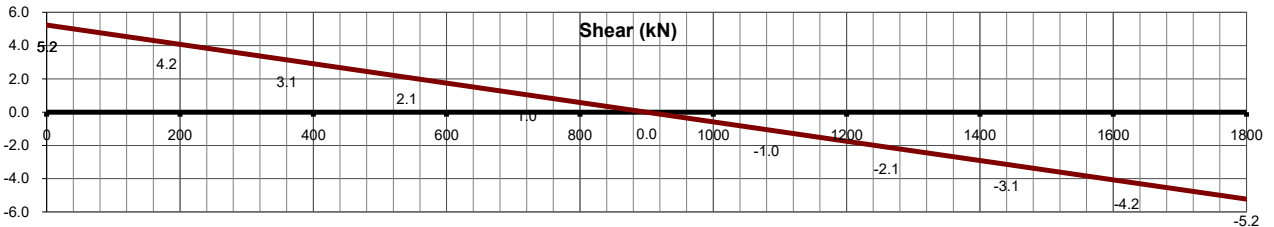
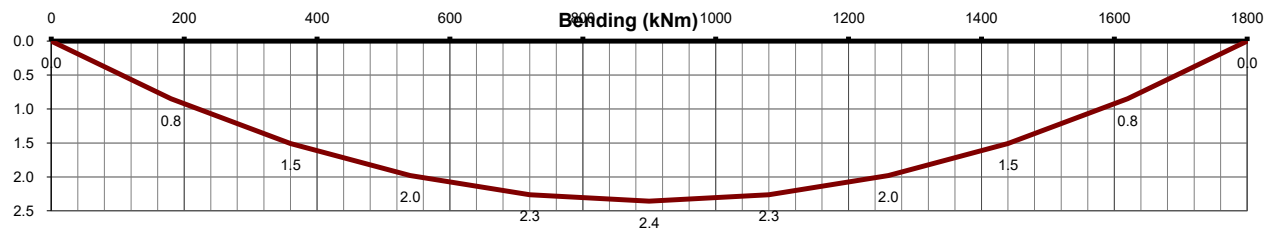
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	3.97		3.97					kN	
Rll	0.32		0.32					kN	
R*	5.24		5.24					kN	
M*	0.00	2.36	0.00	2.36	900	0.00	0	kNm	
V*	5.24	0.00	-5.24	5.24	0			kN	Span /
δdl	0.00	1.08	0.00	1.08	900	0.00	0	mm	1660
δll	0.00	0.09	0.00	0.09	900	0.00	0	mm	20914
δdl+Ψs*δll	0.00	1.17	0.00	1.17	900	0.00	0	mm	1538

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

Page:  
Project No.: 2109031  
Designed: BE

1800x200x100 Concrete Sleeper 5 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (1800x200x100 Concrete Sleeper 5 KPa 2N10) 100mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.23  
 Strength: (+ve M) M\* = 2.4kNm < øMu0 = 3.7kNm OK (0.63)  
 Cracking: fscr = 211MPa < Fscr = 362MPa & fscr1 = 211MPa < Fscr1 = 400MPa OK (0.53,0.58)  
 Ast.min: Ast.min = 47mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.30)

Geometry S.Wt = 0.50 kN/m L/D ratio = 18.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 100 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 20000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	2.4	0.0	kNm
Ms1*	0.0	1.9	0.0	kNm
Ms*	0.0	1.9	0.0	kNm
Ast req'd	0	96	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.2-N10	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 65 mm  
 Depth to bottom steel (ds) = 65 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 44 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 157 mm² ds = 65 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 4.7 kNm ku = 0.231  
 Design capacity (øMu0) = 3.7 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 47 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 211 MPa Max. stress (Fscr) = 362 MPa OK (0.58)  
 Steel stress (fscr1) = 211 MPa Max. stress (Fscr1) = 400 MPa OK (0.53)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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1800x200x120 Concrete Sleeper 5 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (1800x200x120 Concrete Sleeper 5 KPa 2N10): Concrete simple beam

Description = 120mm (D) x 200mm (W) beam	lx = 28.8 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) = 1790 mm	
Span type = S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Ag = 24000 mm <sup>2</sup>
Material type = C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	Density = 25 kN/m <sup>3</sup>
	E = 33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	6.30			Dead load (pdl) =			
Live load (wll) =	0.35			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	1790			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m					
Ultimate load (w*) =	8.09	0.00	0.00	Include S.Wt =	N (Y)es,(N)o		
				Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 895 mm

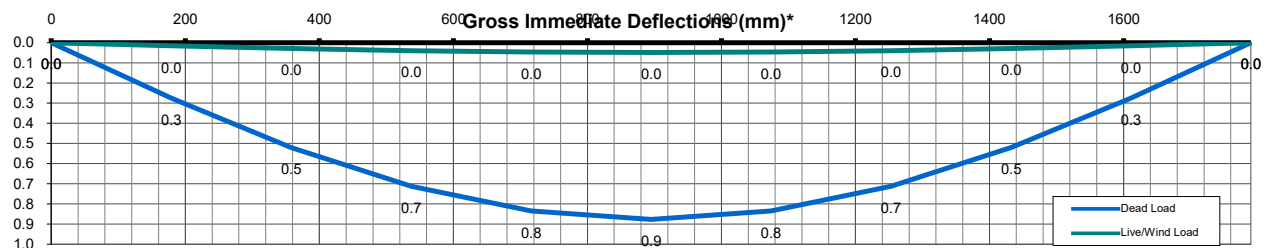
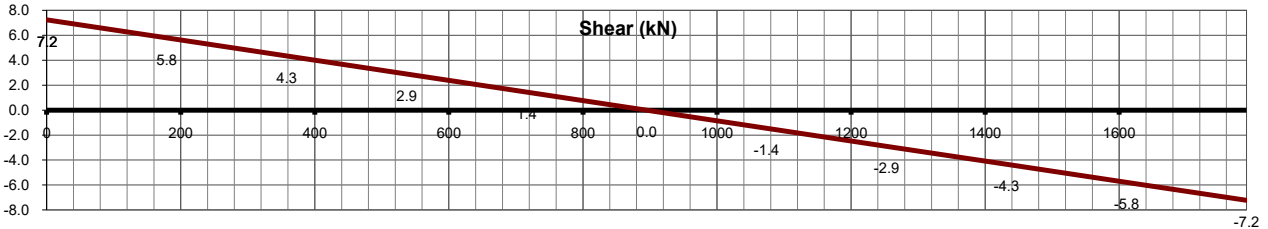
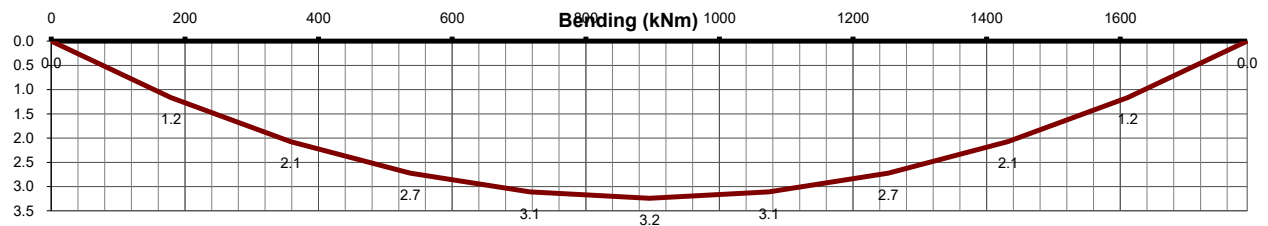
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	5.64		5.64					kN	
Rll	0.31		0.31					kN	
R*	7.24		7.24					kN	
M*	0.00	3.24	0.00	3.24	895	0.00	0	kNm	
V*	7.24	0.00	-7.24	7.24	0			kN	Span /
δdl	0.00	0.88	0.00	0.88	895	0.00	0	mm	2042
δll	0.00	0.05	0.00	0.05	895	0.00	0	mm	36748
δdl+Ψs*δll	0.00	0.93	0.00	0.93	895	0.00	0	mm	1934

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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1800x200x120 Concrete Sleeper 5 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (1800x200x120 Concrete Sleeper 5 KPa 2N10) 120mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.18  
 Strength: (+ve M) M\* = 3.2kNm < øMu0 = 5.0kNm OK (0.65)  
 Cracking: fscr = 220MPa < Fscr = 362MPa & fscr1 = 220MPa < Fscr1 = 400MPa OK (0.55,0.61)  
 Ast.min: Ast.min = 51mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.33)

Geometry S.Wt = 0.60 kN/m L/D ratio = 14.9

Concrete strength (f'c) = 40 MPa

Depth (D) = 120 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 24000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	3.2	0.0	kNm
Ms1*	0.0	2.7	0.0	kNm
Ms*	0.0	2.7	0.0	kNm
Ast req'd	0	100	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.3-N10	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 85 mm  
 Depth to bottom steel (ds) = 85 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsyc) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 64 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm  
 Tensile steel area (As) = 157 mm²  
 Comp. steel area (Ac) = 0 mm²  
 Ultimate Moment (Mu) = 6.2 kNm  
 Design capacity (øMu0) = 5.0 kNm

Design flange (bef) = 200 mm  
 ds = 85 mm  
 dc = 56 mm  
 ku = 0.176  
 ø = 0.800 Table 2.2.2  
 Ast.min = 51 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 220 MPa Max. stress (Fscr) = 362 MPa OK (0.61)  
 Steel stress (fscr1) = 220 MPa Max. stress (Fscr1) = 400 MPa OK (0.55)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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1800x200x100 Concrete Sleeper 10 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (1800x200x100 Concrete Sleeper 10 KPa 2N10): Concrete simple beam

Description =	100mm (D) x 200mm (W) beam	lx =	16.66666667 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	1800 mm	Ag =	20000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	3.78			Dead load (pdl) =			
Live load (wll) =	0.80			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	1800			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	5.74	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 900 mm

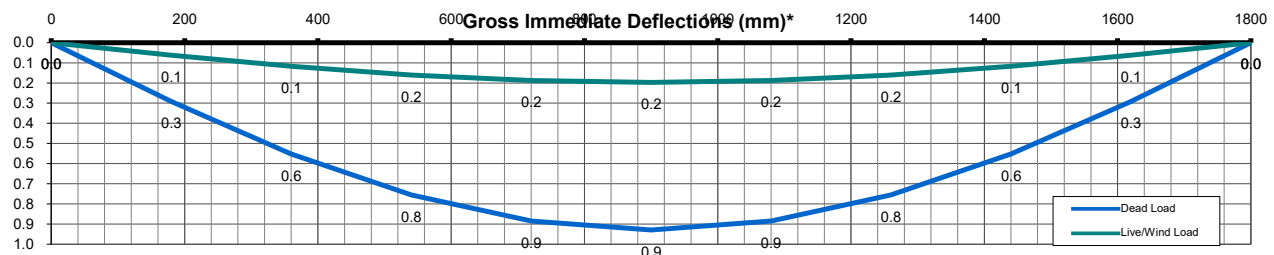
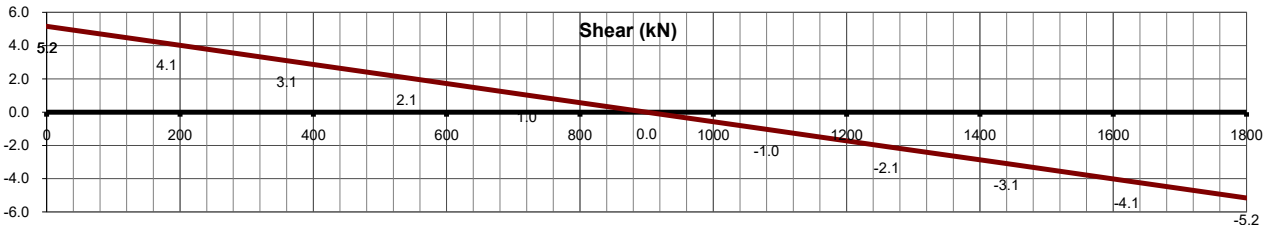
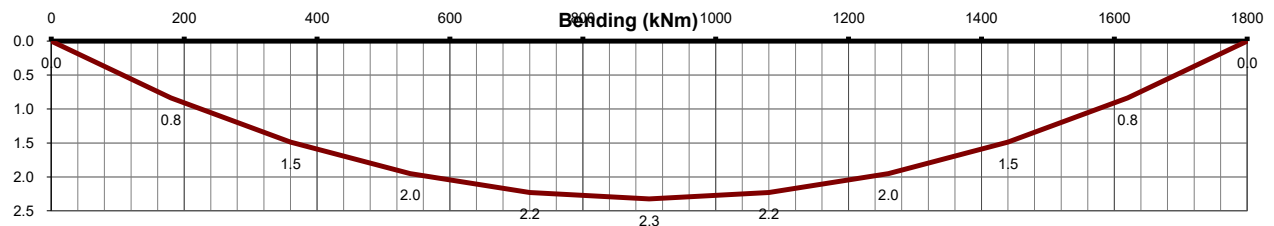
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	3.40		3.40					kN	
Rll	0.72		0.72					kN	
R*	5.16		5.16					kN	
M*	0.00	2.32	0.00	2.32	900	0.00	0	kNm	
V*	5.16	0.00	-5.16	5.16	0			kN	Span /
δdl	0.00	0.93	0.00	0.93	900	0.00	0	mm	1936
δll	0.00	0.20	0.00	0.20	900	0.00	0	mm	9150
δdl+Ψs*δll	0.00	1.13	0.00	1.13	900	0.00	0	mm	1598

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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1800x200x100 Concrete Sleeper 10 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (1800x200x100 Concrete Sleeper 10 KPa 2N10) 100mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.23  
 Strength: (+ve M) M\* = 2.3kNm < øMu0 = 3.7kNm OK (0.62)  
 Cracking: fscr = 203MPa < Fscr = 362MPa & fscr1 = 203MPa < Fscr1 = 400MPa OK (0.51,0.56)  
 Ast.min: Ast.min = 47mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.30)

Geometry S.Wt = 0.50 kN/m L/D ratio = 18.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 100 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard),(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes),(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 20000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual, (L)eft, Position (X) from analysis, (R)ight)

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	2.3	0.0	kNm
Ms1*	0.0	1.9	0.0	kNm
Ms*	0.0	1.9	0.0	kNm
Ast req'd	0	95	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.2-N10	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (Normal),(L)ow,(A)uto  
 Reinf't ductility class = N (Normal),(L)ow  
 Depth to bottom steel layer (ds.max) = 65 mm  
 Depth to bottom steel (ds) = 65 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal),(L)ow,(A)uto  
 Reinf't ductility class = N (Normal),(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 44 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 157 mm² ds = 65 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 4.7 kNm ku = 0.231  
 Design capacity (øMu0) = 3.7 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 47 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 203 MPa Max. stress (Fscr) = 362 MPa OK (0.56)  
 Steel stress (fscr1) = 203 MPa Max. stress (Fscr1) = 400 MPa OK (0.51)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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1800x200x120 Concrete Sleeper 10 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (1800x200x120 Concrete Sleeper 10 KPa 2N10): Concrete simple beam

Description = 120mm (D) x 200mm (W) beam	lx = 28.8 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) = 1800 mm	
Span type = S (Simple),(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Ag = 24000 mm <sup>2</sup>
Material type = C (Timber),(S)teel,(C)onc.,(SC)comp. steel,(O)ther	Density = 25 kN/m <sup>3</sup>
	E = 33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	5.67			Dead load (pdl) =			
Live load (wll) =	0.70			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	1800			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m					
Ultimate load (w*) =	7.85	0.00	0.00	Include S.Wt =	N (Yes),(N)o		
				Strength loadcase =	C (Dead Only),(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 900 mm

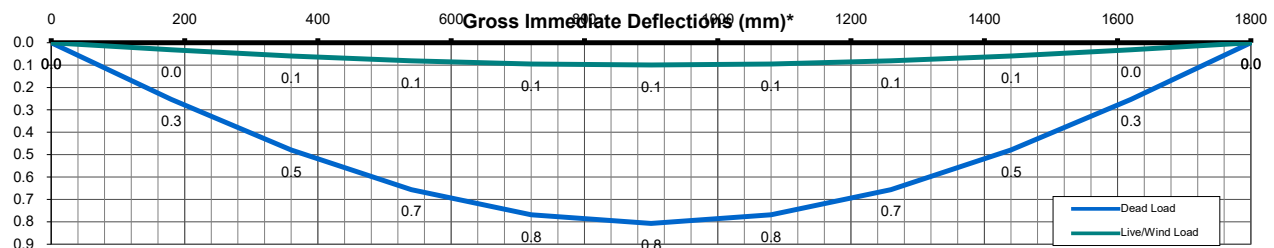
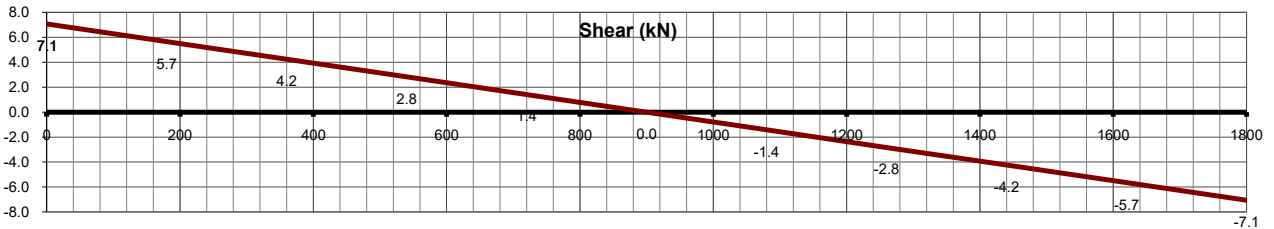
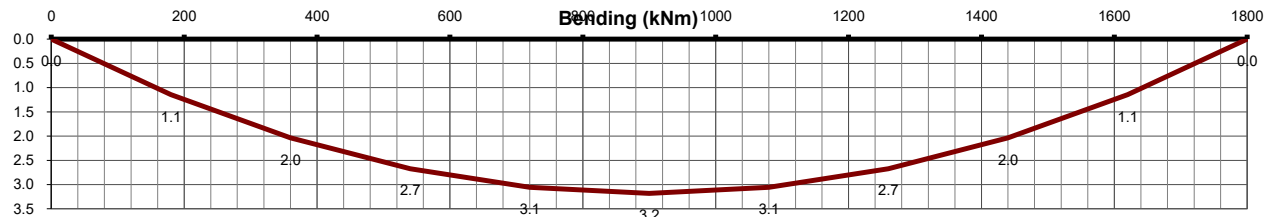
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	5.10		5.10					kN	
Rll	0.63		0.63					kN	
R*	7.07		7.07					kN	
M*	0.00	3.18	0.00	3.18	900	0.00	0	kNm	
V*	7.07	0.00	-7.07	7.07	0			kN	Span /
δdl	0.00	0.81	0.00	0.81	900	0.00	0	mm	2231
δll	0.00	0.10	0.00	0.10	900	0.00	0	mm	18070
δdl+Ψs*δll	0.00	0.91	0.00	0.91	900	0.00	0	mm	1986

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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Project No.: 2109031  
Designed: BE

1800x200x120 Concrete Sleeper 10 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (1800x200x120 Concrete Sleeper 10 KPa 2N10) 120mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.18  
 Strength: (+ve M) M\* = 3.2kNm < øMu0 = 5.0kNm OK (0.64)  
 Cracking: fscr = 213MPa < Fscr = 362MPa & fscr1 = 213MPa < Fscr1 = 400MPa OK (0.53,0.59)  
 Ast.min: Ast.min = 51mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.33)

Geometry S.Wt = 0.60 kN/m L/D ratio = 15.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 120 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard), (R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes), (N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 24000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual), (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	3.2	0.0	kNm
Ms1*	0.0	2.6	0.0	kNm
Ms*	0.0	2.6	0.0	kNm
Ast req'd	0	98	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.2-N10	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to bottom steel layer (ds.max) = 85 mm  
 Depth to bottom steel (ds) = 85 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 64 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 157 mm² ds = 85 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 6.2 kNm ku = 0.176  
 Design capacity (øMu0) = 5.0 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 51 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 213 MPa Max. stress (Fscr) = 362 MPa OK (0.59)  
 Steel stress (fscr1) = 213 MPa Max. stress (Fscr1) = 400 MPa OK (0.53)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2000x200x120 Concrete Sleeper 10 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (2000x200x120 Concrete Sleeper 10 KPa 2N10): Concrete simple beam

Description =	120mm (D) x 200mm (W) beam	lx =	28.8 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	2000 mm	Ag =	24000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	4.16			Dead load (pdl) =			
Live load (wll) =	0.70			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	2000			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	6.04	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1000 mm

1.20\*G+1.50\*Q analysed

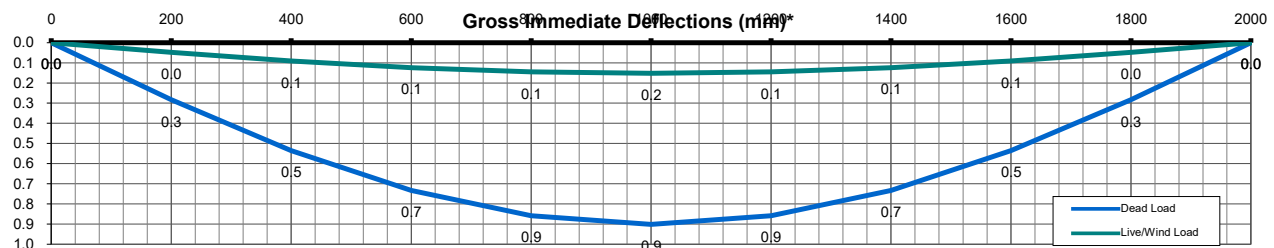
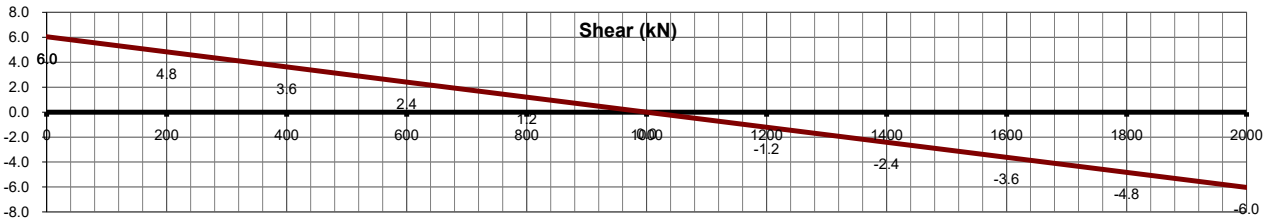
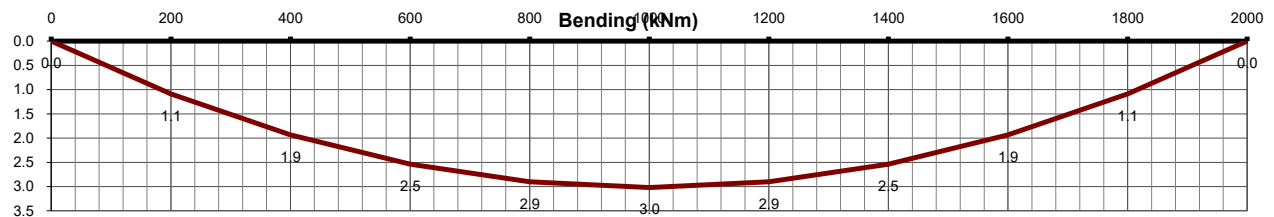
	Left	At x	Right	Max	At	Min	At	Units
Rdl	4.16		4.16					kN
Rll	0.70		0.70					kN
R*	6.04		6.04					kN
M*	0.00	3.02	0.00	3.02	1000	0.00	0	kNm
V*	6.04	0.00	-6.04	6.04	0			kN
δdl	0.00	0.90	0.00	0.90	1000	0.00	0	mm
δll	0.00	0.15	0.00	0.15	1000	0.00	0	mm
δdl+Ψs*δll	0.00	1.05	0.00	1.05	1000	0.00	0	mm

Span / 2218  
13173  
1898

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

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2000x200x120 Concrete Sleeper 10 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (2000x200x120 Concrete Sleeper 10 KPa 2N10) 120mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.18  
 Strength: (+ve M) M\* = 3.0kNm < øMu0 = 5.0kNm OK (0.61)  
 Cracking: fscr = 201MPa < Fscr = 362MPa & fscr1 = 201MPa < Fscr1 = 400MPa OK (0.50,0.56)  
 Ast.min: Ast.min = 51mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.33)

Geometry S.Wt = 0.60 kN/m L/D ratio = 16.7

Concrete strength (f'c) = 40 MPa

Depth (D) = 120 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
 Tension

Side cover = 30 mm Formwork = S (Standard),(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes),(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 24000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual, (L)eft, Position (X) from analysis, (R)ight)

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	3.0	0.0	kNm
Ms1*	0.0	2.4	0.0	kNm
Ms*	0.0	2.4	0.0	kNm
Ast req'd	0	93	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.2-N10	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (Normal),(L)ow,(A)uto  
 Reinf't ductility class = N (Normal),(L)ow  
 Depth to bottom steel layer (ds.max) = 85 mm  
 Depth to bottom steel (ds) = 85 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal),(L)ow,(A)uto  
 Reinf't ductility class = N (Normal),(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 64 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 157 mm² ds = 85 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 6.2 kNm ku = 0.176  
 Design capacity (øMu0) = 5.0 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 51 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 201 MPa Max. stress (Fscr) = 362 MPa OK (0.56)  
 Steel stress (fscr1) = 201 MPa Max. stress (Fscr1) = 400 MPa OK (0.50)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
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2000x200x120 Concrete Sleeper 5 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (2000x200x120 Concrete Sleeper 5 KPa 2N10): Concrete simple beam

Description =	120mm (D) x 200mm (W) beam	lx =	28.8 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	2000 mm	Ag =	24000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	4.41			Dead load (pdl) =			
Live load (wll) =	0.35			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	2000			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	5.82	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1000 mm

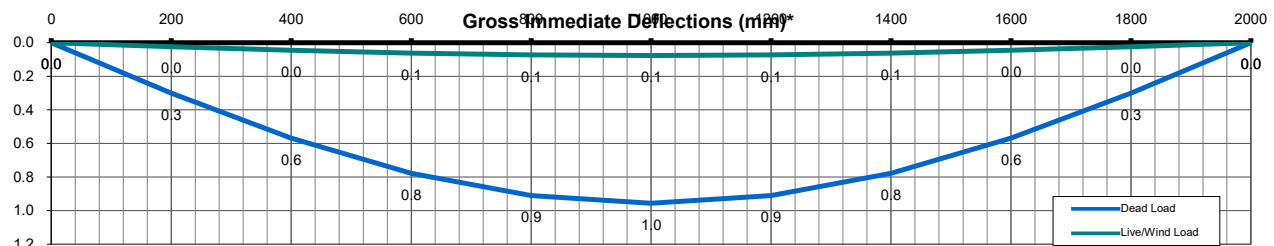
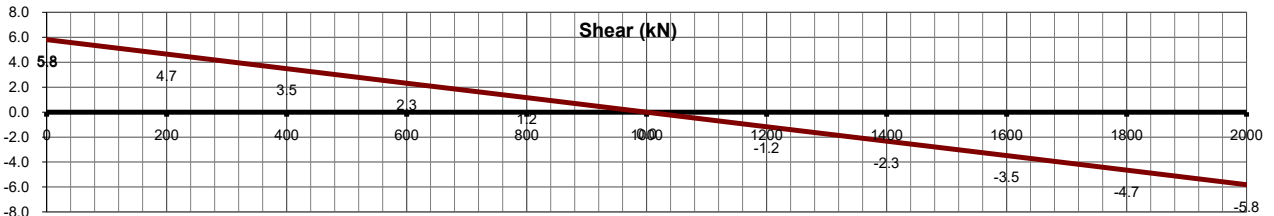
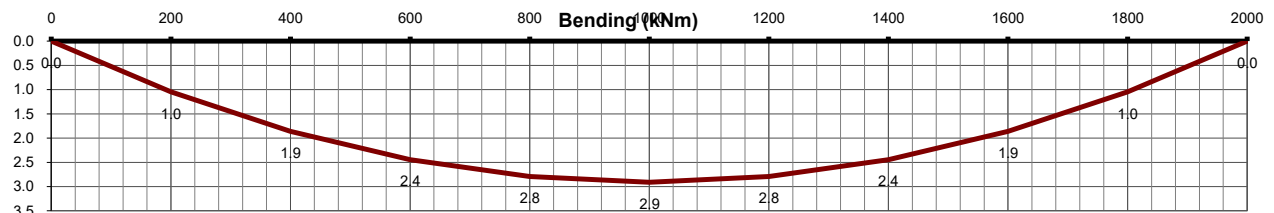
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	4.41		4.41					kN	
Rll	0.35		0.35					kN	
R*	5.82		5.82					kN	
M*	0.00	2.91	0.00	2.91	1000	0.00	0	kNm	
V*	5.82	0.00	-5.82	5.82	0			kN	Span /
δdl	0.00	0.96	0.00	0.96	1000	0.00	0	mm	2091
δll	0.00	0.08	0.00	0.08	1000	0.00	0	mm	26345
δdl+Ψs*δll	0.00	1.03	0.00	1.03	1000	0.00	0	mm	1937

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
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2000x200x120 Concrete Sleeper 5 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (2000x200x120 Concrete Sleeper 5 KPa 2N10) 120mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.18  
 Strength: (+ve M) M\* = 2.9kNm < øMu0 = 5.0kNm OK (0.58)  
 Cracking: fscr = 197MPa < Fscr = 362MPa & fscr1 = 197MPa < Fscr1 = 400MPa OK (0.49,0.54)  
 Ast.min: Ast.min = 51mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.33)

Geometry S.Wt = 0.60 kN/m L/D ratio = 16.7

Concrete strength (f'c) = 40 MPa

Depth (D) = 120 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 24000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	2.9	0.0	kNm
Ms1*	0.0	2.4	0.0	kNm
Ms*	0.0	2.4	0.0	kNm
Ast req'd	0	89	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.1-N10	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 85 mm  
 Depth to bottom steel (ds) = 85 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsyc) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 64 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 157 mm² ds = 85 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 6.2 kNm ku = 0.176  
 Design capacity (øMu0) = 5.0 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 51 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 197 MPa Max. stress (Fscr) = 362 MPa OK (0.54)  
 Steel stress (fscr1) = 197 MPa Max. stress (Fscr1) = 400 MPa OK (0.49)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
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2000x200x100 Concrete Sleeper 10 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (2000x200x100 Concrete Sleeper 10 KPa 2N10): Concrete simple beam

Description =	100mm (D) x 200mm (W) beam	lx =	16.66666667 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	2000 mm	Ag =	20000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	2.90			Dead load (pdl) =			
Live load (wll) =	0.70			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	2000			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	4.53	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1000 mm

1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units
Rdl	2.90		2.90					kN
Rll	0.70		0.70					kN
R*	4.53		4.53					kN
M*	0.00	2.26	0.00	2.26	1000	0.00	0	kNm
V*	4.53	0.00	-4.53	4.53	0			kN
δdl	0.00	1.09	0.00	1.09	1000	0.00	0	mm
δll	0.00	0.26	0.00	0.26	1000	0.00	0	mm
δdl+Ψs*δll	0.00	1.35	0.00	1.35	1000	0.00	0	mm

Span /

1841

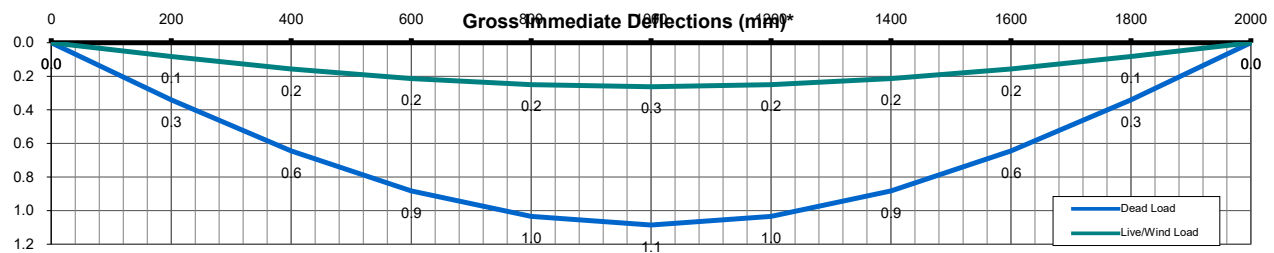
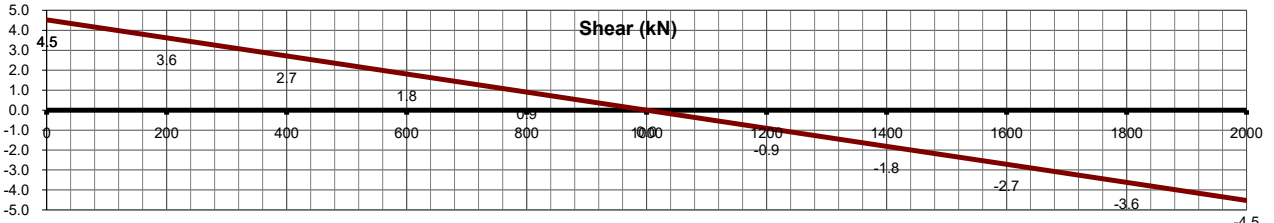
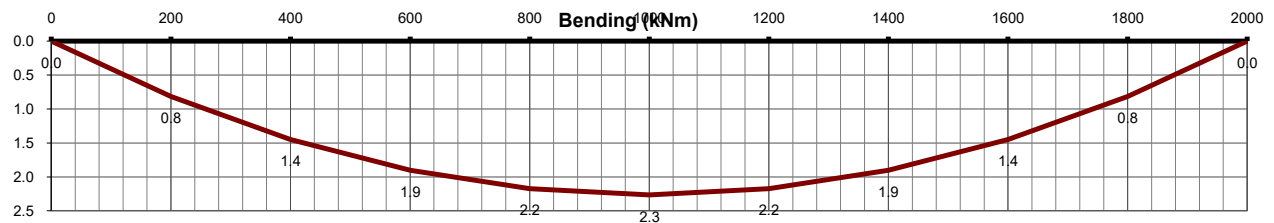
7623

1483

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
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2000x200x100 Concrete Sleeper 10 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (2000x200x100 Concrete Sleeper 10 KPa 2N10) 100mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.23  
 Strength: (+ve M) M\* = 2.3kNm < øMuo = 3.7kNm OK (0.61)  
 Cracking: fscr = 197MPa < Fscr = 362MPa & fscr1 = 197MPa < Fscr1 = 400MPa OK (0.49,0.54)  
 Ast.min: Ast.min = 47mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.30)

Geometry S.Wt = 0.50 kN/m L/D ratio = 20.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 100 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard), (R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes), (N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 20000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual), (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	2.3	0.0	kNm
Ms1*	0.0	1.8	0.0	kNm
Ms*	0.0	1.8	0.0	kNm
Ast req'd	0	92	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.2-N10	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to bottom steel layer (ds.max) = 65 mm  
 Depth to bottom steel (ds) = 65 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsyc) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 44 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 157 mm² ds = 65 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 4.7 kNm ku = 0.231  
 Design capacity (øMuo) = 3.7 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 47 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 197 MPa Max. stress (Fscr) = 362 MPa OK (0.54)  
 Steel stress (fscr1) = 197 MPa Max. stress (Fscr1) = 400 MPa OK (0.49)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2000x200x100 Concrete Sleeper 5 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (2000x200x100 Concrete Sleeper 5 KPa 2N10): Concrete simple beam

Description =	100mm (D) x 200mm (W) beam	Ix =	16.66666667 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	2000 mm	Ag =	20000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	3.15			Dead load (pdl) =			
Live load (wll) =	0.35			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	2000			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Yes,(N)o		
Ultimate load (w*) =	4.31	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1000 mm

**1.20\*G+1.50\*Q analysed**

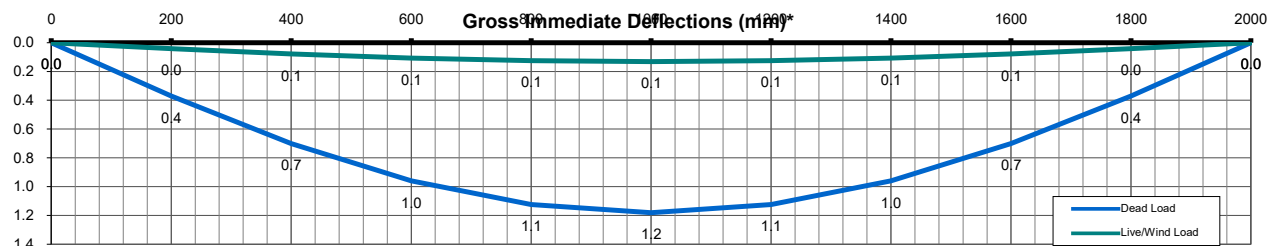
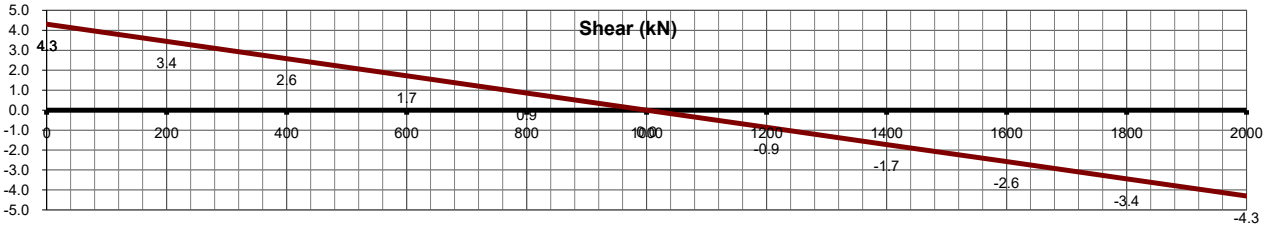
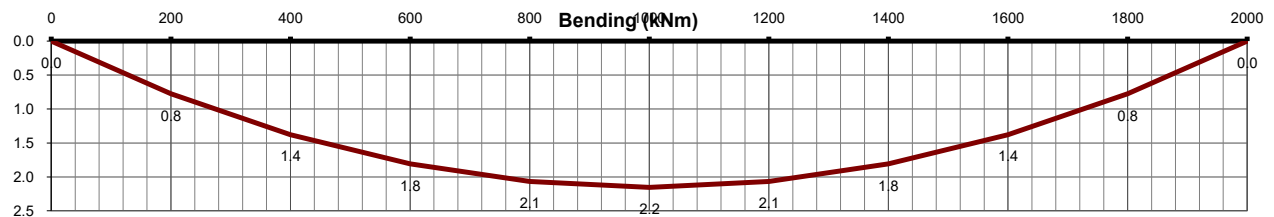
	Left	At x	Right	Max	At	Min	At	Units
<b>Rdl</b>	3.15		3.15					kN
<b>Rll</b>	0.35		0.35					kN
<b>R*</b>	4.31		4.31					kN
<b>M*</b>	0.00	2.15	0.00	2.15	1000	0.00	0	kNm
<b>V*</b>	4.31	0.00	-4.31	4.31	0			kN
<b>δdl</b>	0.00	1.18	0.00	1.18	1000	0.00	0	mm
<b>δll</b>	0.00	0.13	0.00	0.13	1000	0.00	0	mm
<b>δdl+Ψs*δll</b>	0.00	1.31	0.00	1.31	1000	0.00	0	mm

Span / 1694

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

Page:  
Project No.: 2109031  
Designed: BE

2000x200x100 Concrete Sleeper 5 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (2000x200x100 Concrete Sleeper 5 KPa 2N10) 100mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.23  
 Strength: (+ve M) M\* = 2.2kNm < øMu0 = 3.7kNm OK (0.58)  
 Cracking: fscr = 192MPa < Fscr = 362MPa & fscr1 = 192MPa < Fscr1 = 400MPa OK (0.48,0.53)  
 Ast.min: Ast.min = 47mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.30)

Geometry S.Wt = 0.50 kN/m L/D ratio = 20.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 100 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 20000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	2.2	0.0	kNm
Ms1*	0.0	1.8	0.0	kNm
Ms*	0.0	1.8	0.0	kNm
Ast req'd	0	87	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.1-N10	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 65 mm  
 Depth to bottom steel (ds) = 65 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsyc) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 44 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 157 mm² ds = 65 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 4.7 kNm ku = 0.231  
 Design capacity (øMu0) = 3.7 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 47 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 192 MPa Max. stress (Fscr) = 362 MPa OK (0.53)  
 Steel stress (fscr1) = 192 MPa Max. stress (Fscr1) = 400 MPa OK (0.48)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2000x200x80 Concrete Sleeper 10 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (2000x200x80 Concrete Sleeper 10 KPa 2N10): Concrete simple beam

Description =	77mm (D) x 200mm (W) beam	Ix =	7.60888333 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	2000 mm	Ag =	15400 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	2.40			Dead load (pdl) =			
Live load (wll) =	0.80			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	2000			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	4.08	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1000 mm

1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units
Rdl	2.40		2.40					kN
Rll	0.80		0.80					kN
R*	4.08		4.08					kN
M*	0.00	2.04	0.00	2.04	1000	0.00	0	kNm
V*	4.08	0.00	-4.08	4.08	0			kN
δdl	0.00	1.97	0.00	1.97	1000	0.00	0	mm
δll	0.00	0.66	0.00	0.66	1000	0.00	0	mm
δdl+Ψs*δll	0.00	2.63	0.00	2.63	1000	0.00	0	mm

Span /

1015

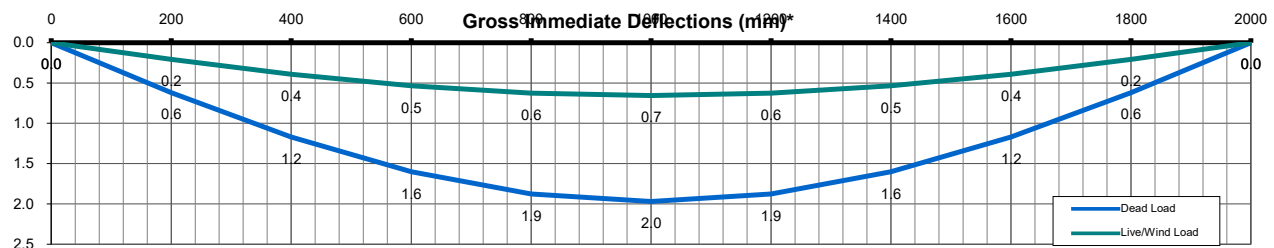
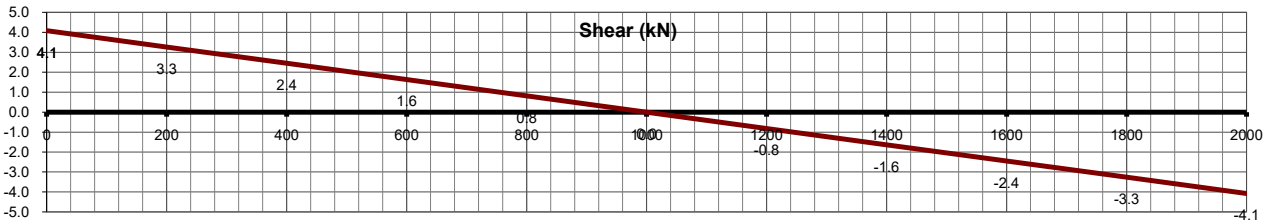
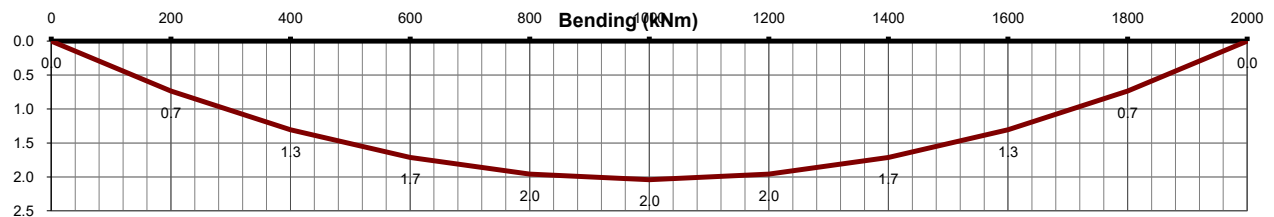
3045

761

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2000x200x80 Concrete Sleeper 10 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (2000x200x80 Concrete Sleeper 10 KPa 2N10) 77mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.36  
 Strength: (+ve M) M\* = 2.0kNm < øMuo = 2.3kNm OK (0.90)  
 Cracking: fscr = 277MPa < Fscr = 362MPa & fscr1 = 277MPa < Fscr1 = 400MPa OK (0.69,0.77)  
 Ast.min: Ast.min = 43mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.27)

Geometry S.Wt = 0.39 kN/m L/D ratio = 26.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 77 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard), (R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes), (N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 15400 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual), (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	2.0	0.0	kNm
Ms1*	0.0	1.6	0.0	kNm
Ms*	0.0	1.6	0.0	kNm
Ast req'd	0	140	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.8-N10	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to bottom steel layer (ds.max) = 42 mm  
 Depth to bottom steel (ds) = 42 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsyc) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 21 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 157 mm² ds = 42 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 2.8 kNm ku = 0.357  
 Design capacity (øMuo) = 2.3 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 43 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 277 MPa Max. stress (Fscr) = 362 MPa OK (0.77)  
 Steel stress (fscr1) = 277 MPa Max. stress (Fscr1) = 400 MPa OK (0.69)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2000x200x80 Concrete Sleeper 5 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (2000x200x80 Concrete Sleeper 5 KPa 2N10): Concrete simple beam

Description =	77mm (D) x 200mm (W) beam	Ix =	7.60888333 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	2000 mm	Ag =	15400 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	34760 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	2.40			Dead load (pdl) =			
Live load (wll) =	0.40			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	2000			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	3.48	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1000 mm

1.20\*G+1.50\*Q analysed

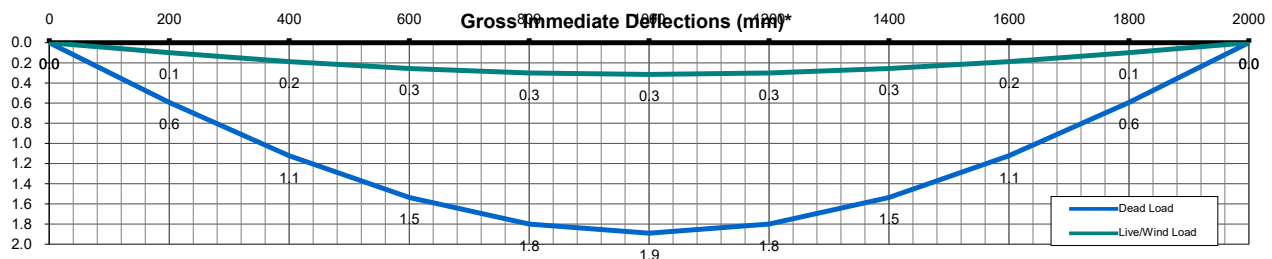
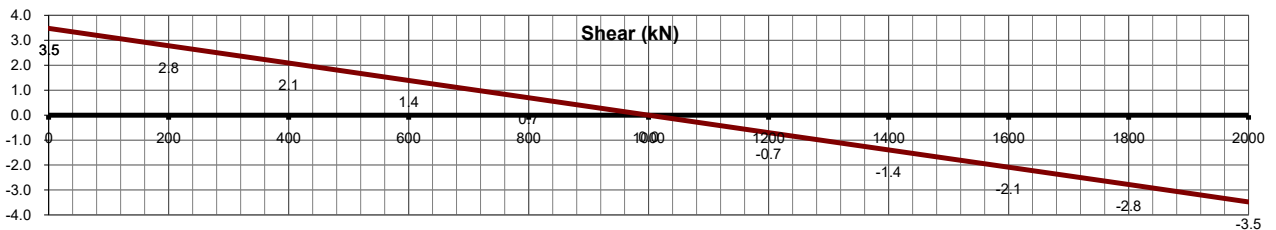
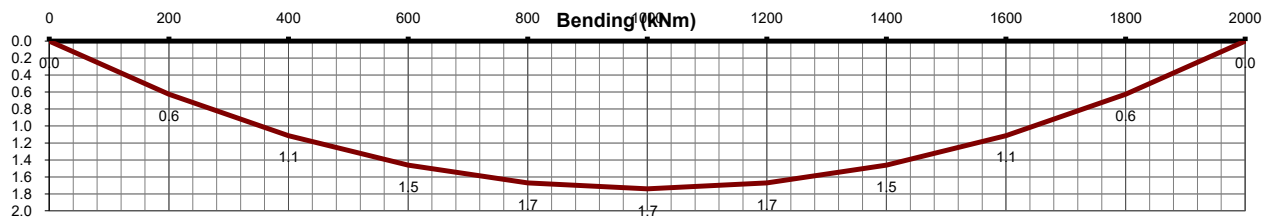
	Left	At x	Right	Max	At	Min	At	Units
Rdl	2.40		2.40					kN
Rll	0.40		0.40					kN
R*	3.48		3.48					kN
M*	0.00	1.74	0.00	1.74	1000	0.00	0	kNm
V*	3.48	0.00	-3.48	3.48	0			kN
δdl	0.00	1.89	0.00	1.89	1000	0.00	0	mm
δll	0.00	0.32	0.00	0.32	1000	0.00	0	mm
δdl+Ψs*δll	0.00	2.21	0.00	2.21	1000	0.00	0	mm

Span / 1058  
6348  
907

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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### Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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### 2000x200x80 Concrete Sleeper 5 KPa 2N10

#### CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (2000x200x80 Concrete Sleeper 5 KPa 2N10) 77mm (D) x 200mm (W) beam, f'c=50MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.31  
 Strength: (+ve M) M\* = 1.7kNm < øMu0 = 1.9kNm OK (0.93)  
 Cracking: fscr = 242MPa < Fscr = 362MPa & fscr1 = 242MPa < Fscr1 = 400MPa OK (0.60,0.67)  
 Ast.min: Ast.min = 48mm<sup>2</sup> < Ast = 157mm<sup>2</sup> (Minimum of Deemed and actual) OK (0.31)

Geometry S.Wt = 0.39 kN/m L/D ratio = 26.0

Concrete strength (f'c) = 50 MPa

Depth (D) = 77 mm  
Web width (W) = 200 mm, (S)lab  
Flange width (Bf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m<sup>3</sup> Exposure top = C1 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 15400 mm<sup>2</sup> Side = B1 Tab 4.10.3.2

#### Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	1.7	0.0	kNm
Ms1*	0.0	1.4	0.0	kNm
Ms*	0.0	1.4	0.0	kNm
Ast req'd	0	151	0	mm <sup>2</sup>
Ast	157	157	157	mm <sup>2</sup>
Reinf't req'd	-	1.9-N10	-	

#### Reinforcement

Ligs = No ligs

##### Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm<sup>2</sup> = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm<sup>2</sup>  
 Ductility class = L (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = L (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 42 mm  
 Depth to bottom steel (ds) = 42 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

##### Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm<sup>2</sup> = 0 No  
 Yield strength (fsyc) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm<sup>2</sup>  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 21 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

#### Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 157 mm<sup>2</sup> ds = 42 mm  
 Comp. steel area (Ac) = 0 mm<sup>2</sup> dc = 56 mm  
 Ultimate Moment (Mu) = 2.9 kNm ku = 0.314  
 Design capacity (øMu0) = 1.9 kNm ø = 0.640 Table 2.2.2  
 Ast.min = 48 mm<sup>2</sup>

#### Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 242 MPa Max. stress (Fscr) = 362 MPa OK (0.67)  
 Steel stress (fscr1) = 242 MPa Max. stress (Fscr1) = 400 MPa OK (0.60)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2000x200x120 Concrete Sleeper 10 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (2000x200x120 Concrete Sleeper 10 KPa): Concrete simple beam

Description =	120mm (D) x 200mm (W) beam	lx =	28.8 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	2000 mm	Ag =	24000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	5.54			Dead load (pdl) =			
Live load (wll) =	0.70			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	2000			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	7.70	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1000 mm

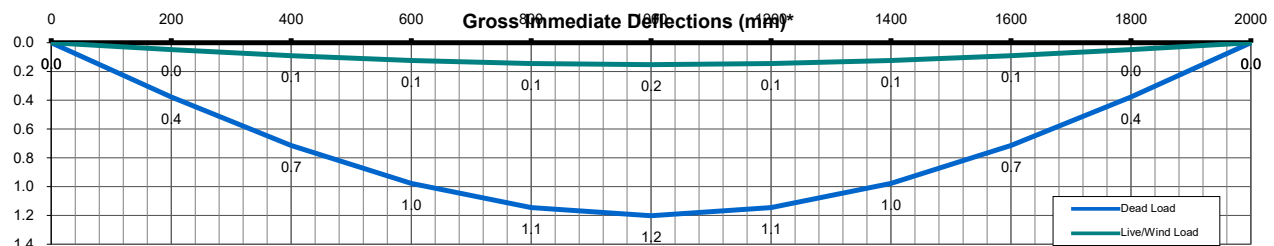
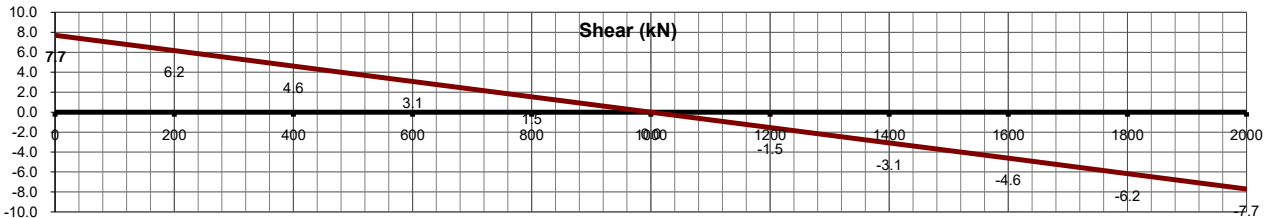
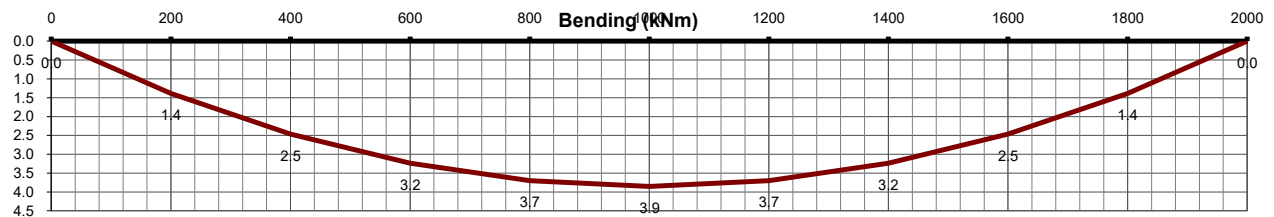
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	5.54		5.54					kN	
Rll	0.70		0.70					kN	
R*	7.70		7.70					kN	
M*	0.00	3.85	0.00	3.85	1000	0.00	0	kNm	
V*	7.70	0.00	-7.70	7.70	0			kN	Span /
δdl	0.00	1.20	0.00	1.20	1000	0.00	0	mm	1663
δll	0.00	0.15	0.00	0.15	1000	0.00	0	mm	13173
δdl+Ψs*δll	0.00	1.35	0.00	1.35	1000	0.00	0	mm	1477

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
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2000x200x120 Concrete Sleeper 10 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (2000x200x120 Concrete Sleeper 10 KPa) 120mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.26  
 Strength: (+ve M) M\* = 3.9kNm < øMuo = 6.8kNm OK (0.56)  
 Cracking: fscr = 185MPa < Fscr = 330MPa & fscr1 = 185MPa < Fscr1 = 400MPa OK (0.46,0.56)  
 Ast.min: Ast.min = 52mm² < Ast = 226mm² (Minimum of Deemed and actual) OK (0.23)

Geometry S.Wt = 0.60 kN/m L/D ratio = 16.7

Concrete strength (f'c) = 40 MPa

Depth (D) = 120 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard), (R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes), (N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 24000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual), (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	3.9	0.0	kNm
Ms1*	0.0	3.1	0.0	kNm
Ms*	0.0	3.1	0.0	kNm
Ast req'd	0	121	0	mm²
Ast	226	226	226	mm²
Reinf't req'd	-	1.1-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm²  
 Ductility class = N (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to bottom steel layer (ds.max) = 84 mm  
 Depth to bottom steel (ds) = 84 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 64 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 226 mm² ds = 84 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 8.6 kNm ku = 0.257  
 Design capacity (øMuo) = 6.8 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 52 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 185 MPa Max. stress (Fscr) = 330 MPa OK (0.56)  
 Steel stress (fscr1) = 185 MPa Max. stress (Fscr1) = 400 MPa OK (0.46)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
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2000x200x120 Concrete Sleeper 5 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (2000x200x120 Concrete Sleeper 5 KPa): Concrete simple beam

Description = 120mm (D) x 200mm (W) beam	lx = 28.8 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) = 2000 mm	
Span type = S (Simple),(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Ag = 24000 mm <sup>2</sup>
Material type = C (Timber),(S)teel,(C)onc.,(SC)comp. steel,(O)ther	Density = 25 kN/m <sup>3</sup>
	E = 33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	5.67			Dead load (pdl) =			
Live load (wll) =	0.35			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	2000			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m					
Ultimate load (w*) =	7.33	0.00	0.00	Include S.Wt =	N (Yes,(N)o		
				Strength loadcase =	C (Dead Only),(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1000 mm

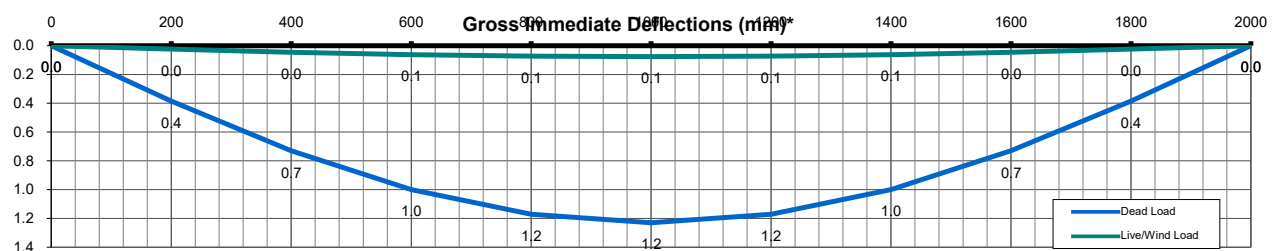
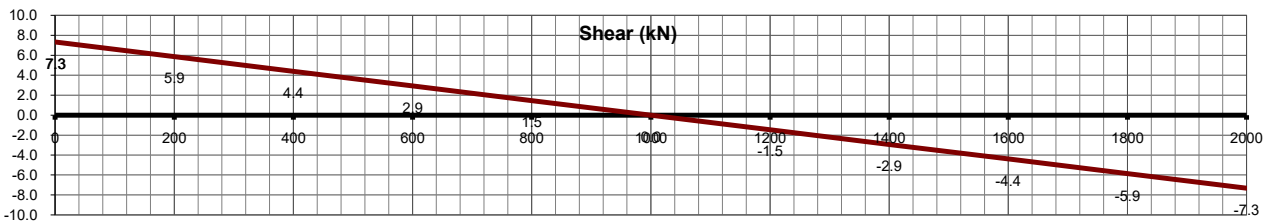
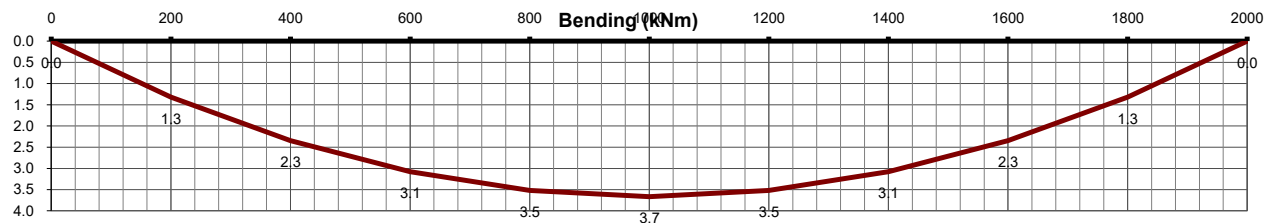
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	5.67		5.67					kN	
Rll	0.35		0.35					kN	
R*	7.33		7.33					kN	
M*	0.00	3.66	0.00	3.66	1000	0.00	0	kNm	
V*	7.33	0.00	-7.33	7.33	0			kN	Span /
δdl	0.00	1.23	0.00	1.23	1000	0.00	0	mm	1626
δll	0.00	0.08	0.00	0.08	1000	0.00	0	mm	26345
δdl+Ψs*δll	0.00	1.31	0.00	1.31	1000	0.00	0	mm	1532

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

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2000x200x120 Concrete Sleeper 5 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (2000x200x120 Concrete Sleeper 5 KPa) 120mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.26  
 Strength: (+ve M) M\* = 3.7kNm < øMuo = 6.8kNm OK (0.54)  
 Cracking: fscr = 178MPa < Fscr = 330MPa & fscr1 = 178MPa < Fscr1 = 400MPa OK (0.44,0.54)  
 Ast.min: Ast.min = 52mm² < Ast = 226mm² (Minimum of Deemed and actual) OK (0.23)

Geometry S.Wt = 0.60 kN/m L/D ratio = 16.7

Concrete strength (f'c) = 40 MPa

Depth (D) = 120 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard),(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes),(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 24000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual), (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	3.7	0.0	kNm
Ms1*	0.0	3.0	0.0	kNm
Ms*	0.0	3.0	0.0	kNm
Ast req'd	0	115	0	mm²
Ast	226	226	226	mm²
Reinf't req'd	-	1.0-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm²  
 Ductility class = N (Normal),(L)ow,(A)uto  
 Reinf't ductility class = N (Normal),(L)ow  
 Depth to bottom steel layer (ds.max) = 84 mm  
 Depth to bottom steel (ds) = 84 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal),(L)ow,(A)uto  
 Reinf't ductility class = N (Normal),(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 64 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 226 mm² ds = 84 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 8.6 kNm ku = 0.257  
 Design capacity (øMuo) = 6.8 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 52 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 178 MPa Max. stress (Fscr) = 330 MPa OK (0.54)  
 Steel stress (fscr1) = 178 MPa Max. stress (Fscr1) = 400 MPa OK (0.44)



Concrete Sleeper Retaining Wall

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2000x200x100 Concrete Sleeper 10 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (2000x200x100 Concrete Sleeper 10 KPa): Concrete simple beam

Description =	100mm (D) x 200mm (W) beam	lx =	16.66666667 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	2000 mm	Ag =	20000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	4.54			Dead load (pdl) =			
Live load (wll) =	0.70			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	2000			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	6.49	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1000 mm

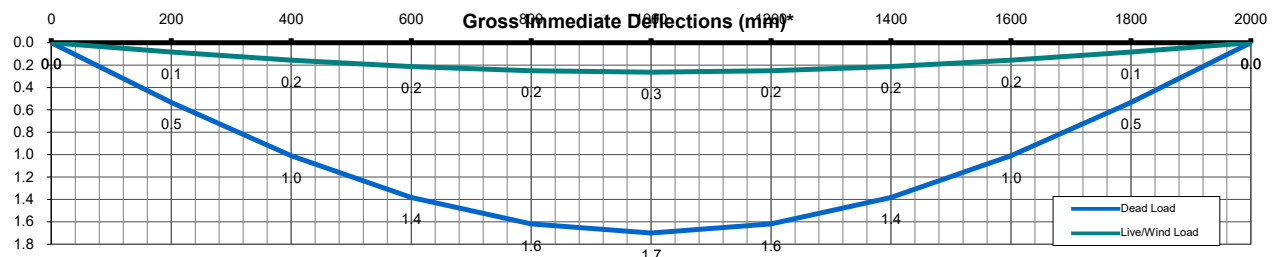
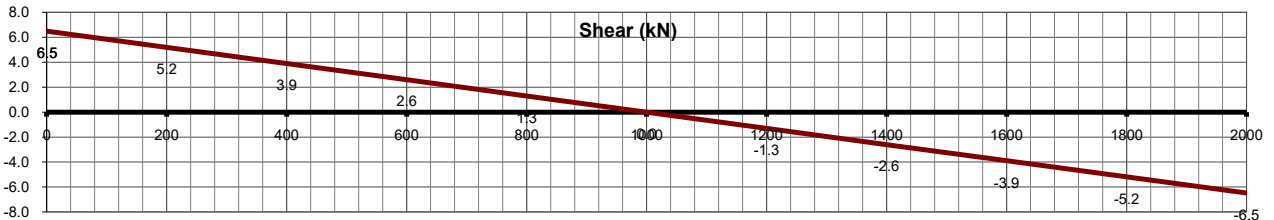
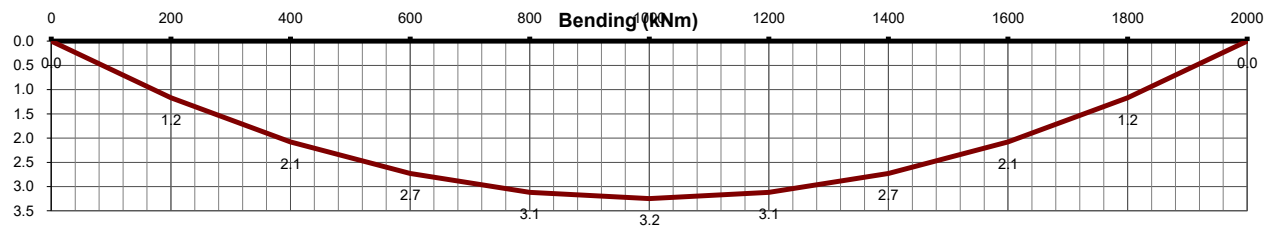
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	4.54		4.54					kN	
Rll	0.70		0.70					kN	
R*	6.49		6.49					kN	
M*	0.00	3.25	0.00	3.25	1000	0.00	0	kNm	
V*	6.49	0.00	-6.49	6.49	0			kN	Span /
δdl	0.00	1.70	0.00	1.70	1000	0.00	0	mm	1176
δll	0.00	0.26	0.00	0.26	1000	0.00	0	mm	7623
δdl+Ψs*δll	0.00	1.96	0.00	1.96	1000	0.00	0	mm	1019

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

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2000x200x100 Concrete Sleeper 10 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (2000x200x100 Concrete Sleeper 10 KPa) 100mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.34  
 Strength: (+ve M) M\* = 3.2kNm < øMuo = 5.0kNm OK (0.64)  
 Cracking: fscr = 206MPa < Fscr = 330MPa & fscr1 = 206MPa < Fscr1 = 400MPa OK (0.52,0.62)  
 Ast.min: Ast.min = 47mm² < Ast = 226mm² (Minimum of Deemed and actual) OK (0.21)

Geometry S.Wt = 0.50 kN/m L/D ratio = 20.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 100 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
 Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 20000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	3.2	0.0	kNm
Ms1*	0.0	2.6	0.0	kNm
Ms*	0.0	2.6	0.0	kNm
Ast req'd	0	139	0	mm²
Ast	226	226	226	mm²
Reinf't req'd	-	1.2-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm²  
 Ductility class = N (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 64 mm  
 Depth to bottom steel (ds) = 64 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 44 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 226 mm² ds = 64 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 6.3 kNm ku = 0.337  
 Design capacity (øMuo) = 5.0 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 47 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 206 MPa Max. stress (Fscr) = 330 MPa OK (0.62)  
 Steel stress (fscr1) = 206 MPa Max. stress (Fscr1) = 400 MPa OK (0.52)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2000x200x100 Concrete Sleeper 5 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (2000x200x100 Concrete Sleeper 5 KPa): Concrete simple beam

Description =	100mm (D) x 200mm (W) beam	lx =	16.66666667 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	2000 mm	Ag =	20000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	4.79			Dead load (pdl) =			
Live load (wll) =	0.35			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	2000			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	6.27	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1000 mm

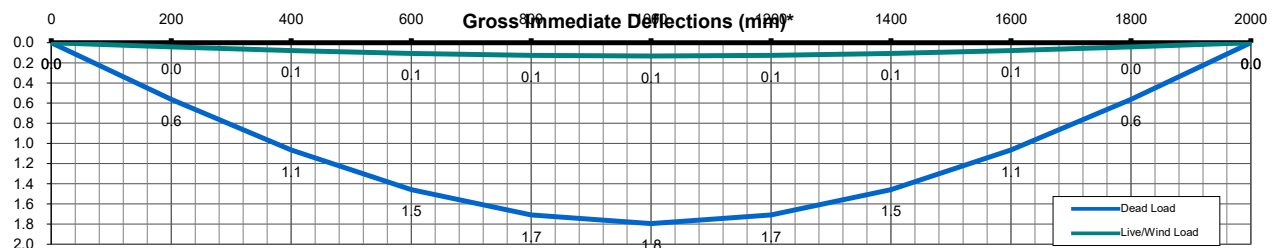
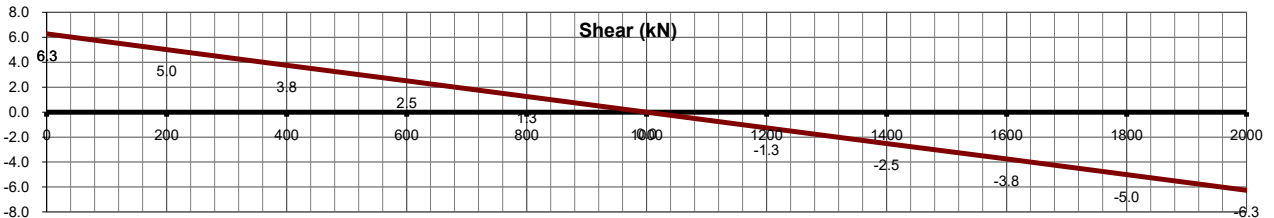
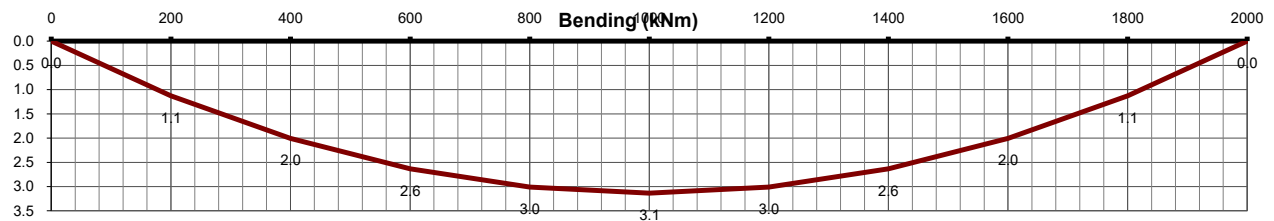
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	4.79		4.79					kN	
Rll	0.35		0.35					kN	
R*	6.27		6.27					kN	
M*	0.00	3.14	0.00	3.14	1000	0.00	0	kNm	
V*	6.27	0.00	-6.27	6.27	0			kN	Span /
δdl	0.00	1.79	0.00	1.79	1000	0.00	0	mm	1114
δll	0.00	0.13	0.00	0.13	1000	0.00	0	mm	15246
δdl+Ψs*δll	0.00	1.93	0.00	1.93	1000	0.00	0	mm	1039

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2000x200x100 Concrete Sleeper 5 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (2000x200x100 Concrete Sleeper 5 KPa) 100mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.34  
 Strength: (+ve M) M\* = 3.1kNm < øMuo = 5.0kNm OK (0.62)  
 Cracking: fscr = 202MPa < Fscr = 330MPa & fscr1 = 202MPa < Fscr1 = 400MPa OK (0.51,0.61)  
 Ast.min: Ast.min = 47mm² < Ast = 226mm² (Minimum of Deemed and actual) OK (0.21)

Geometry S.Wt = 0.50 kN/m L/D ratio = 20.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 100 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard), (R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes), (N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 20000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual), (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	3.1	0.0	kNm
Ms1*	0.0	2.6	0.0	kNm
Ms*	0.0	2.6	0.0	kNm
Ast req'd	0	133	0	mm²
Ast	226	226	226	mm²
Reinf't req'd	-	1.2-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm²  
 Ductility class = N (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to bottom steel layer (ds.max) = 64 mm  
 Depth to bottom steel (ds) = 64 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 44 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 226 mm² ds = 64 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 6.3 kNm ku = 0.337  
 Design capacity (øMuo) = 5.0 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 47 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 202 MPa Max. stress (Fscr) = 330 MPa OK (0.61)  
 Steel stress (fscr1) = 202 MPa Max. stress (Fscr1) = 400 MPa OK (0.51)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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Designed: BE

2000x200x80 Concrete Sleeper 10 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (2000x200x80 Concrete Sleeper 10 KPa): Concrete simple beam

Description =	77mm (D) x 200mm (W) beam	ix =	7.608883333 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	2000 mm	Ag =	15400 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	2.65			Dead load (pdl) =			
Live load (wll) =	0.70			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	2000			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	4.23	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1000 mm

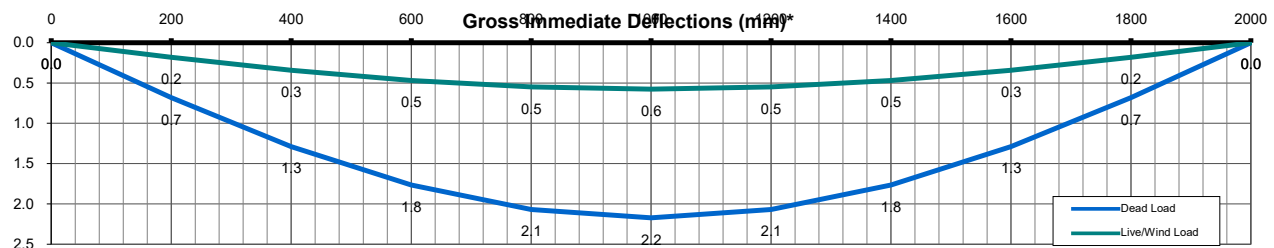
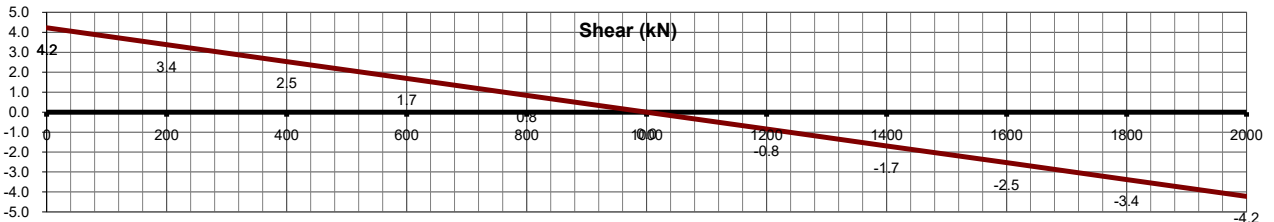
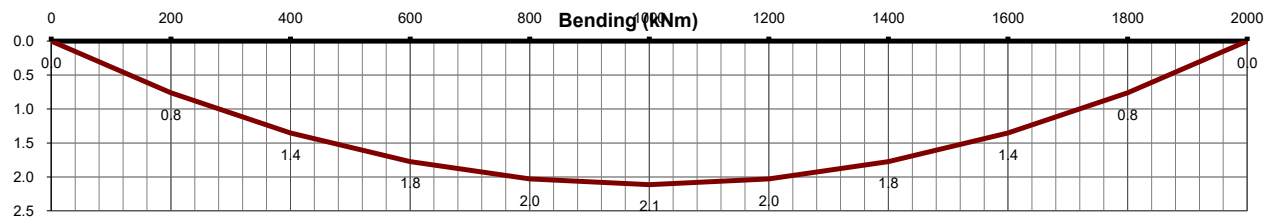
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	2.65		2.65					kN	
Rll	0.70		0.70					kN	
R*	4.23		4.23					kN	
M*	0.00	2.11	0.00	2.11	1000	0.00	0	kNm	
V*	4.23	0.00	-4.23	4.23	0			kN	Span /
δdl	0.00	2.17	0.00	2.17	1000	0.00	0	mm	921
δll	0.00	0.57	0.00	0.57	1000	0.00	0	mm	3480
δdl+Ψs*δll	0.00	2.75	0.00	2.75	1000	0.00	0	mm	728

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2000x200x80 Concrete Sleeper 10 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (2000x200x80 Concrete Sleeper 10 KPa) 77mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: **2.0-N12 bottom, ku = 0.53 > 0.36 - Non ductile**  
 Strength: (+ve M) M\* = 2.1kNm < øMuo = 2.3kNm OK (0.92)  
 Cracking: fscr = 211MPa < Fscr = 330MPa & fscr1 = 211MPa < Fscr1 = 400MPa OK (0.53,0.64)  
 Ast.min: Ast.min = 44mm² < Ast = 226mm² (Minimum of Deemed and actual) OK (0.19)

Geometry S.Wt = 0.39 kN/m L/D ratio = 26.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 77 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 15400 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	2.1	0.0	kNm
Ms1*	0.0	1.7	0.0	kNm
Ms*	0.0	1.7	0.0	kNm
Ast req'd	0	150	0	mm²
Ast	226	226	226	mm²
Reinf't req'd	-	1.3-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm²  
 Ductility class = N (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 41 mm  
 Depth to bottom steel (ds) = 41 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 21 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm	Design flange (bef) = 200 mm
Tensile steel area (As) = 226 mm²	ds = 41 mm
Comp. steel area (Ac) = 0 mm²	dc = 56 mm
Ultimate Moment (Mu) = 3.7 kNm	ku = 0.527 Warning - ku > 0.36 - Cl 8.1.5
Design capacity (øMuo) = 2.3 kNm	ø = 0.619 Table 2.2.2
	Ast.min = 44 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 211 MPa	Max. stress (Fscr) = 330 MPa	OK (0.64)
Steel stress (fscr1) = 211 MPa	Max. stress (Fscr1) = 400 MPa	OK (0.53)



Concrete Sleeper Retaining Wall

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2000x200x80 Concrete Sleeper 5 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (2000x200x80 Concrete Sleeper 5 KPa): Concrete simple beam

Description =	77mm (D) x 200mm (W) beam	Ix =	7.608883333 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	2000 mm	Ag =	15400 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	3.02			Dead load (pdl) =			
Live load (wll) =	0.35			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	2000			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	4.15	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1000 mm

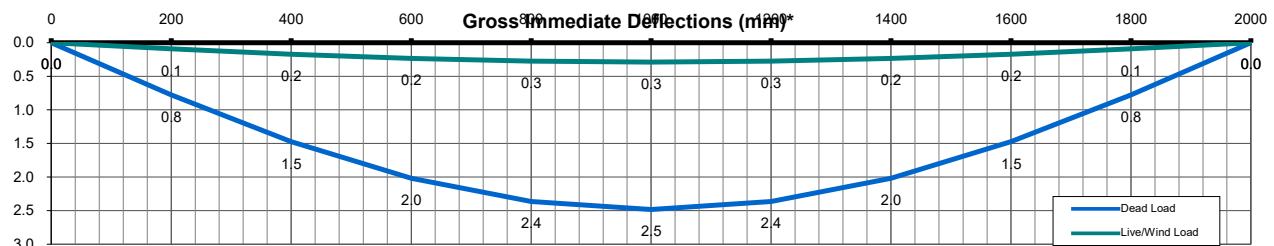
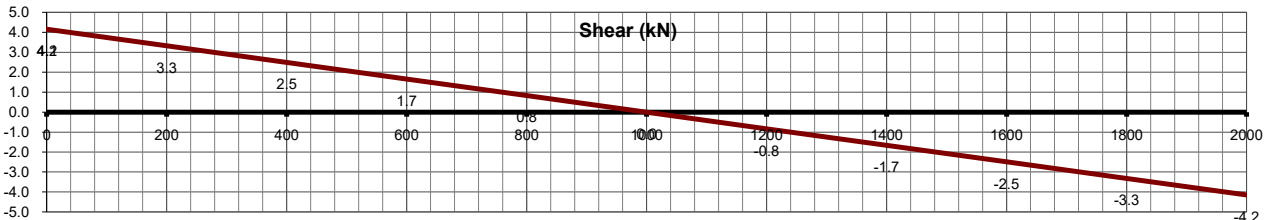
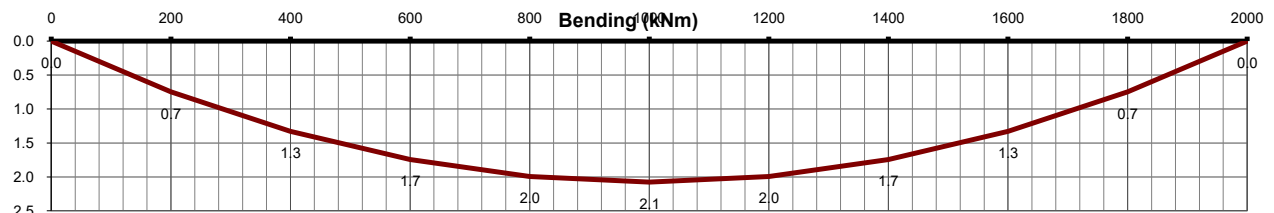
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	3.02		3.02					kN	
Rll	0.35		0.35					kN	
R*	4.15		4.15					kN	
M*	0.00	2.08	0.00	2.08	1000	0.00	0	kNm	
V*	4.15	0.00	-4.15	4.15	0			kN	Span /
δdl	0.00	2.48	0.00	2.48	1000	0.00	0	mm	806
δll	0.00	0.29	0.00	0.29	1000	0.00	0	mm	6960
δdl+Ψs*δll	0.00	2.77	0.00	2.77	1000	0.00	0	mm	722

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2000x200x80 Concrete Sleeper 5 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (2000x200x80 Concrete Sleeper 5 KPa) 77mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: **2.0-N12 bottom, ku = 0.53 > 0.36 - Non ductile**  
 Strength: (+ve M) M\* = 2.1kNm < øMuo = 2.3kNm **OK (0.91)**  
 Cracking: fscr = 213MPa < Fscr = 330MPa & fscr1 = 213MPa < Fscr1 = 400MPa **OK (0.53,0.64)**  
 Ast.min: Ast.min = 44mm<sup>2</sup> < Ast = 226mm<sup>2</sup> (Minimum of Deemed and actual) **OK (0.19)**

Geometry S.Wt = 0.39 kN/m L/D ratio = 26.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 77 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m<sup>3</sup> Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 15400 mm<sup>2</sup> Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	2.1	0.0	kNm
Ms1*	0.0	1.7	0.0	kNm
Ms*	0.0	1.7	0.0	kNm
Ast req'd	0	212	0	mm <sup>2</sup>
Ast	226	226	226	mm <sup>2</sup>
Reinf't req'd	-	1.9-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm<sup>2</sup> = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm<sup>2</sup>  
 Ductility class = L (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = L (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 41 mm  
 Depth to bottom steel (ds) = 41 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm<sup>2</sup> = 0 No  
 Yield strength (fsyc) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm<sup>2</sup>  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 21 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm  
 Tensile steel area (As) = 226 mm<sup>2</sup>  
 Comp. steel area (Ac) = 0 mm<sup>2</sup>  
 Ultimate Moment (Mu) = 3.7 kNm  
 Design capacity (øMuo) = 2.3 kNm

Design flange (bef) = 200 mm  
 ds = 41 mm  
 dc = 56 mm  
 ku = 0.527 Warning - ku > 0.36 - Cl 8.1.5  
 ø = 0.619 Table 2.2.2  
 Ast.min = 44 mm<sup>2</sup>

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 213 MPa Max. stress (Fscr) = 330 MPa OK (0.64)  
 Steel stress (fscr1) = 213 MPa Max. stress (Fscr1) = 400 MPa OK (0.53)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2400x200x80 Concrete Sleeper 5 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (2400x200x80 Concrete Sleeper 5 KPa): Concrete simple beam

Description =	77mm (D) x 200mm (W) beam	lx =	7.608883333 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	2400 mm	Ag =	15400 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	2.14			Dead load (pdl) =			
Live load (wll) =	0.35			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	2400			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	3.10	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1200 mm

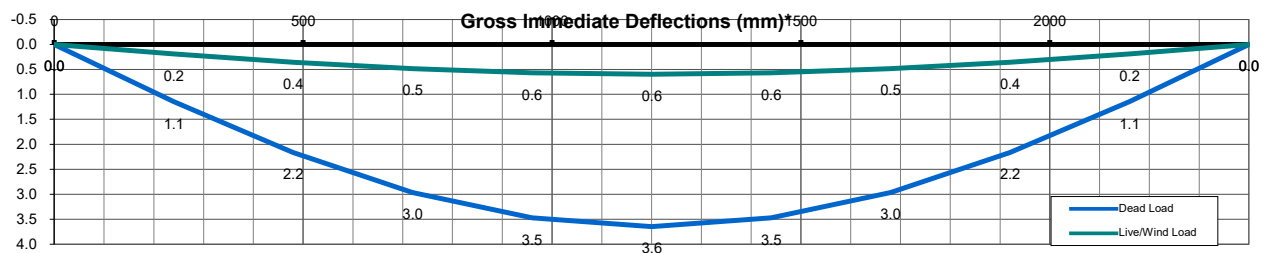
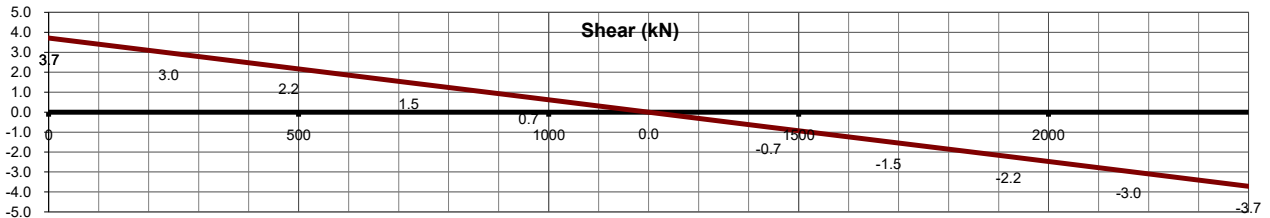
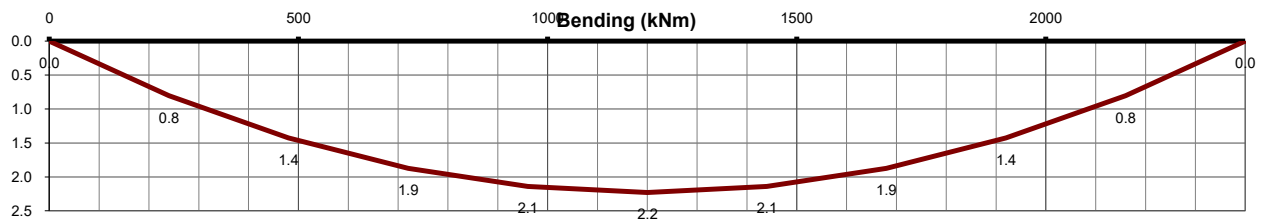
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	2.57		2.57					kN	
Rll	0.42		0.42					kN	
R*	3.71		3.71					kN	
M*	0.00	2.23	0.00	2.23	1200	0.00	0	kNm	
V*	3.71	0.00	-3.71	3.71	0			kN	Span /
δdl	0.00	3.65	0.00	3.65	1200	0.00	0	mm	658
δll	0.00	0.60	0.00	0.60	1200	0.00	0	mm	4028
δdl+Ψs*δll	0.00	4.24	0.00	4.24	1200	0.00	0	mm	566

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2400x200x80 Concrete Sleeper 5 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (2400x200x80 Concrete Sleeper 5 KPa) 77mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: **2.0-N12 bottom, ku = 0.53 > 0.36 - Non ductile**  
 Strength: (+ve M) M\* = 2.2kNm < øMuo = 2.3kNm **OK (0.97)**  
 Cracking: fscr = 226MPa < Fscr = 330MPa & fscr1 = 226MPa < Fscr1 = 400MPa **OK (0.57,0.68)**  
 Ast.min: Ast.min = 44mm<sup>2</sup> < Ast = 226mm<sup>2</sup> (Minimum of Deemed and actual) **OK (0.19)**

Geometry S.Wt = 0.39 kN/m L/D ratio = 31.2

Concrete strength (f'c) = 40 MPa

Depth (D) = 77 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m<sup>3</sup> Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 15400 mm<sup>2</sup> Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	2.2	0.0	kNm
Ms1*	0.0	1.8	0.0	kNm
Ms*	0.0	1.8	0.0	kNm
Ast req'd	0	236	0	mm <sup>2</sup>
Ast	226	226	226	mm <sup>2</sup>
Reinf't req'd	-	2.1-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm<sup>2</sup> = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm<sup>2</sup>  
 Ductility class = L (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = L (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 41 mm  
 Depth to bottom steel (ds) = 41 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm<sup>2</sup> = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm<sup>2</sup>  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 21 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 226 mm<sup>2</sup> ds = 41 mm  
 Comp. steel area (Ac) = 0 mm<sup>2</sup> dc = 56 mm  
 Ultimate Moment (Mu) = 3.7 kNm ku = **0.527 Warning - ku > 0.36 - Cl 8.1.5**  
 Design capacity (øMuo) = 2.3 kNm ø = 0.619 Table 2.2.2  
 Ast.min = 44 mm<sup>2</sup>

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 226 MPa Max. stress (Fscr) = 330 MPa OK (0.68)  
 Steel stress (fscr1) = 226 MPa Max. stress (Fscr1) = 400 MPa OK (0.57)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2400x200x80 Concrete Sleeper 10 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (2400x200x80 Concrete Sleeper 10 KPa): Concrete simple beam

Description =	77mm (D) x 200mm (W) beam	lx =	7.608883333 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	2400 mm	Ag =	15400 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	1.76			Dead load (pdl) =			
Live load (wll) =	0.70			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	2400			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	3.17	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1200 mm

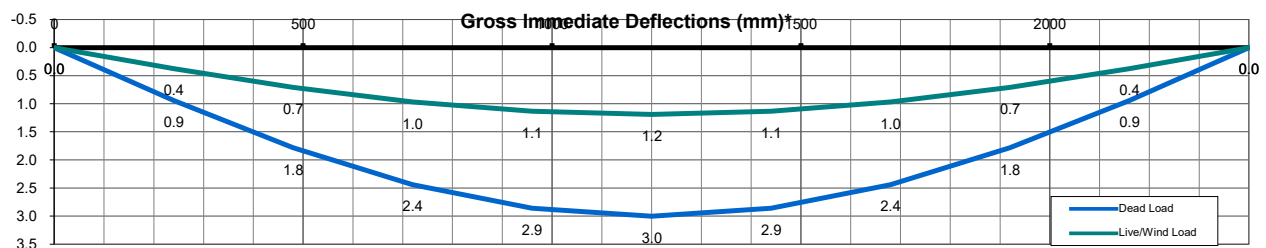
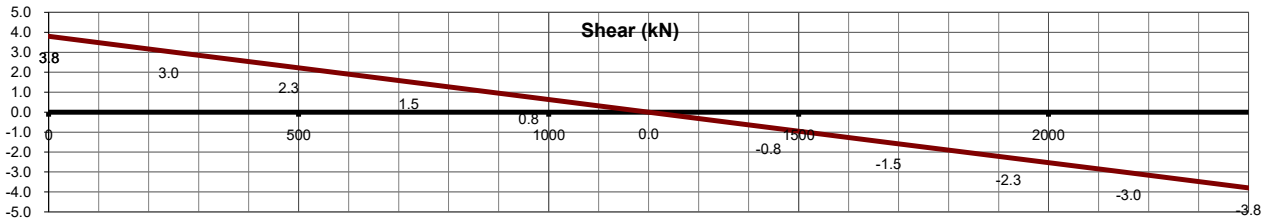
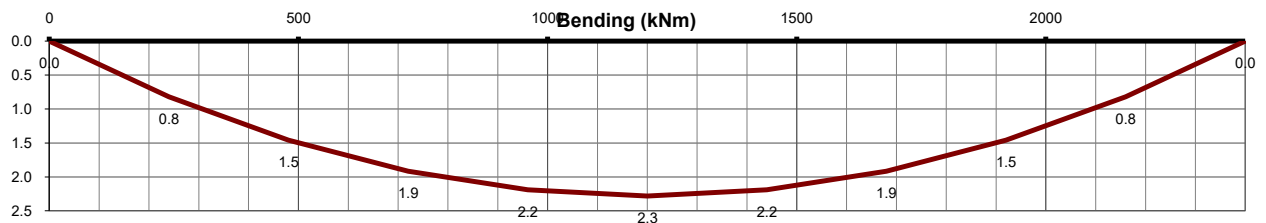
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	2.12		2.12					kN	
Rll	0.84		0.84					kN	
R*	3.80		3.80					kN	
M*	0.00	2.28	0.00	2.28	1200	0.00	0	kNm	
V*	3.80	0.00	-3.80	3.80	0			kN	Span /
δdl	0.00	3.00	0.00	3.00	1200	0.00	0	mm	799
δll	0.00	1.19	0.00	1.19	1200	0.00	0	mm	2014
δdl+Ψs*δll	0.00	4.19	0.00	4.19	1200	0.00	0	mm	572

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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Project No.: 2109031  
Designed: BE

2400x200x80 Concrete Sleeper 10 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (2400x200x80 Concrete Sleeper 10 KPa) 77mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: **2.0-N12 bottom, ku = 0.53 > 0.36 - Non ductile**  
 Strength: (+ve M) M\* = 2.3kNm < øMuo = 2.3kNm **OK (1.00)**  
 Cracking: fscr = 224MPa < Fscr = 330MPa & fscr1 = 224MPa < Fscr1 = 400MPa **OK (0.56,0.68)**  
 Ast.min: Ast.min = 44mm² < Ast = 226mm² (Minimum of Deemed and actual) **OK (0.19)**

Geometry S.Wt = 0.39 kN/m L/D ratio = 31.2

Concrete strength (f'c) = 40 MPa

Depth (D) = 77 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard), (R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes), (N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 15400 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual), (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	2.3	0.0	kNm
Ms1*	0.0	1.8	0.0	kNm
Ms*	0.0	1.8	0.0	kNm
Ast req'd	0	165	0	mm²
Ast	226	226	226	mm²
Reinf't req'd	-	1.5-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm²  
 Ductility class = N (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to bottom steel layer (ds.max) = 41 mm  
 Depth to bottom steel (ds) = 41 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 21 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 226 mm² ds = 41 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 3.7 kNm ku = **0.527 Warning - ku > 0.36 - Cl 8.1.5**  
 Design capacity (øMuo) = 2.3 kNm ø = 0.619 Table 2.2.2  
 Ast.min = 44 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 224 MPa Max. stress (Fscr) = 330 MPa OK (0.68)  
 Steel stress (fscr1) = 224 MPa Max. stress (Fscr1) = 400 MPa OK (0.56)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2400x200x100 Concrete Sleeper 5 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (2400x200x100 Concrete Sleeper 5 KPa): Concrete simple beam

Description =	100mm (D) x 200mm (W) beam	lx =	16.66666667 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	2400 mm	Ag =	20000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	3.78			Dead load (pdl) =			
Live load (wll) =	0.35			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	2400			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	5.06	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1200 mm

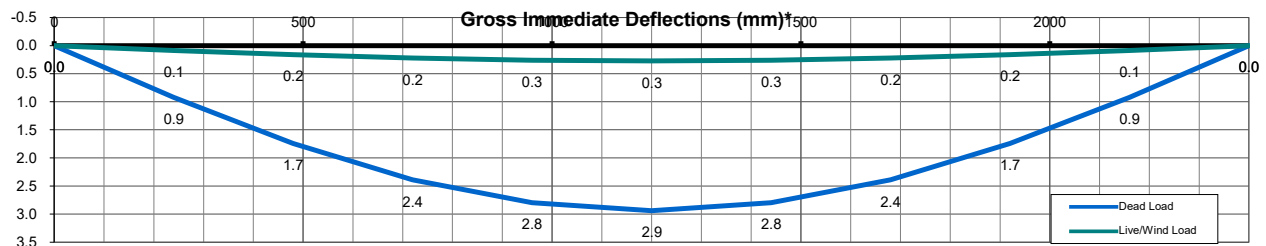
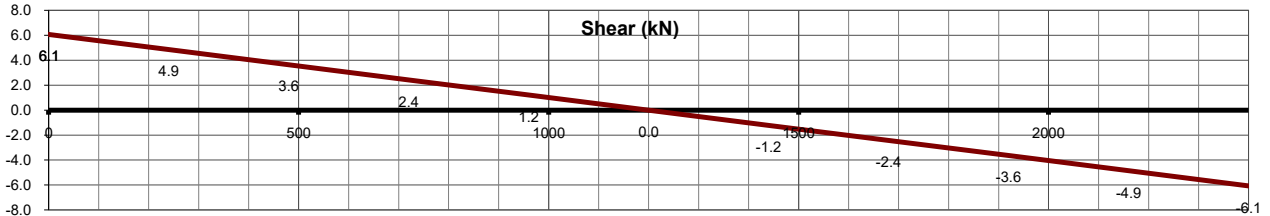
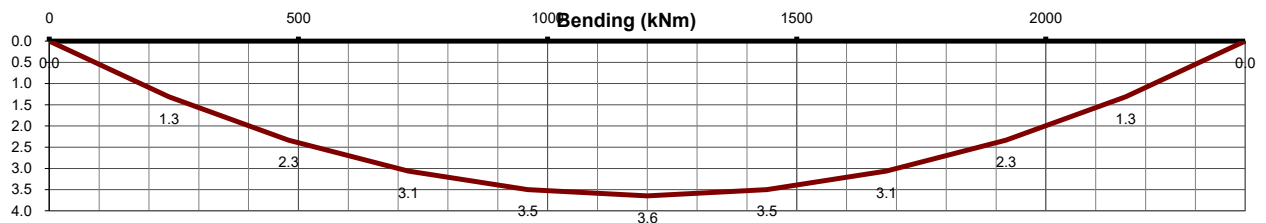
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	Span /
Rdl	4.54		4.54					kN	
Rll	0.42		0.42					kN	
R*	6.07		6.07					kN	
M*	0.00	3.64	0.00	3.64	1200	0.00	0	kNm	
V*	6.07	0.00	-6.07	6.07	0			kN	817
δdl	0.00	2.94	0.00	2.94	1200	0.00	0	mm	8823
δll	0.00	0.27	0.00	0.27	1200	0.00	0	mm	748
δdl+Ψs*δll	0.00	3.21	0.00	3.21	1200	0.00	0	mm	

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2400x200x100 Concrete Sleeper 5 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (2400x200x100 Concrete Sleeper 5 KPa) 100mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.34  
 Strength: (+ve M) M\* = 3.6kNm < øMuo = 5.0kNm OK (0.72)  
 Cracking: fscr = 234MPa < Fscr = 330MPa & fscr1 = 234MPa < Fscr1 = 400MPa OK (0.58,0.71)  
 Ast.min: Ast.min = 47mm² < Ast = 226mm² (Minimum of Deemed and actual) OK (0.21)

Geometry S.Wt = 0.50 kN/m L/D ratio = 24.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 100 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard),(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes),(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 20000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual, (L)eft, Position (X) from analysis, (R)ight)

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	3.6	0.0	kNm
Ms1*	0.0	3.0	0.0	kNm
Ms*	0.0	3.0	0.0	kNm
Ast req'd	0	157	0	mm²
Ast	226	226	226	mm²
Reinf't req'd	-	1.4-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm²  
 Ductility class = N (Normal),(L)ow,(A)uto  
 Reinf't ductility class = N (Normal),(L)ow  
 Depth to bottom steel layer (ds.max) = 64 mm  
 Depth to bottom steel (ds) = 64 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal),(L)ow,(A)uto  
 Reinf't ductility class = N (Normal),(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 44 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 226 mm² ds = 64 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 6.3 kNm ku = 0.337  
 Design capacity (øMuo) = 5.0 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 47 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 234 MPa Max. stress (Fscr) = 330 MPa OK (0.71)  
 Steel stress (fscr1) = 234 MPa Max. stress (Fscr1) = 400 MPa OK (0.58)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2400x200x100 Concrete Sleeper 10 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (2400x200x100 Concrete Sleeper 10 KPa): Concrete simple beam

Description =	100mm (D) x 200mm (W) beam	lx =	16.66666667 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	2400 mm	Ag =	20000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	3.53			Dead load (pdl) =			
Live load (wll) =	0.70			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	2400			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	5.28	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1200 mm

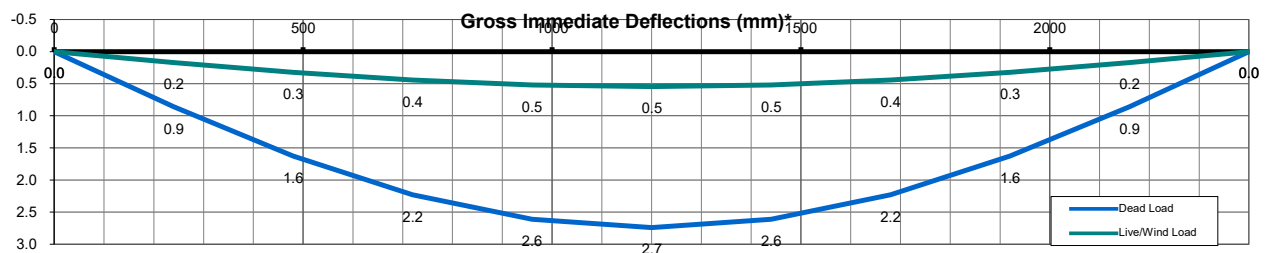
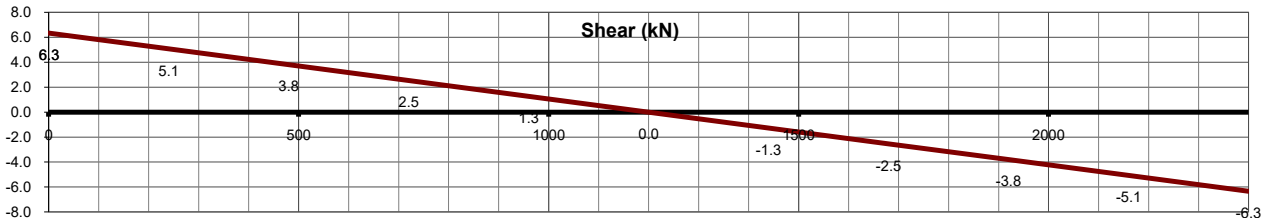
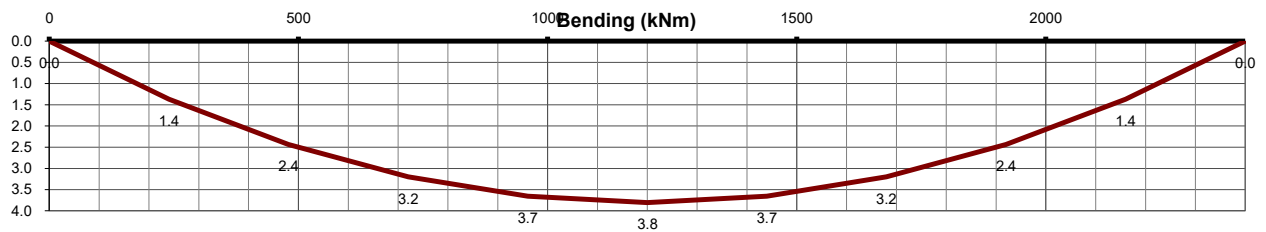
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	4.23		4.23					kN	
Rll	0.84		0.84					kN	
R*	6.34		6.34					kN	
M*	0.00	3.80	0.00	3.80	1200	0.00	0	kNm	
V*	6.34	0.00	-6.34	6.34	0			kN	Span /
δdl	0.00	2.74	0.00	2.74	1200	0.00	0	mm	875
δll	0.00	0.54	0.00	0.54	1200	0.00	0	mm	4412
δdl+Ψs*δll	0.00	3.29	0.00	3.29	1200	0.00	0	mm	730

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2400x200x100 Concrete Sleeper 10 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (2400x200x100 Concrete Sleeper 10 KPa) 100mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.34  
 Strength: (+ve M) M\* = 3.8kNm < øMuo = 5.0kNm OK (0.76)  
 Cracking: fscr = 240MPa < Fscr = 330MPa & fscr1 = 240MPa < Fscr1 = 400MPa OK (0.60,0.73)  
 Ast.min: Ast.min = 47mm² < Ast = 226mm² (Minimum of Deemed and actual) OK (0.21)

Geometry S.Wt = 0.50 kN/m L/D ratio = 24.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 100 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 20000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	3.8	0.0	kNm
Ms1*	0.0	3.0	0.0	kNm
Ms*	0.0	3.0	0.0	kNm
Ast req'd	0	165	0	mm²
Ast	226	226	226	mm²
Reinf't req'd	-	1.5-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm²  
 Ductility class = N (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 64 mm  
 Depth to bottom steel (ds) = 64 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 44 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 226 mm² ds = 64 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 6.3 kNm ku = 0.337  
 Design capacity (øMuo) = 5.0 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 47 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 240 MPa Max. stress (Fscr) = 330 MPa OK (0.73)  
 Steel stress (fscr1) = 240 MPa Max. stress (Fscr1) = 400 MPa OK (0.60)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2400x200x120 Concrete Sleeper 5 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (2400x200x120 Concrete Sleeper 5 KPa): Concrete simple beam

Description =	120mm (D) x 200mm (W) beam	lx =	28.8 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	2400 mm	Ag =	24000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	5.04			Dead load (pdl) =			
Live load (wll) =	0.35			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	2400			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	6.57	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1200 mm

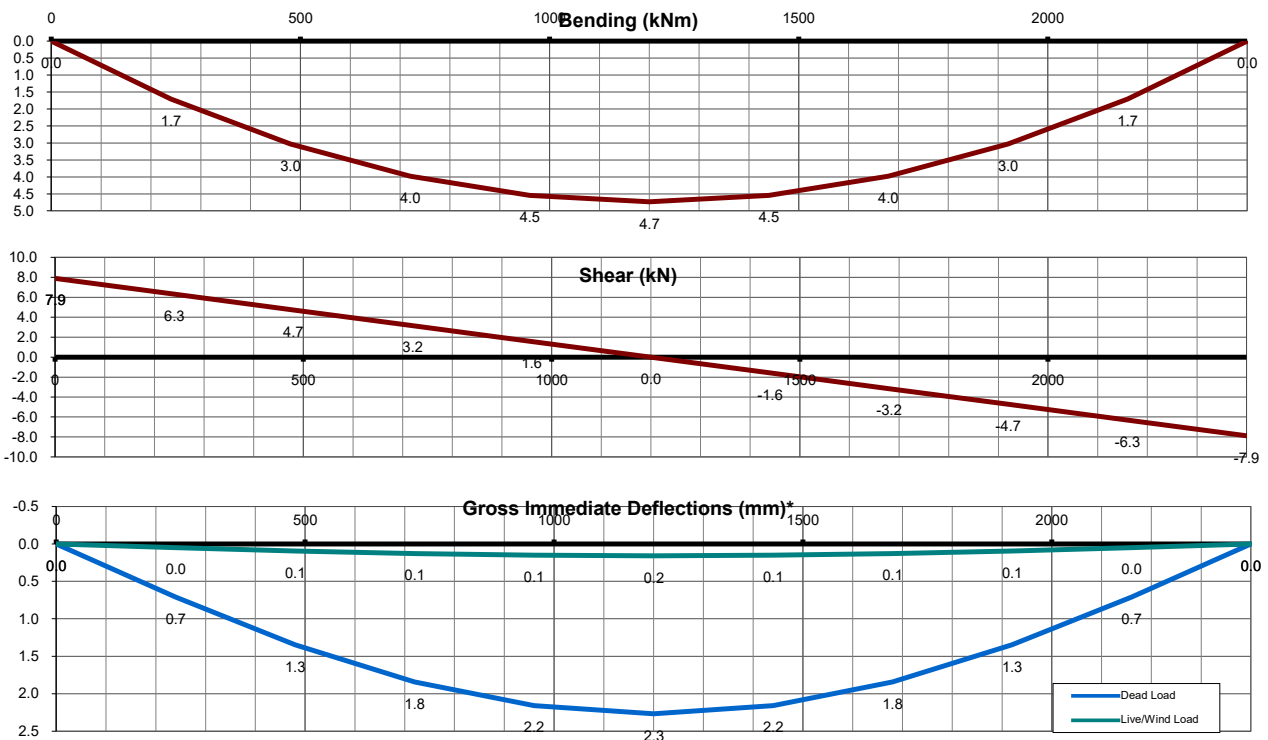
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	6.05		6.05					kN	
Rll	0.42		0.42					kN	
R*	7.89		7.89					kN	
M*	0.00	4.73	0.00	4.73	1200	0.00	0	kNm	
V*	7.89	0.00	-7.89	7.89	0			kN	Span /
δdl	0.00	2.27	0.00	2.27	1200	0.00	0	mm	1059
δll	0.00	0.16	0.00	0.16	1200	0.00	0	mm	15246
δdl+Ψs*δll	0.00	2.42	0.00	2.42	1200	0.00	0	mm	990

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2400x200x120 Concrete Sleeper 5 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (2400x200x120 Concrete Sleeper 5 KPa) 120mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.26  
 Strength: (+ve M) M\* = 4.7kNm < øMuo = 6.8kNm OK (0.69)  
 Cracking: fscr = 229MPa < Fscr = 330MPa & fscr1 = 229MPa < Fscr1 = 400MPa OK (0.57,0.69)  
 Ast.min: Ast.min = 52mm² < Ast = 226mm² (Minimum of Deemed and actual) OK (0.23)

Geometry S.Wt = 0.60 kN/m L/D ratio = 20.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 120 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)andard,(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 24000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)anual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	4.7	0.0	kNm
Ms1*	0.0	3.9	0.0	kNm
Ms*	0.0	3.9	0.0	kNm
Ast req'd	0	152	0	mm²
Ast	226	226	226	mm²
Reinf't req'd	-	1.3-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm²  
 Ductility class = N (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 84 mm  
 Depth to bottom steel (ds) = 84 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 64 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm  
 Tensile steel area (As) = 226 mm²  
 Comp. steel area (Ac) = 0 mm²  
 Ultimate Moment (Mu) = 8.6 kNm  
 Design capacity (øMuo) = 6.8 kNm

Design flange (bef) = 200 mm  
 ds = 84 mm  
 dc = 56 mm  
 ku = 0.257  
 ø = 0.800 Table 2.2.2  
 Ast.min = 52 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 229 MPa Max. stress (Fscr) = 330 MPa OK (0.69)  
 Steel stress (fscr1) = 229 MPa Max. stress (Fscr1) = 400 MPa OK (0.57)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2400x200x120 Concrete Sleeper 10 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (2400x200x120 Concrete Sleeper 10 KPa): Concrete simple beam

Description =	120mm (D) x 200mm (W) beam	lx =	28.8 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	2400 mm	Ag =	24000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	4.54			Dead load (pdl) =			
Live load (wll) =	0.70			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	2400			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	6.49	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1200 mm

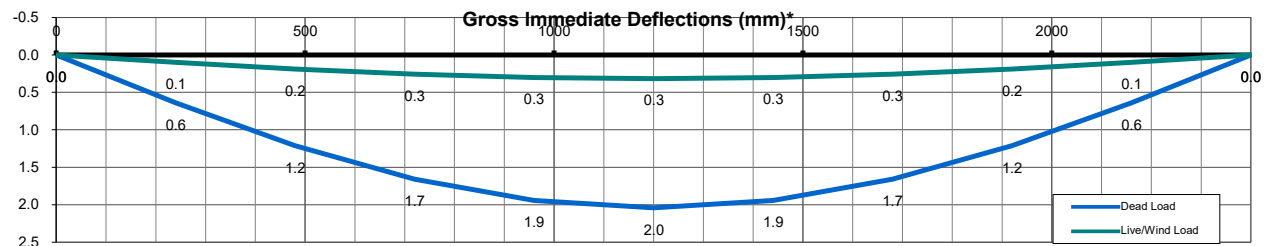
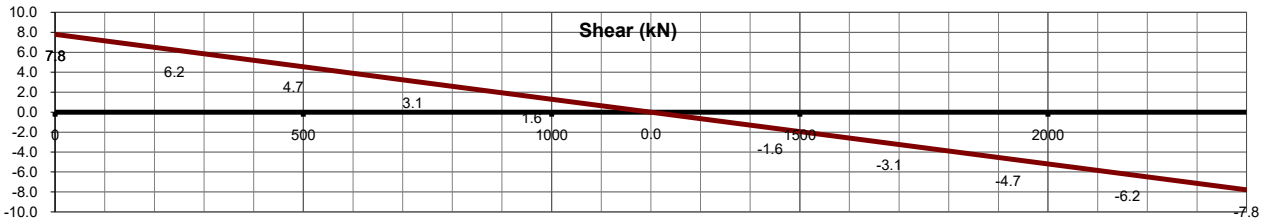
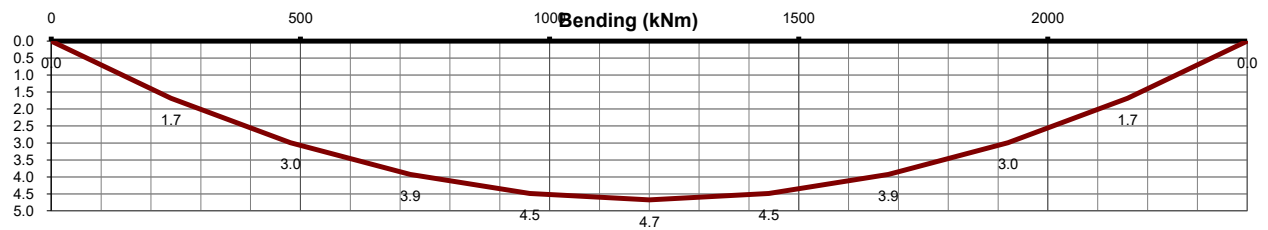
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	5.44		5.44					kN	
Rll	0.84		0.84					kN	
R*	7.79		7.79					kN	
M*	0.00	4.68	0.00	4.68	1200	0.00	0	kNm	
V*	7.79	0.00	-7.79	7.79	0			kN	Span /
δdl	0.00	2.04	0.00	2.04	1200	0.00	0	mm	1176
δll	0.00	0.31	0.00	0.31	1200	0.00	0	mm	7623
δdl+Ψs*δll	0.00	2.35	0.00	2.35	1200	0.00	0	mm	1019

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
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2400x200x120 Concrete Sleeper 10 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (2400x200x120 Concrete Sleeper 10 KPa) 120mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.26  
 Strength: (+ve M) M\* = 4.7kNm < øMuo = 6.8kNm OK (0.68)  
 Cracking: fscr = 223MPa < Fscr = 330MPa & fscr1 = 223MPa < Fscr1 = 400MPa OK (0.56,0.68)  
 Ast.min: Ast.min = 52mm<sup>2</sup> < Ast = 226mm<sup>2</sup> (Minimum of Deemed and actual) OK (0.23)

Geometry S.Wt = 0.60 kN/m L/D ratio = 20.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 120 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard), (R)igid  
 Concrete weight = 25.0 kN/m<sup>3</sup> Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes), (N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 24000 mm<sup>2</sup> Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual), (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	4.7	0.0	kNm
Ms1*	0.0	3.8	0.0	kNm
Ms*	0.0	3.8	0.0	kNm
Ast req'd	0	150	0	mm <sup>2</sup>
Ast	226	226	226	mm <sup>2</sup>
Reinf't req'd	-	1.3-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm<sup>2</sup> = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm<sup>2</sup>  
 Ductility class = N (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to bottom steel layer (ds.max) = 84 mm  
 Depth to bottom steel (ds) = 84 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm<sup>2</sup> = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm<sup>2</sup>  
 Ductility class = A (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 64 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 226 mm<sup>2</sup> ds = 84 mm  
 Comp. steel area (Ac) = 0 mm<sup>2</sup> dc = 56 mm  
 Ultimate Moment (Mu) = 8.6 kNm ku = 0.257  
 Design capacity (øMuo) = 6.8 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 52 mm<sup>2</sup>

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 223 MPa Max. stress (Fscr) = 330 MPa OK (0.68)  
 Steel stress (fscr1) = 223 MPa Max. stress (Fscr1) = 400 MPa OK (0.56)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2400x200x80 Concrete Sleeper 5 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (2400x200x80 Concrete Sleeper 5 KPa 2N10): Concrete simple beam

Description =	77mm (D) x 200mm (W) beam	lx =	7.608883333 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	2400 mm	Ag =	15400 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	1.64			Dead load (pdl) =			
Live load (wll) =	0.35			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	2400			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	2.49	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1200 mm

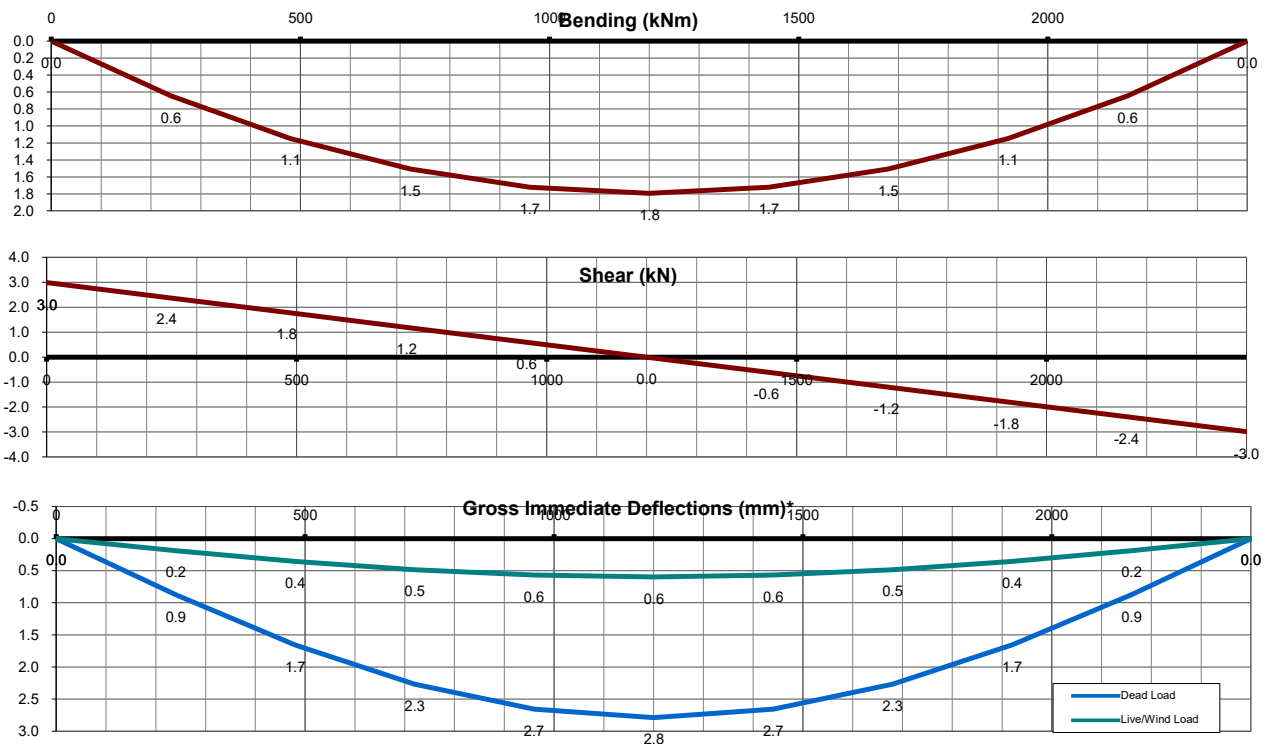
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	1.97		1.97					kN	
Rll	0.42		0.42					kN	
R*	2.99		2.99					kN	
M*	0.00	1.79	0.00	1.79	1200	0.00	0	kNm	
V*	2.99	0.00	-2.99	2.99	0			kN	Span /
δdl	0.00	2.79	0.00	2.79	1200	0.00	0	mm	861
δll	0.00	0.60	0.00	0.60	1200	0.00	0	mm	4028
δdl+Ψs*δll	0.00	3.38	0.00	3.38	1200	0.00	0	mm	709

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2400x200x80 Concrete Sleeper 5 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (2400x200x80 Concrete Sleeper 5 KPa 2N10) 77mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.36  
 Strength: (+ve M) M\* = 1.8kNm < øMu0 = 1.8kNm OK (0.98)  
 Cracking: fscr = 248MPa < Fscr = 362MPa & fscr1 = 248MPa < Fscr1 = 400MPa OK (0.62,0.69)  
 Ast.min: Ast.min = 43mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.27)

Geometry S.Wt = 0.39 kN/m L/D ratio = 31.2

Concrete strength (f'c) = 40 MPa

Depth (D) = 77 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 15400 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	1.8	0.0	kNm
Ms1*	0.0	1.4	0.0	kNm
Ms*	0.0	1.4	0.0	kNm
Ast req'd	0	165	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	2.1-N10	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = L (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = L (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 42 mm  
 Depth to bottom steel (ds) = 42 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 21 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 157 mm² ds = 42 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 2.8 kNm ku = 0.357  
 Design capacity (øMu0) = 1.8 kNm ø = 0.640 Table 2.2.2  
 Ast.min = 43 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 248 MPa Max. stress (Fscr) = 362 MPa OK (0.69)  
 Steel stress (fscr1) = 248 MPa Max. stress (Fscr1) = 400 MPa OK (0.62)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2400x200x80 Concrete Sleeper 10 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (2400x200x80 Concrete Sleeper 10 KPa 2N10): Concrete simple beam

Description =	77mm (D) x 200mm (W) beam	lx =	7.608883333 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	2400 mm	Ag =	15400 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	1.51			Dead load (pdl) =			
Live load (wll) =	0.70			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	2400			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	2.86	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1200 mm

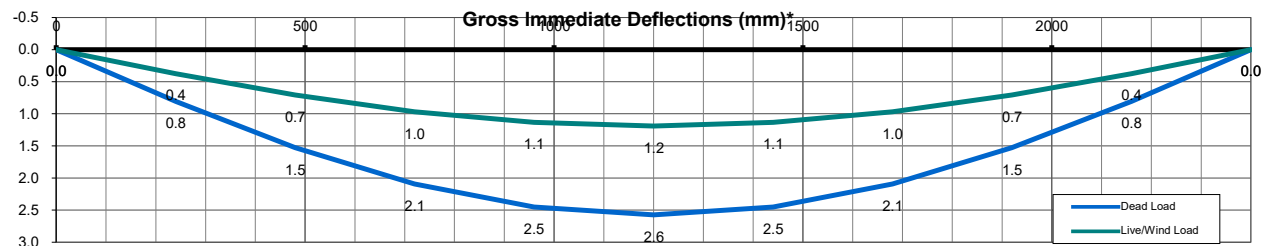
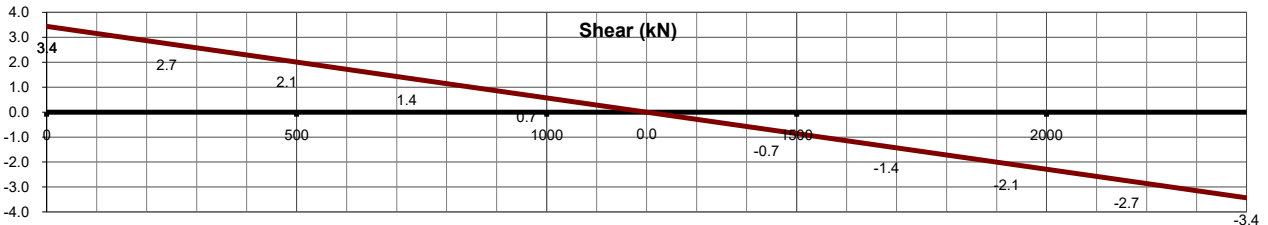
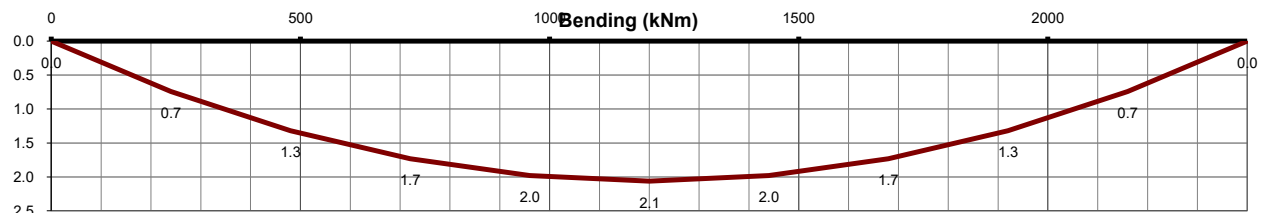
**1.20\*G+1.50\*Q analysed**

	Left	At x	Right	Max	At	Min	At	Units
Rdl	1.81		1.81					kN
Rll	0.84		0.84					kN
R*	3.44		3.44					kN
M*	0.00	2.06	0.00	2.06	1200	0.00	0	kNm
V*	3.44	0.00	-3.44	3.44	0			kN
δdl	0.00	2.57	0.00	2.57	1200	0.00	0	mm
δll	0.00	1.19	0.00	1.19	1200	0.00	0	mm
δdl+Ψs*δll	0.00	3.77	0.00	3.77	1200	0.00	0	mm

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2400x200x80 Concrete Sleeper 10 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (2400x200x80 Concrete Sleeper 10 KPa 2N10) 77mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.36  
 Strength: (+ve M) M\* = 2.1kNm < øMu0 = 2.3kNm OK (0.91)  
 Cracking: fscr = 276MPa < Fscr = 362MPa & fscr1 = 276MPa < Fscr1 = 400MPa OK (0.69,0.76)  
 Ast.min: Ast.min = 43mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.27)

Geometry S.Wt = 0.39 kN/m L/D ratio = 31.2

Concrete strength (f'c) = 40 MPa

Depth (D) = 77 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard), (R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes), (N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 15400 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual), (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	2.1	0.0	kNm
Ms1*	0.0	1.6	0.0	kNm
Ms*	0.0	1.6	0.0	kNm
Ast req'd	0	141	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.8-N10	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to bottom steel layer (ds.max) = 42 mm  
 Depth to bottom steel (ds) = 42 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to top steel layer = 55 mm  
 Depth to top steel = 55 mm  
 D-ds = 22 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 157 mm² ds = 42 mm  
 Comp. steel area (Ac) = 0 mm² dc = 55 mm  
 Ultimate Moment (Mu) = 2.8 kNm ku = 0.357  
 Design capacity (øMu0) = 2.3 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 43 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 276 MPa Max. stress (Fscr) = 362 MPa OK (0.76)  
 Steel stress (fscr1) = 276 MPa Max. stress (Fscr1) = 400 MPa OK (0.69)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2400x200x100 Concrete Sleeper 5 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (2400x200x100 Concrete Sleeper 5 KPa 2N10): Concrete simple beam

Description =	100mm (D) x 200mm (W) beam	lx =	16.66666667 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	2400 mm	Ag =	20000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	2.27			Dead load (pdl) =			
Live load (wll) =	0.35			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	2400			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	3.25	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1200 mm

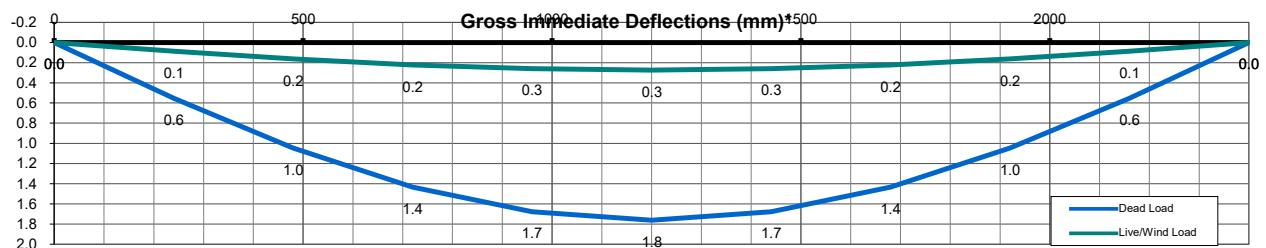
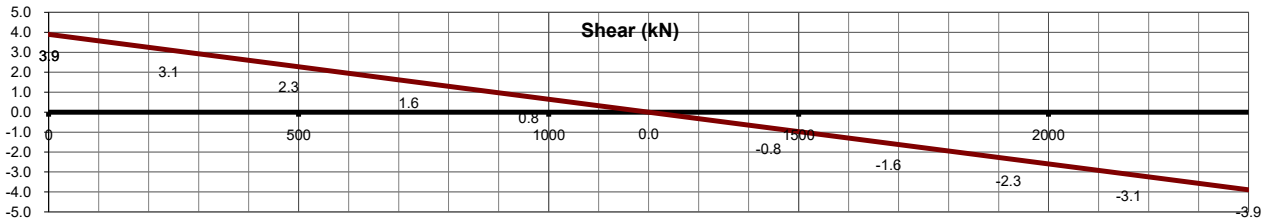
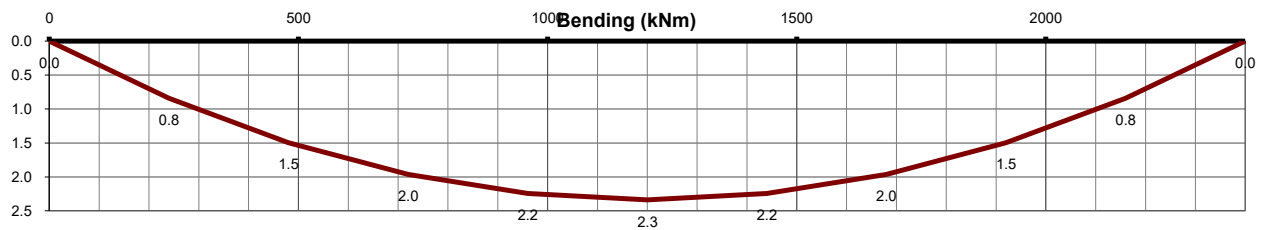
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	2.72		2.72					kN	
Rll	0.42		0.42					kN	
R*	3.90		3.90					kN	
M*	0.00	2.34	0.00	2.34	1200	0.00	0	kNm	
V*	3.90	0.00	-3.90	3.90	0			kN	Span /
δdl	0.00	1.76	0.00	1.76	1200	0.00	0	mm	1362
δll	0.00	0.27	0.00	0.27	1200	0.00	0	mm	8823
δdl+Ψs*δll	0.00	2.03	0.00	2.03	1200	0.00	0	mm	1180

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

Page:  
Project No.: 2109031  
Designed: BE

2400x200x100 Concrete Sleeper 5 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (2400x200x100 Concrete Sleeper 5 KPa 2N10) 100mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.23  
 Strength: (+ve M) M\* = 2.3kNm < øMu0 = 3.7kNm OK (0.63)  
 Cracking: fscr = 206MPa < Fscr = 362MPa & fscr1 = 206MPa < Fscr1 = 400MPa OK (0.52,0.57)  
 Ast.min: Ast.min = 47mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.30)

Geometry S.Wt = 0.50 kN/m L/D ratio = 24.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 100 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 20000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	2.3	0.0	kNm
Ms1*	0.0	1.9	0.0	kNm
Ms*	0.0	1.9	0.0	kNm
Ast req'd	0	95	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.2-N10	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 65 mm  
 Depth to bottom steel (ds) = 65 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsyc) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 44 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 157 mm² ds = 65 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 4.7 kNm ku = 0.231  
 Design capacity (øMu0) = 3.7 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 47 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 206 MPa Max. stress (Fscr) = 362 MPa OK (0.57)  
 Steel stress (fscr1) = 206 MPa Max. stress (Fscr1) = 400 MPa OK (0.52)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2400x200x100 Concrete Sleeper 10 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (2400x200x100 Concrete Sleeper 10 KPa 2N10): Concrete simple beam

Description =	100mm (D) x 200mm (W) beam	lx =	16.66666667 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	2400 mm	Ag =	20000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	2.02			Dead load (pdl) =			
Live load (wll) =	0.70			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	2400			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	3.47	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1200 mm

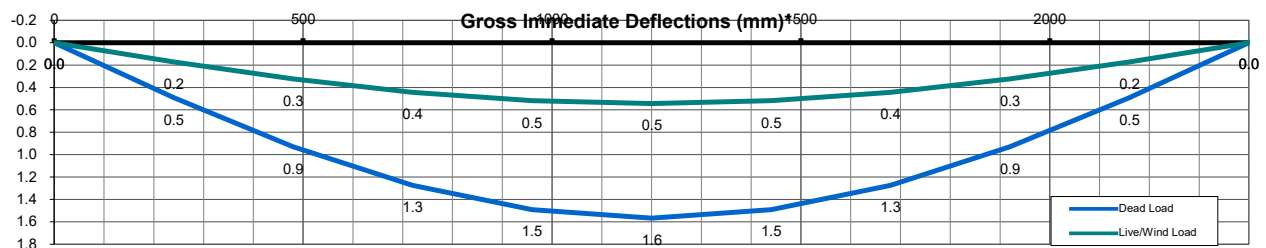
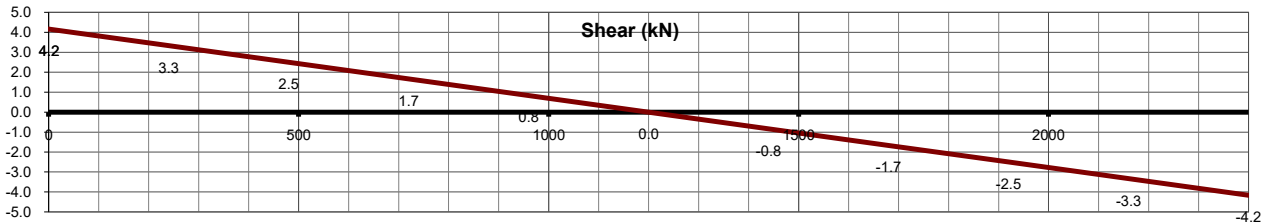
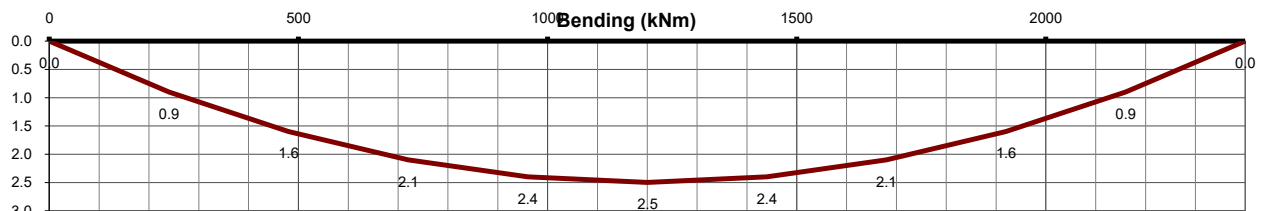
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	2.42		2.42					kN	
Rll	0.84		0.84					kN	
R*	4.16		4.16					kN	
M*	0.00	2.50	0.00	2.50	1200	0.00	0	kNm	
V*	4.16	0.00	-4.16	4.16	0			kN	Span /
δdl	0.00	1.57	0.00	1.57	1200	0.00	0	mm	1532
δll	0.00	0.54	0.00	0.54	1200	0.00	0	mm	4412
δdl+Ψs*δll	0.00	2.11	0.00	2.11	1200	0.00	0	mm	1137

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2400x200x100 Concrete Sleeper 10 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (2400x200x100 Concrete Sleeper 10 KPa 2N10) 100mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.23  
 Strength: (+ve M) M\* = 2.5kNm < øMu0 = 3.7kNm OK (0.67)  
 Cracking: fscr = 214MPa < Fscr = 362MPa & fscr1 = 214MPa < Fscr1 = 400MPa OK (0.54,0.59)  
 Ast.min: Ast.min = 47mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.30)

Geometry S.Wt = 0.50 kN/m L/D ratio = 24.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 100 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard), (R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes), (N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 20000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual), (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	2.5	0.0	kNm
Ms1*	0.0	2.0	0.0	kNm
Ms*	0.0	2.0	0.0	kNm
Ast req'd	0	102	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.3-N10	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to bottom steel layer (ds.max) = 65 mm  
 Depth to bottom steel (ds) = 65 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 44 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 157 mm² ds = 65 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 4.7 kNm ku = 0.231  
 Design capacity (øMu0) = 3.7 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 47 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 214 MPa Max. stress (Fscr) = 362 MPa OK (0.59)  
 Steel stress (fscr1) = 214 MPa Max. stress (Fscr1) = 400 MPa OK (0.54)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
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2400x200x120 Concrete Sleeper 5 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (2400x200x120 Concrete Sleeper 5 KPa 2N10): Concrete simple beam

Description =	120mm (D) x 200mm (W) beam	lx =	28.8 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	2400 mm	Ag =	24000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	3.78			Dead load (pdl) =			
Live load (wll) =	0.35			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	2400			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	5.06	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1200 mm

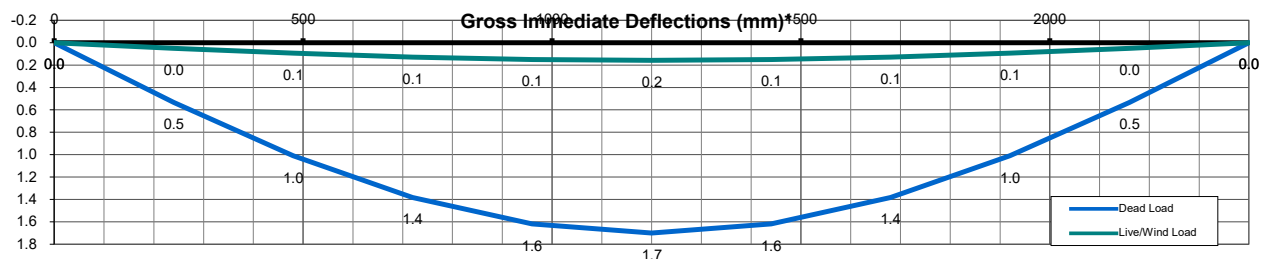
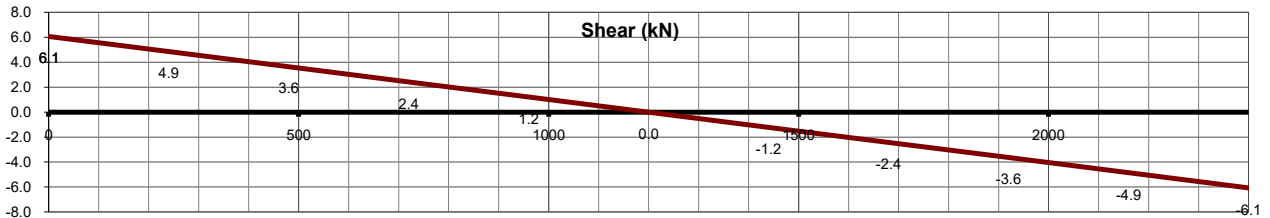
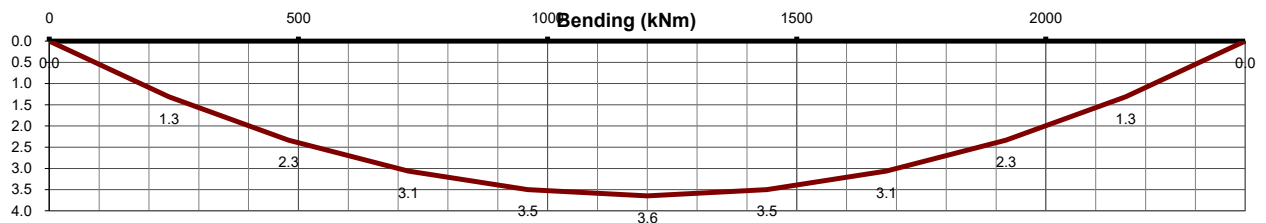
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	4.54		4.54					kN	
Rll	0.42		0.42					kN	
R*	6.07		6.07					kN	
M*	0.00	3.64	0.00	3.64	1200	0.00	0	kNm	
V*	6.07	0.00	-6.07	6.07	0			kN	Span /
δdl	0.00	1.70	0.00	1.70	1200	0.00	0	mm	1412
δll	0.00	0.16	0.00	0.16	1200	0.00	0	mm	15246
δdl+Ψs*δll	0.00	1.86	0.00	1.86	1200	0.00	0	mm	1292

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2400x200x120 Concrete Sleeper 5 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (2400x200x120 Concrete Sleeper 5 KPa 2N10) 120mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.18  
 Strength: (+ve M) M\* = 3.6kNm < øMu0 = 5.0kNm OK (0.73)  
 Cracking: fscr = 246MPa < Fscr = 362MPa & fscr1 = 246MPa < Fscr1 = 400MPa OK (0.61,0.68)  
 Ast.min: Ast.min = 51mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.33)

Geometry S.Wt = 0.60 kN/m L/D ratio = 20.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 120 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 24000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	3.6	0.0	kNm
Ms1*	0.0	3.0	0.0	kNm
Ms*	0.0	3.0	0.0	kNm
Ast req'd	0	113	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.4-N10	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 85 mm  
 Depth to bottom steel (ds) = 85 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsyc) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 64 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 157 mm² ds = 85 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 6.2 kNm ku = 0.176  
 Design capacity (øMu0) = 5.0 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 51 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 246 MPa Max. stress (Fscr) = 362 MPa OK (0.68)  
 Steel stress (fscr1) = 246 MPa Max. stress (Fscr1) = 400 MPa OK (0.61)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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2400x200x120 Concrete Sleeper 10 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (2400x200x120 Concrete Sleeper 10 KPa 2N10): Concrete simple beam

Description =	120mm (D) x 200mm (W) beam	lx =	28.8 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	2400 mm	Ag =	24000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	3.28			Dead load (pdl) =			
Live load (wll) =	0.70			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	2400			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	4.98	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1200 mm

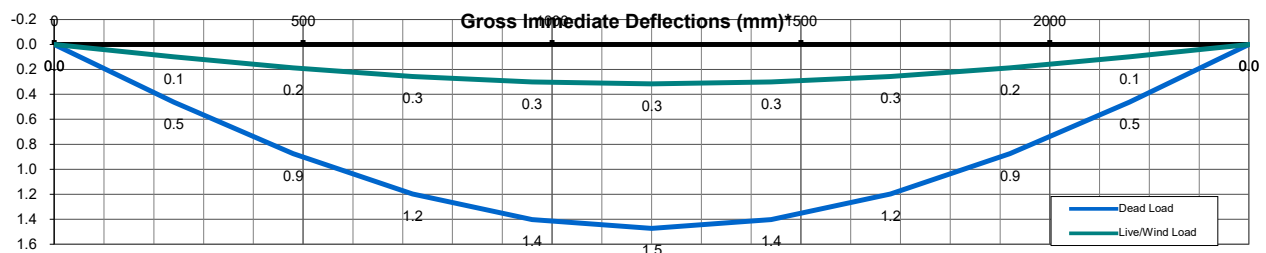
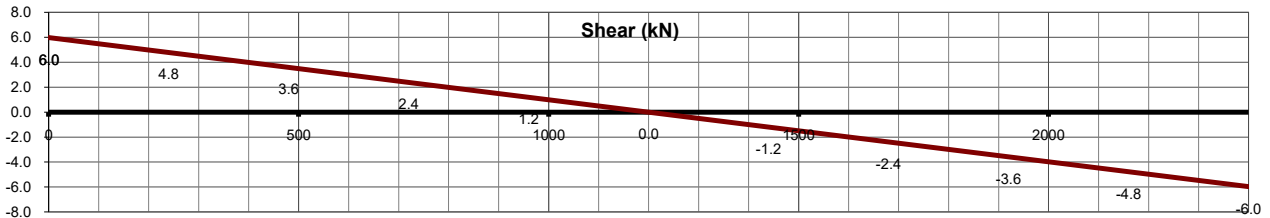
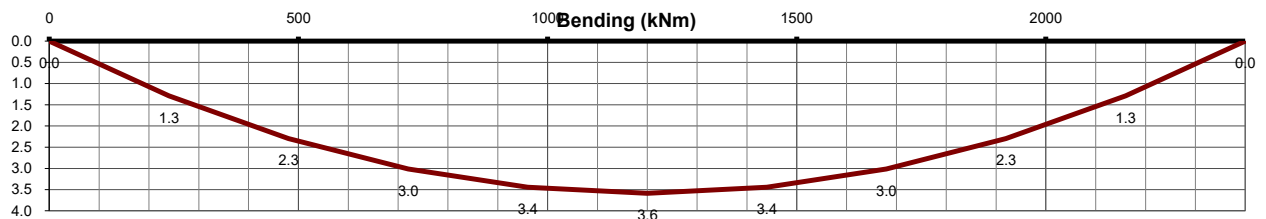
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	3.93		3.93					kN	
Rll	0.84		0.84					kN	
R*	5.98		5.98					kN	
M*	0.00	3.59	0.00	3.59	1200	0.00	0	kNm	
V*	5.98	0.00	-5.98	5.98	0			kN	Span /
δdl	0.00	1.47	0.00	1.47	1200	0.00	0	mm	1629
δll	0.00	0.31	0.00	0.31	1200	0.00	0	mm	7623
δdl+Ψs*δll	0.00	1.79	0.00	1.79	1200	0.00	0	mm	1342

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

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2400x200x120 Concrete Sleeper 10 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (2400x200x120 Concrete Sleeper 10 KPa 2N10) 120mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.18  
 Strength: (+ve M) M\* = 3.6kNm < øMuo = 5.0kNm OK (0.72)  
 Cracking: fscr = 237MPa < Fscr = 362MPa & fscr1 = 237MPa < Fscr1 = 400MPa OK (0.59,0.65)  
 Ast.min: Ast.min = 51mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.33)

Geometry S.Wt = 0.60 kN/m L/D ratio = 20.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 120 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard), (R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes), (N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 24000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual), (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	3.6	0.0	kNm
Ms1*	0.0	2.9	0.0	kNm
Ms*	0.0	2.9	0.0	kNm
Ast req'd	0	111	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.4-N10	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to bottom steel layer (ds.max) = 85 mm  
 Depth to bottom steel (ds) = 85 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 64 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 157 mm² ds = 85 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 6.2 kNm ku = 0.176  
 Design capacity (øMuo) = 5.0 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 51 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 237 MPa Max. stress (Fscr) = 362 MPa OK (0.65)  
 Steel stress (fscr1) = 237 MPa Max. stress (Fscr1) = 400 MPa OK (0.59)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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3000x200x80 Concrete Sleeper 5 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (3000x200x80 Concrete Sleeper 5 KPa): Concrete simple beam

Description =	77mm (D) x 200mm (W) beam	ix =	7.608883333 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	3000 mm	Ag =	15400 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	1.01			Dead load (pdl) =			
Live load (wll) =	0.35			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	3000			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	1.73	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1500 mm

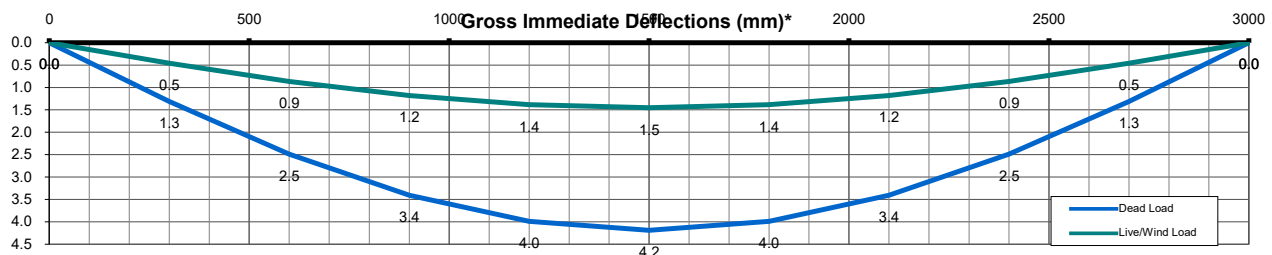
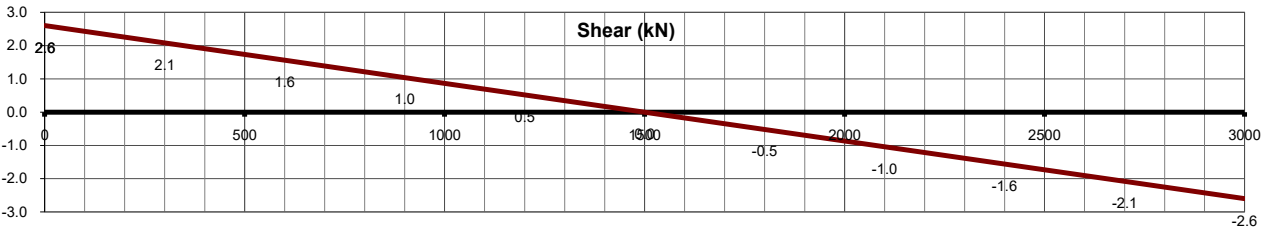
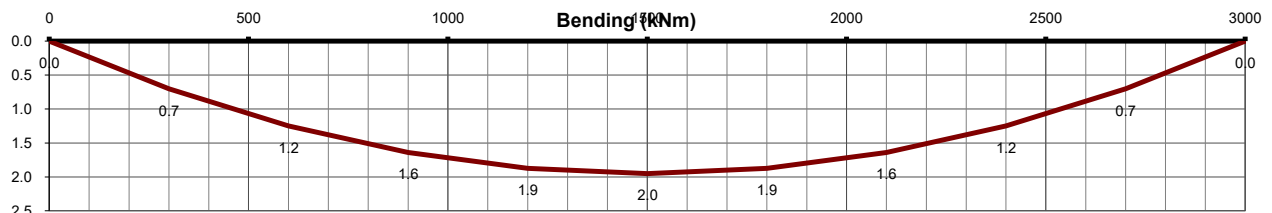
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	1.51		1.51					kN	
Rll	0.53		0.53					kN	
R*	2.60		2.60					kN	
M*	0.00	1.95	0.00	1.95	1500	0.00	0	kNm	
V*	2.60	0.00	-2.60	2.60	0			kN	Span /
δdl	0.00	4.19	0.00	4.19	1500	0.00	0	mm	716
δll	0.00	1.45	0.00	1.45	1500	0.00	0	mm	2062
δdl+Ψs*δll	0.00	5.64	0.00	5.64	1500	0.00	0	mm	532

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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3000x200x80 Concrete Sleeper 5 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (3000x200x80 Concrete Sleeper 5 KPa) 77mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.53 > 0.36 - Non ductile  
 Strength: (+ve M) M\* = 2.0kNm < øMu0 = 2.3kNm OK (0.85)  
 Cracking: fscr = 193MPa < Fscr = 330MPa & fscr1 = 193MPa < Fscr1 = 400MPa OK (0.48,0.58)  
 Ast.min: Ast.min = 44mm² < Ast = 226mm² (Minimum of Deemed and actual) OK (0.19)

Geometry S.Wt = 0.39 kN/m L/D ratio = 39.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 77 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 15400 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	2.0	0.0	kNm
Ms1*	0.0	1.5	0.0	kNm
Ms*	0.0	1.5	0.0	kNm
Ast req'd	0	137	0	mm²
Ast	226	226	226	mm²
Reinf't req'd	-	1.2-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm²  
 Ductility class = N (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 41 mm  
 Depth to bottom steel (ds) = 41 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 21 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm  
 Tensile steel area (As) = 226 mm²  
 Comp. steel area (Ac) = 0 mm²  
 Ultimate Moment (Mu) = 3.7 kNm  
 Design capacity (øMu0) = 2.3 kNm

Design flange (bef) = 200 mm  
 ds = 41 mm  
 dc = 56 mm  
 ku = 0.527 Warning - ku > 0.36 - Cl 8.1.5  
 ø = 0.619 Table 2.2.2  
 Ast.min = 44 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 193 MPa Max. stress (Fscr) = 330 MPa OK (0.58)  
 Steel stress (fscr1) = 193 MPa Max. stress (Fscr1) = 400 MPa OK (0.48)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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3000x200x80 Concrete Sleeper 10 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (3000x200x80 Concrete Sleeper 10 KPa): Concrete simple beam

Description =	77mm (D) x 200mm (W) beam	lx =	7.608883333 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	3000 mm	Ag =	15400 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	0.63			Dead load (pdl) =			
Live load (wll) =	0.70			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	3000			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	1.81	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1500 mm

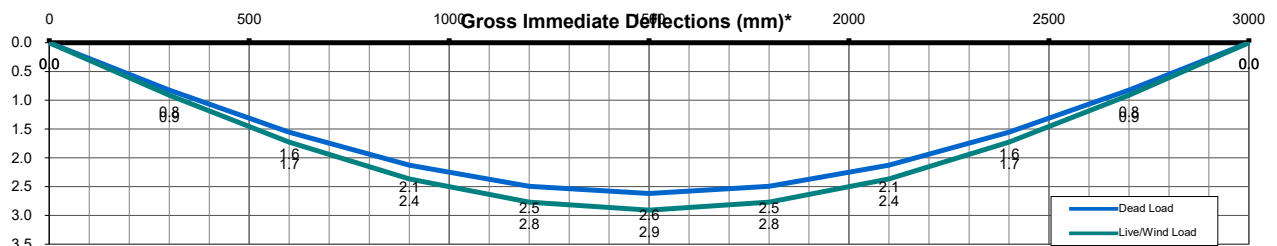
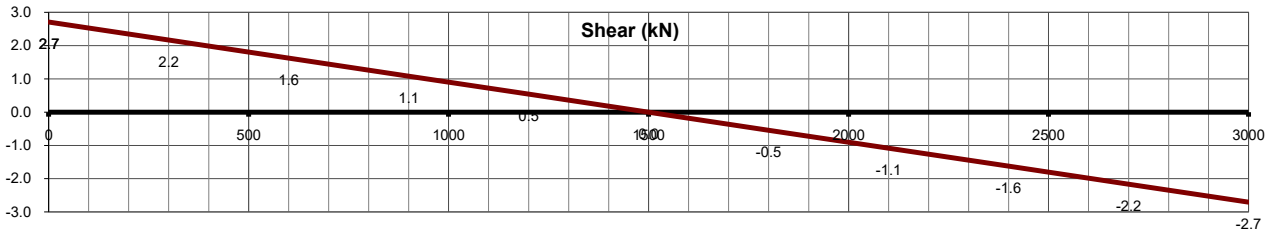
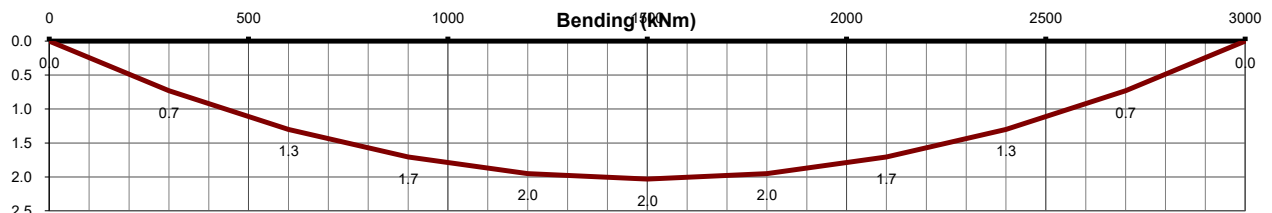
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	0.95		0.95					kN	
Rll	1.05		1.05					kN	
R*	2.71		2.71					kN	
M*	0.00	2.03	0.00	2.03	1500	0.00	0	kNm	
V*	2.71	0.00	-2.71	2.71	0			kN	Span /
δdl	0.00	2.62	0.00	2.62	1500	0.00	0	mm	1146
δll	0.00	2.91	0.00	2.91	1500	0.00	0	mm	1031
δdl+Ψs*δll	0.00	5.53	0.00	5.53	1500	0.00	0	mm	543

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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3000x200x80 Concrete Sleeper 10 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (3000x200x80 Concrete Sleeper 10 KPa) 77mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: **2.0-N12 bottom, ku = 0.53 > 0.36 - Non ductile**  
 Strength: (+ve M) M\* = 2.0kNm < øMuo = 2.3kNm **OK (0.89)**  
 Cracking: fscr = 189MPa < Fscr = 330MPa & fscr1 = 189MPa < Fscr1 = 400MPa **OK (0.47,0.57)**  
 Ast.min: Ast.min = 44mm² < Ast = 226mm² (Minimum of Deemed and actual) **OK (0.19)**

Geometry S.Wt = 0.39 kN/m L/D ratio = 39.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 77 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 15400 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	2.0	0.0	kNm
Ms1*	0.0	1.5	0.0	kNm
Ms*	0.0	1.5	0.0	kNm
Ast req'd	0	144	0	mm²
Ast	226	226	226	mm²
Reinf't req'd	-	1.3-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm²  
 Ductility class = N (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 41 mm  
 Depth to bottom steel (ds) = 41 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 21 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 226 mm² ds = 41 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 3.7 kNm ku = **0.527 Warning - ku > 0.36 - Cl 8.1.5**  
 Design capacity (øMuo) = 2.3 kNm ø = 0.619 Table 2.2.2  
 Ast.min = 44 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 189 MPa Max. stress (Fscr) = 330 MPa OK (0.57)  
 Steel stress (fscr1) = 189 MPa Max. stress (Fscr1) = 400 MPa OK (0.47)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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3000x200x100 Concrete Sleeper 5 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (3000x200x100 Concrete Sleeper 5 KPa): Concrete simple beam

Description =	100mm (D) x 200mm (W) beam	Ix =	16.66666667 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	3000 mm	Ag =	20000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	3.15			Dead load (pdl) =			
Live load (wll) =	0.35			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	3000			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	4.31	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1500 mm

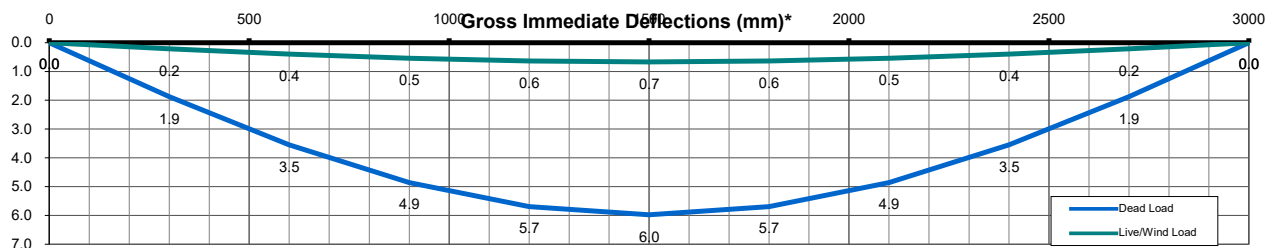
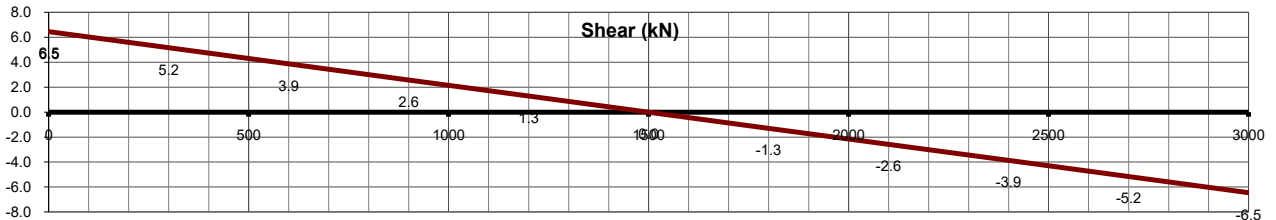
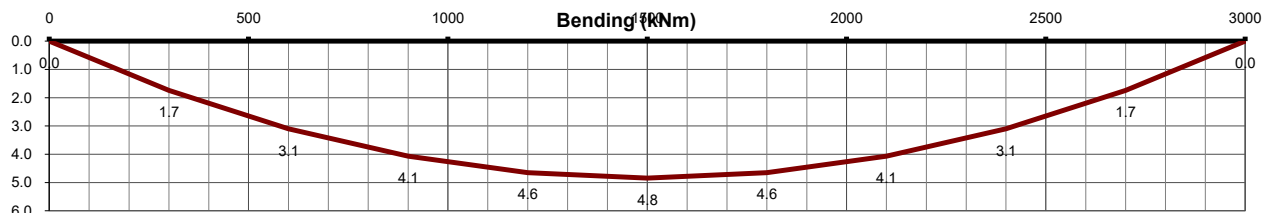
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	4.73		4.73					kN	
Rll	0.53		0.53					kN	
R*	6.46		6.46					kN	
M*	0.00	4.84	0.00	4.84	1500	0.00	0	kNm	
V*	6.46	0.00	-6.46	6.46	0			kN	Span /
δdl	0.00	5.98	0.00	5.98	1500	0.00	0	mm	502
δll	0.00	0.66	0.00	0.66	1500	0.00	0	mm	4517
δdl+Ψs*δll	0.00	6.64	0.00	6.64	1500	0.00	0	mm	452

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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### Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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3000x200x100 Concrete Sleeper 5 KPa

#### CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (3000x200x100 Concrete Sleeper 5 KPa) 100mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.34  
 Strength: (+ve M) M\* = 4.8kNm < øMuo = 5.0kNm OK (0.96)  
 Cracking: fscr = 310MPa < Fscr = 330MPa & fscr1 = 310MPa < Fscr1 = 400MPa OK (0.77,0.94)  
 Ast.min: Ast.min = 47mm<sup>2</sup> < Ast = 226mm<sup>2</sup> (Minimum of Deemed and actual) OK (0.21)

Geometry S.Wt = 0.50 kN/m L/D ratio = 30.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 100 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
 Tension

Side cover = 30 mm Formwork = S (Standard), (R)igid  
 Concrete weight = 25.0 kN/m<sup>3</sup> Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes), (N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 20000 mm<sup>2</sup> Side = B1 Tab 4.10.3.2

#### Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual), (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	4.8	0.0	kNm
Ms1*	0.0	3.9	0.0	kNm
Ms*	0.0	3.9	0.0	kNm
Ast req'd	0	218	0	mm <sup>2</sup>
Ast	226	226	226	mm <sup>2</sup>
Reinf't req'd	-	1.9-N12	-	

#### Reinforcement

Ligs = No ligs

##### Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm<sup>2</sup> = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm<sup>2</sup>  
 Ductility class = N (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to bottom steel layer (ds.max) = 64 mm  
 Depth to bottom steel (ds) = 64 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

##### Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm<sup>2</sup> = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm<sup>2</sup>  
 Ductility class = A (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 44 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

#### Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 226 mm<sup>2</sup> ds = 64 mm  
 Comp. steel area (Ac) = 0 mm<sup>2</sup> dc = 56 mm  
 Ultimate Moment (Mu) = 6.3 kNm ku = 0.337  
 Design capacity (øMuo) = 5.0 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 47 mm<sup>2</sup>

#### Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 310 MPa Max. stress (Fscr) = 330 MPa OK (0.94)  
 Steel stress (fscr1) = 310 MPa Max. stress (Fscr1) = 400 MPa OK (0.77)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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3000x200x100 Concrete Sleeper 10 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (3000x200x100 Concrete Sleeper 10 KPa): Concrete simple beam

Description =	100mm (D) x 200mm (W) beam	lx =	16.66666667 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	3000 mm	Ag =	20000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	2.52			Dead load (pdl) =			
Live load (wll) =	0.70			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	3000			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	4.07	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1500 mm

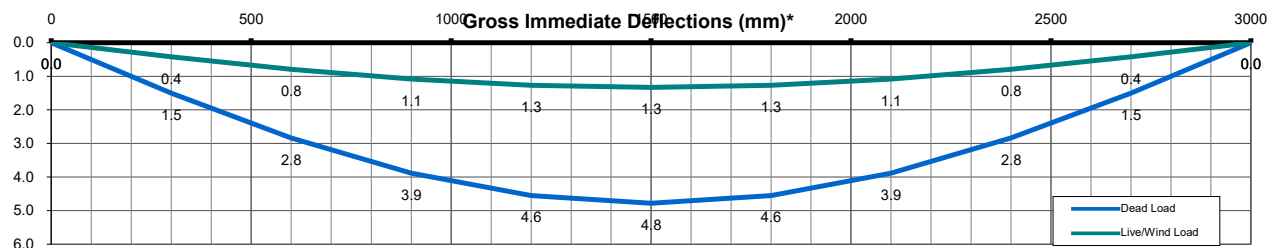
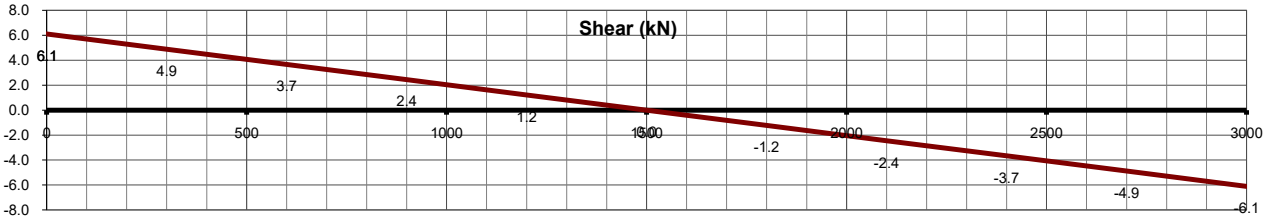
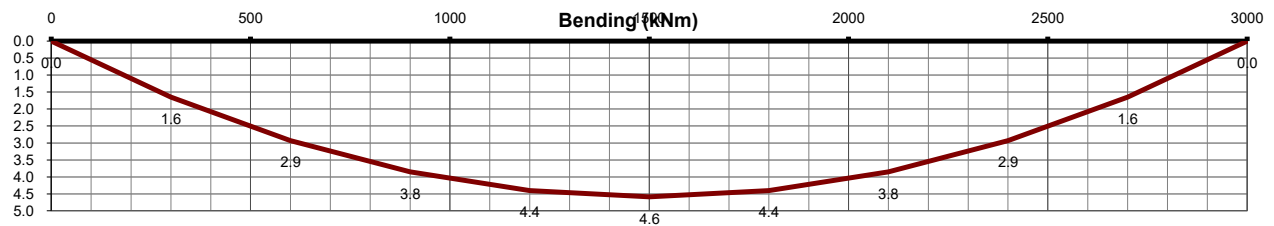
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	3.78		3.78					kN	
Rll	1.05		1.05					kN	
R*	6.11		6.11					kN	
M*	0.00	4.58	0.00	4.58	1500	0.00	0	kNm	
V*	6.11	0.00	-6.11	6.11	0			kN	Span /
δdl	0.00	4.78	0.00	4.78	1500	0.00	0	mm	627
δll	0.00	1.33	0.00	1.33	1500	0.00	0	mm	2259
δdl+Ψs*δll	0.00	6.11	0.00	6.11	1500	0.00	0	mm	491

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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3000x200x100 Concrete Sleeper 10 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (3000x200x100 Concrete Sleeper 10 KPa) 100mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.34  
 Strength: (+ve M) M\* = 4.6kNm < øMuo = 5.0kNm OK (0.91)  
 Cracking: fscr = 285MPa < Fscr = 330MPa & fscr1 = 285MPa < Fscr1 = 400MPa OK (0.71,0.86)  
 Ast.min: Ast.min = 47mm<sup>2</sup> < Ast = 226mm<sup>2</sup> (Minimum of Deemed and actual) OK (0.21)

Geometry S.Wt = 0.50 kN/m L/D ratio = 30.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 100 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m<sup>3</sup> Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 20000 mm<sup>2</sup> Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	4.6	0.0	kNm
Ms1*	0.0	3.6	0.0	kNm
Ms*	0.0	3.6	0.0	kNm
Ast req'd	0	205	0	mm <sup>2</sup>
Ast	226	226	226	mm <sup>2</sup>
Reinf't req'd	-	1.8-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm<sup>2</sup> = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm<sup>2</sup>  
 Ductility class = N (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 64 mm  
 Depth to bottom steel (ds) = 64 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm<sup>2</sup> = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm<sup>2</sup>  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 44 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 226 mm<sup>2</sup> ds = 64 mm  
 Comp. steel area (Ac) = 0 mm<sup>2</sup> dc = 56 mm  
 Ultimate Moment (Mu) = 6.3 kNm ku = 0.337  
 Design capacity (øMuo) = 5.0 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 47 mm<sup>2</sup>

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 285 MPa Max. stress (Fscr) = 330 MPa OK (0.86)  
 Steel stress (fscr1) = 285 MPa Max. stress (Fscr1) = 400 MPa OK (0.71)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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3000x200x120 Concrete Sleeper 5 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (3000x200x120 Concrete Sleeper 5 KPa): Concrete simple beam

Description =	120mm (D) x 200mm (W) beam	lx =	28.8 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	3000 mm	Ag =	24000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	4.41			Dead load (pdl) =			
Live load (wll) =	0.35			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	3000			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	5.82	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1500 mm

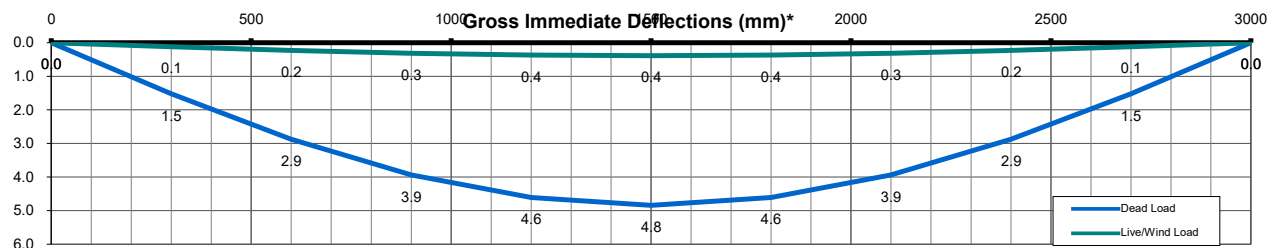
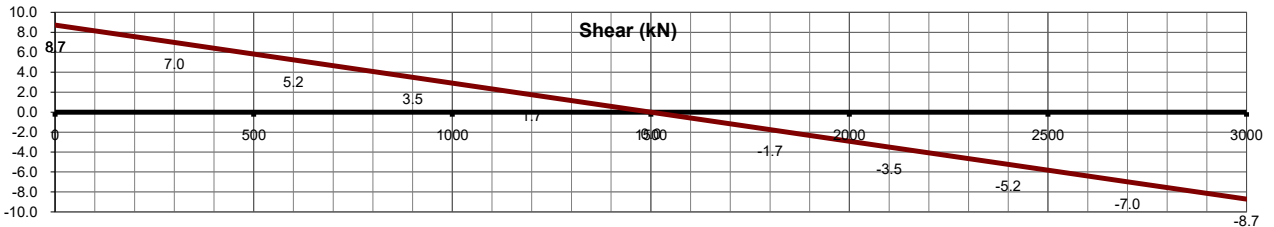
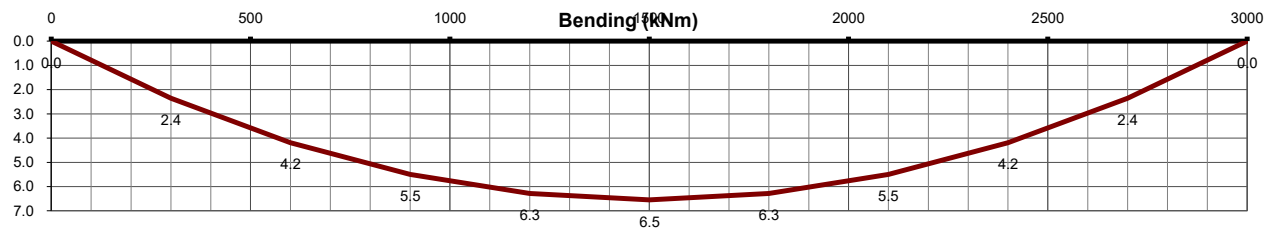
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	6.62		6.62					kN	
Rll	0.53		0.53					kN	
R*	8.73		8.73					kN	
M*	0.00	6.54	0.00	6.54	1500	0.00	0	kNm	
V*	8.73	0.00	-8.73	8.73	0			kN	Span /
δdl	0.00	4.84	0.00	4.84	1500	0.00	0	mm	620
δll	0.00	0.38	0.00	0.38	1500	0.00	0	mm	7806
δdl+Ψs*δll	0.00	5.23	0.00	5.23	1500	0.00	0	mm	574

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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3000x200x120 Concrete Sleeper 5 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (3000x200x120 Concrete Sleeper 5 KPa) 120mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.26  
 Strength: (+ve M) M\* = 6.5kNm < øMuo = 6.8kNm OK (0.96)  
 Cracking: fscr = 317MPa < Fscr = 330MPa & fscr1 = 317MPa < Fscr1 = 400MPa OK (0.79,0.96)  
 Ast.min: Ast.min = 52mm² < Ast = 226mm² (Minimum of Deemed and actual) OK (0.23)

Geometry S.Wt = 0.60 kN/m L/D ratio = 25.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 120 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard), (R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes), (N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 24000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual), (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	6.5	0.0	kNm
Ms1*	0.0	5.4	0.0	kNm
Ms*	0.0	5.4	0.0	kNm
Ast req'd	0	217	0	mm²
Ast	226	226	226	mm²
Reinf't req'd	-	1.9-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm²  
 Ductility class = N (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to bottom steel layer (ds.max) = 84 mm  
 Depth to bottom steel (ds) = 84 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal), (L)ow, (A)uto  
 Reinf't ductility class = N (Normal), (L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 64 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 226 mm² ds = 84 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 8.6 kNm ku = 0.257  
 Design capacity (øMuo) = 6.8 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 52 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 317 MPa Max. stress (Fscr) = 330 MPa OK (0.96)  
 Steel stress (fscr1) = 317 MPa Max. stress (Fscr1) = 400 MPa OK (0.79)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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3000x200x120 Concrete Sleeper 10 KPa

ANALYSIS V5.02

Barrasons Engineers

Geometry for (3000x200x120 Concrete Sleeper 10 KPa): Concrete simple beam

Description =	120mm (D) x 200mm (W) beam	lx =	28.8 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	3000 mm	Ag =	24000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	3.78			Dead load (pdl) =			
Live load (wll) =	0.70			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	3000			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	5.59	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1500 mm

1.20\*G+1.50\*Q analysed

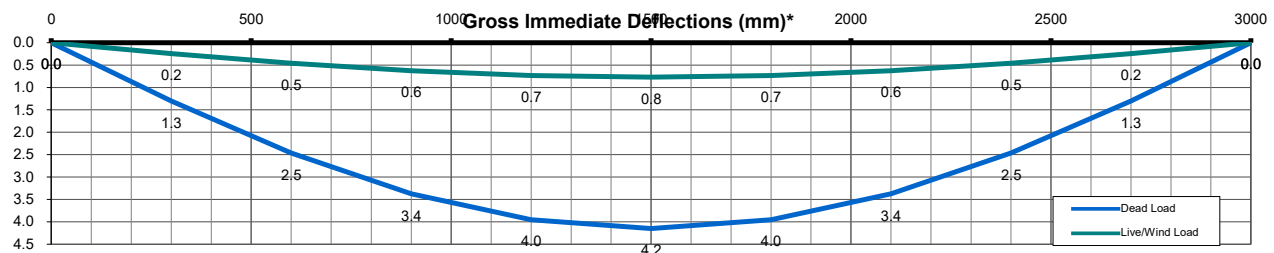
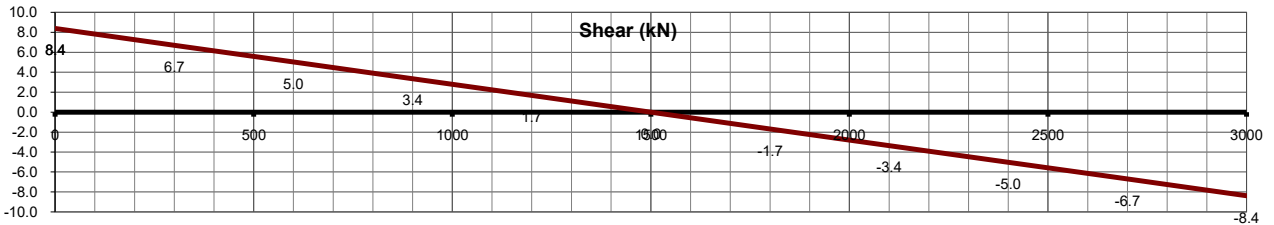
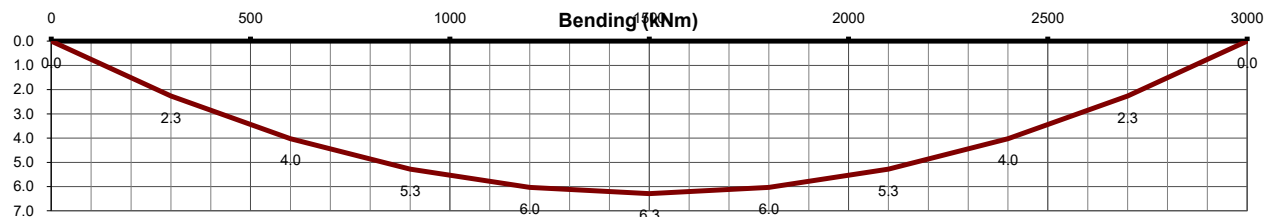
	Left	At x	Right	Max	At	Min	At	Units
Rdl	5.67		5.67					kN
Rll	1.05		1.05					kN
R*	8.38		8.38					kN
M*	0.00	6.28	0.00	6.28	1500	0.00	0	kNm
V*	8.38	0.00	-8.38	8.38	0			kN
δdl	0.00	4.15	0.00	4.15	1500	0.00	0	mm
δll	0.00	0.77	0.00	0.77	1500	0.00	0	mm
δdl+Ψs*δll	0.00	4.92	0.00	4.92	1500	0.00	0	mm

Span / 723  
3903  
610

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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3000x200x120 Concrete Sleeper 10 KPa

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (3000x200x120 Concrete Sleeper 10 KPa) 120mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N12 bottom, ku = 0.26  
 Strength: (+ve M) M\* = 6.3kNm < øMuo = 6.8kNm OK (0.92)  
 Cracking: fscr = 298MPa < Fscr = 330MPa & fscr1 = 298MPa < Fscr1 = 400MPa OK (0.74,0.90)  
 Ast.min: Ast.min = 52mm<sup>2</sup> < Ast = 226mm<sup>2</sup> (Minimum of Deemed and actual) OK (0.23)

Geometry S.Wt = 0.60 kN/m L/D ratio = 25.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 120 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m<sup>3</sup> Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 24000 mm<sup>2</sup> Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	6.3	0.0	kNm
Ms1*	0.0	5.0	0.0	kNm
Ms*	0.0	5.0	0.0	kNm
Ast req'd	0	207	0	mm <sup>2</sup>
Ast	226	226	226	mm <sup>2</sup>
Reinf't req'd	-	1.8-N12	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N12

Bar size = 12 mm  
 Bar cts/No/mm<sup>2</sup> = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 226 mm<sup>2</sup>  
 Ductility class = N (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 84 mm  
 Depth to bottom steel (ds) = 84 mm  
 D-ds = 36 mm  
 No. bars = 2.0 No.  
 Bar centres = 128 mm  
 Max bars per layer = 3  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm<sup>2</sup> = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm<sup>2</sup>  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 64 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm	Design flange (bef) = 200 mm
Tensile steel area (As) = 226 mm <sup>2</sup>	ds = 84 mm
Comp. steel area (Ac) = 0 mm <sup>2</sup>	dc = 56 mm
Ultimate Moment (Mu) = 8.6 kNm	ku = 0.257
Design capacity (øMuo) = 6.8 kNm	ø = 0.800 Table 2.2.2
	Ast.min = 52 mm <sup>2</sup>

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 298 MPa	Max. stress (Fscr) = 330 MPa	OK (0.90)
Steel stress (fscr1) = 298 MPa	Max. stress (Fscr1) = 400 MPa	OK (0.74)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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3000x200x120 Concrete Sleeper 5 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (3000x200x120 Concrete Sleeper 5 KPa 2N10): Concrete simple beam

Description =	120mm (D) x 200mm (W) beam	lx =	28.8 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	3000 mm	Ag =	24000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	3.15			Dead load (pdl) =			
Live load (wll) =	0.35			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	3000			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	4.31	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1500 mm

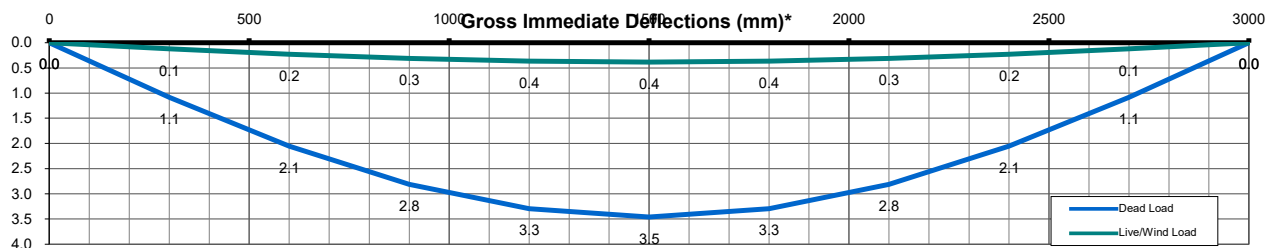
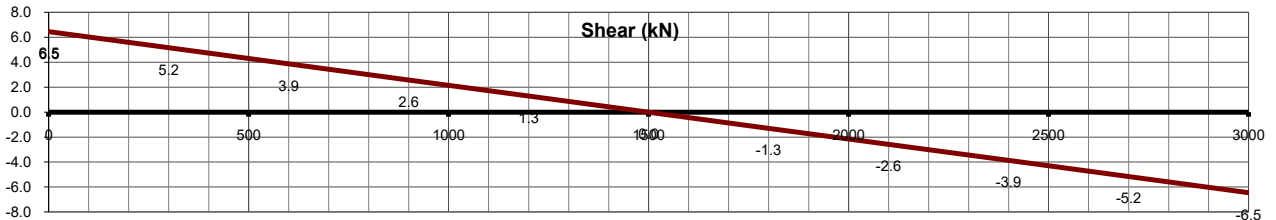
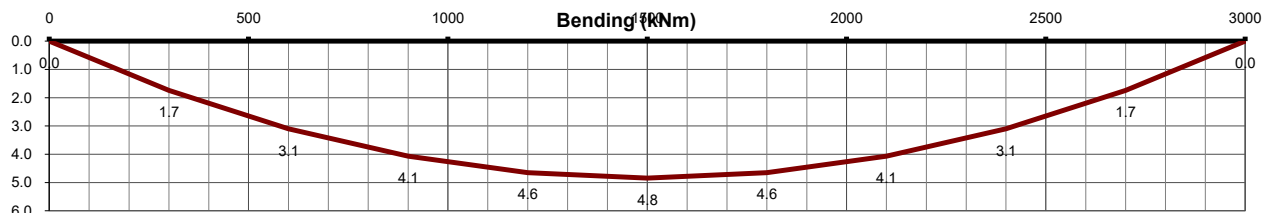
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	4.73		4.73					kN	
Rll	0.53		0.53					kN	
R*	6.46		6.46					kN	
M*	0.00	4.84	0.00	4.84	1500	0.00	0	kNm	
V*	6.46	0.00	-6.46	6.46	0			kN	Span /
δdl	0.00	3.46	0.00	3.46	1500	0.00	0	mm	867
δll	0.00	0.38	0.00	0.38	1500	0.00	0	mm	7806
δdl+Ψs*δll	0.00	3.84	0.00	3.84	1500	0.00	0	mm	781

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers
Barrason's Engineers

Page:
Project No.: 2109031
Designed: BE

3000x200x120 Concrete Sleeper 5 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (3000x200x120 Concrete Sleeper 5 KPa 2N10) 120mm (D) x 200mm (W) beam, f'c=40MPa
Reinf't: 2.0-N10 bottom, ku = 0.18
Strength: (+ve M) M\* = 4.8kNm < phiMu0 = 5.0kNm OK (0.97)
Cracking: fscr = 326MPa < Fscr = 362MPa & fscr1 = 326MPa < Fscr1 = 400MPa OK (0.81,0.90)
Ast.min: Ast.min = 51mm^2 < Ast = 157mm^2 (Minimum of Deemed and actual) OK (0.33)

Geometry S.Wt = 0.60 kN/m L/D ratio = 25.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 120 mm
Web width (W) = 200 mm, (S)lab
Flange width (Bf) = 200 mm
Flange thickness (Tf) = 0 mm



Comp.
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid
Concrete weight = 25.0 kN/m^3 Exposure top = B2 Tab 4.10.3.2
Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2
Gross area (Ag) = 24000 mm^2 Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

Table with 5 columns: Parameter, Left, Max+, Right, Units. Rows include M\*, Ms1\*, Ms\*, Ast req'd, Ast, and Reinf't req'd.

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm
Bar cts/No/mm^2 = 2 No
Yield strength (fsy) = 500 MPa
Bottom cover to ligs = 30 mm
Steel area (Ast) = 157 mm^2
Ductility class = N (N)ormal,(L)ow,(A)uto
Reinf't ductility class = N (N)ormal,(L)ow
Depth to bottom steel layer (ds.max) = 85 mm
Depth to bottom steel (ds) = 85 mm
D-ds = 35 mm
No. bars = 2.0 No.
Bar centres = 130 mm
Max bars per layer = 4
Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm
Bar cts/No/mm^2 = 0 No
Yield strength (fsy) = 500 MPa
Top cover to ligs = 50 mm
Steel area (Asc) = 0 mm^2
Ductility class = A (N)ormal,(L)ow,(A)uto
Reinf't ductility class = N (N)ormal,(L)ow
Depth to top steel layer = 56 mm
Depth to top steel = 56 mm
D-ds = 64 mm
No. bars = 0.0 No.
Bar centres = 0 mm
Max bars per layer = 1
Max bars pers 2nd layer = 0
Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm
Tensile steel area (As) = 157 mm^2 ds = 85 mm
Comp. steel area (Ac) = 0 mm^2 dc = 56 mm
Ultimate Moment (Mu) = 6.2 kNm ku = 0.176
Design capacity (phiMu0) = 5.0 kNm phi = 0.800 Table 2.2.2
Ast.min = 51 mm^2

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 326 MPa Max. stress (Fscr) = 362 MPa OK (0.90)
Steel stress (fscr1) = 326 MPa Max. stress (Fscr1) = 400 MPa OK (0.81)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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3000x200x120 Concrete Sleeper 10 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (3000x200x120 Concrete Sleeper 10 KPa 2N10): Concrete simple beam

Description =	120mm (D) x 200mm (W) beam	lx =	28.8 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	3000 mm	Ag =	24000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	2.52			Dead load (pdl) =			
Live load (wll) =	0.70			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	3000			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	4.07	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1500 mm

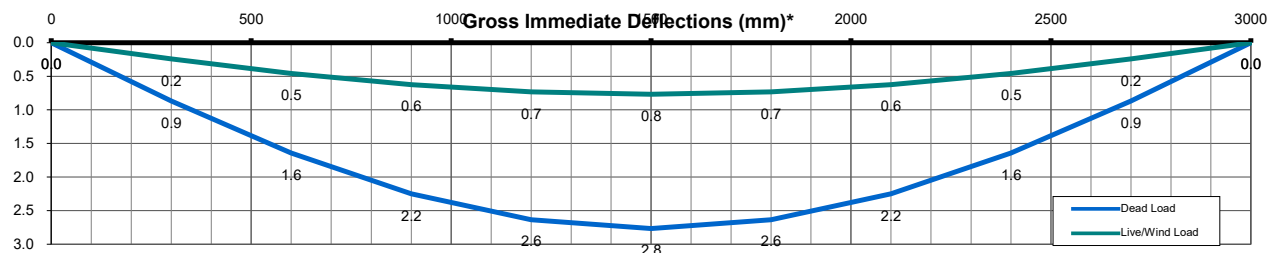
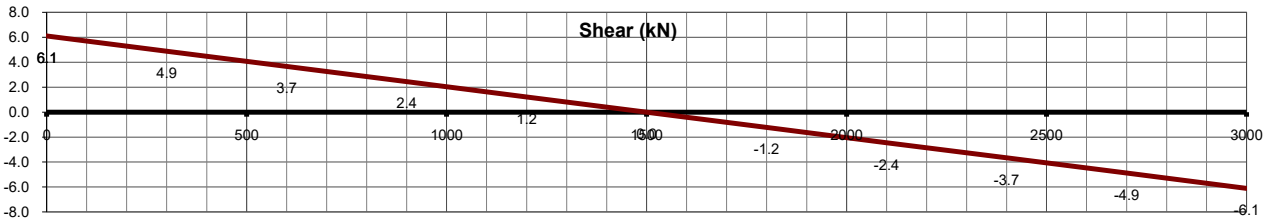
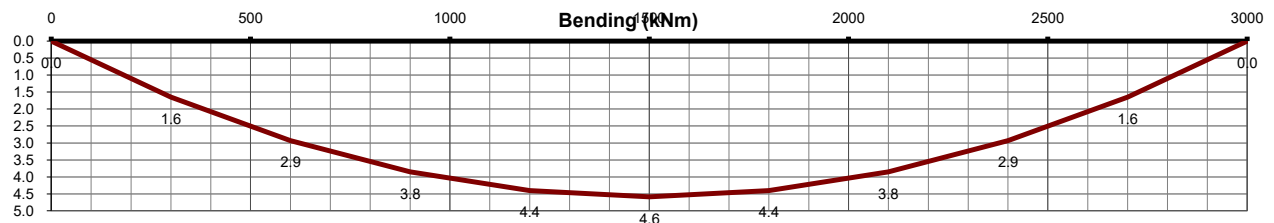
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	3.78		3.78					kN	
Rll	1.05		1.05					kN	
R*	6.11		6.11					kN	
M*	0.00	4.58	0.00	4.58	1500	0.00	0	kNm	
V*	6.11	0.00	-6.11	6.11	0			kN	Span /
δdl	0.00	2.77	0.00	2.77	1500	0.00	0	mm	1084
δll	0.00	0.77	0.00	0.77	1500	0.00	0	mm	3903
δdl+Ψs*δll	0.00	3.54	0.00	3.54	1500	0.00	0	mm	848

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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3000x200x120 Concrete Sleeper 10 KPa 2N10

CONCRETE MEMBER V5.02

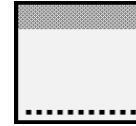
Barrasons Engineers

Section: (3000x200x120 Concrete Sleeper 10 KPa 2N10) 120mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.18  
 Strength: (+ve M) M\* = 4.6kNm < øMuo = 5.0kNm OK (0.92)  
 Cracking: fscr = 299MPa < Fscr = 362MPa & fscr1 = 299MPa < Fscr1 = 400MPa OK (0.75,0.83)  
 Ast.min: Ast.min = 51mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.33)

Geometry S.Wt = 0.60 kN/m L/D ratio = 25.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 120 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 24000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	4.6	0.0	kNm
Ms1*	0.0	3.6	0.0	kNm
Ms*	0.0	3.6	0.0	kNm
Ast req'd	0	144	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.8-N10	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to bottom steel layer (ds.max) = 85 mm  
 Depth to bottom steel (ds) = 85 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsyc) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (N)ormal,(L)ow,(A)uto  
 Reinf't ductility class = N (N)ormal,(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 64 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 157 mm² ds = 85 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 6.2 kNm ku = 0.176  
 Design capacity (øMuo) = 5.0 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 51 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 299 MPa Max. stress (Fscr) = 362 MPa OK (0.83)  
 Steel stress (fscr1) = 299 MPa Max. stress (Fscr1) = 400 MPa OK (0.75)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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3000x200x100 Concrete Sleeper 5 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (3000x200x100 Concrete Sleeper 5 KPa 2N10) 100mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.23  
 Strength: (+ve M) M\* = 3.1kNm < øMu0 = 3.7kNm OK (0.84)  
 Cracking: fscr = 276MPa < Fscr = 362MPa & fscr1 = 276MPa < Fscr1 = 400MPa OK (0.69,0.76)  
 Ast.min: Ast.min = 47mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.30)

Geometry S.Wt = 0.50 kN/m L/D ratio = 30.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 100 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard),(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes),(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 20000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual, (L)eft, Position (X) from analysis, (R)ight)

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	3.1	0.0	kNm
Ms1*	0.0	2.5	0.0	kNm
Ms*	0.0	2.5	0.0	kNm
Ast req'd	0	131	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.7-N10	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (Normal),(L)ow,(A)uto  
 Reinf't ductility class = N (Normal),(L)ow  
 Depth to bottom steel layer (ds.max) = 65 mm  
 Depth to bottom steel (ds) = 65 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal),(L)ow,(A)uto  
 Reinf't ductility class = N (Normal),(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 44 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 157 mm² ds = 65 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 4.7 kNm ku = 0.231  
 Design capacity (øMu0) = 3.7 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 47 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 276 MPa Max. stress (Fscr) = 362 MPa OK (0.76)  
 Steel stress (fscr1) = 276 MPa Max. stress (Fscr1) = 400 MPa OK (0.69)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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3000x200x100 Concrete Sleeper 5 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (3000x200x100 Concrete Sleeper 5 KPa 2N10): Concrete simple beam

Description =	100mm (D) x 200mm (W) beam	lx =	16.66666667 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	3000 mm	Ag =	20000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	1.89			Dead load (pdl) =			
Live load (wll) =	0.35			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	3000			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	2.79	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1500 mm

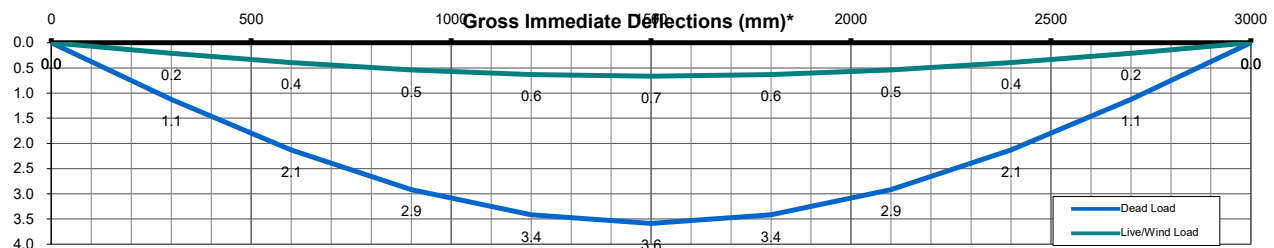
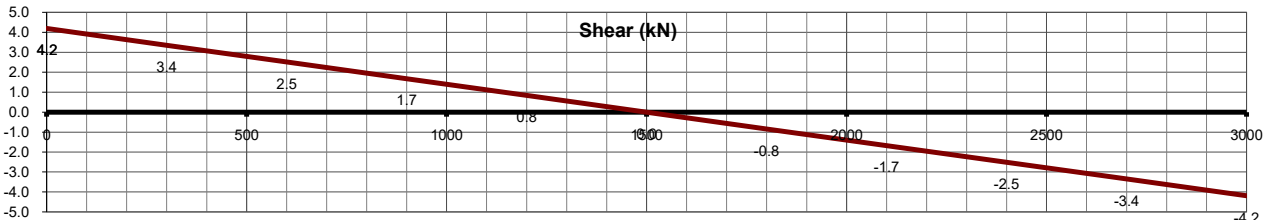
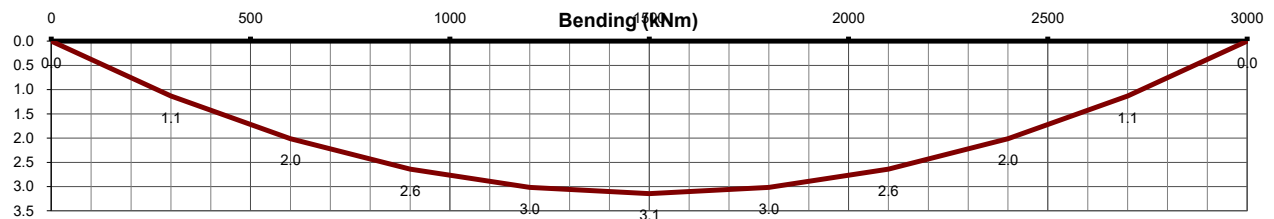
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	2.84		2.84					kN	
Rll	0.53		0.53					kN	
R*	4.19		4.19					kN	
M*	0.00	3.14	0.00	3.14	1500	0.00	0	kNm	
V*	4.19	0.00	-4.19	4.19	0			kN	Span /
δdl	0.00	3.59	0.00	3.59	1500	0.00	0	mm	837
δll	0.00	0.66	0.00	0.66	1500	0.00	0	mm	4517
δdl+Ψs*δll	0.00	4.25	0.00	4.25	1500	0.00	0	mm	706

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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3000x200x100 Concrete Sleeper 10 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (3000x200x100 Concrete Sleeper 10 KPa 2N10) 100mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.23  
 Strength: (+ve M) M\* = 3.4kNm < øMu0 = 3.7kNm OK (0.91)  
 Cracking: fscr = 288MPa < Fscr = 362MPa & fscr1 = 288MPa < Fscr1 = 400MPa OK (0.72,0.80)  
 Ast.min: Ast.min = 47mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.30)

Geometry S.Wt = 0.50 kN/m L/D ratio = 30.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 100 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard),(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes),(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 20000 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual, (L)eft, Position (X) from analysis, (R)ight)

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	3.4	0.0	kNm
Ms1*	0.0	2.6	0.0	kNm
Ms*	0.0	2.6	0.0	kNm
Ast req'd	0	143	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.8-N10	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (Normal),(L)ow,(A)uto  
 Reinf't ductility class = N (Normal),(L)ow  
 Depth to bottom steel layer (ds.max) = 65 mm  
 Depth to bottom steel (ds) = 65 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal),(L)ow,(A)uto  
 Reinf't ductility class = N (Normal),(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 44 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 157 mm² ds = 65 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 4.7 kNm ku = 0.231  
 Design capacity (øMu0) = 3.7 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 47 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 288 MPa Max. stress (Fscr) = 362 MPa OK (0.80)  
 Steel stress (fscr1) = 288 MPa Max. stress (Fscr1) = 400 MPa OK (0.72)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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3000x200x100 Concrete Sleeper 10 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (3000x200x100 Concrete Sleeper 10 KPa 2N10): Concrete simple beam

Description =	100mm (D) x 200mm (W) beam	lx =	16.66666667 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	3000 mm	Ag =	20000 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	1.64			Dead load (pdl) =			
Live load (wll) =	0.70			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	3000			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	3.02	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1500 mm

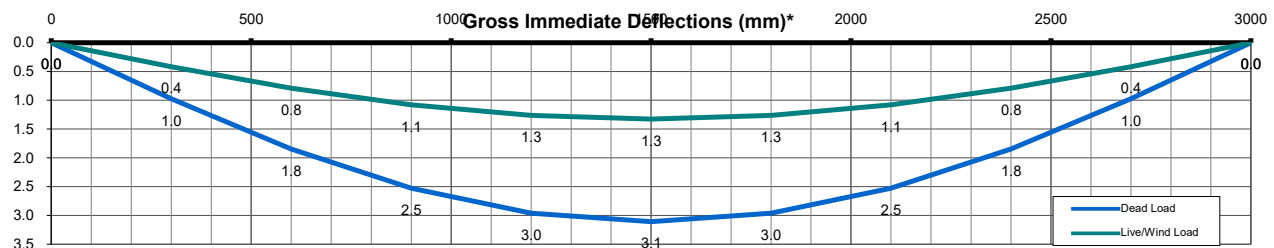
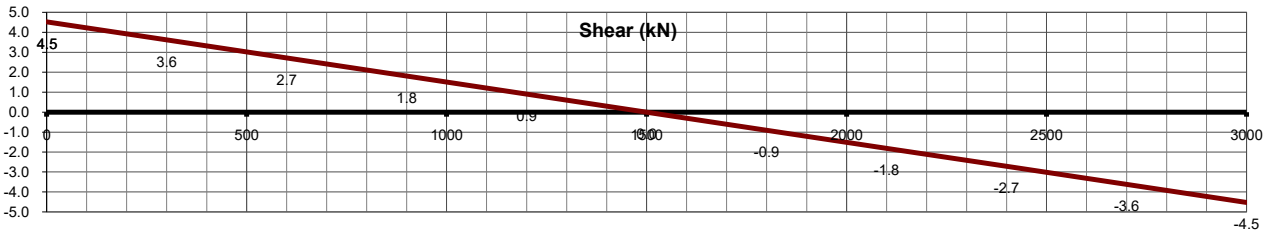
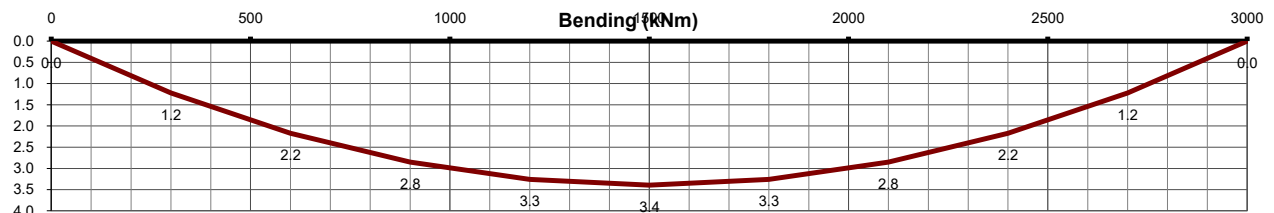
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	2.46		2.46					kN	
Rll	1.05		1.05					kN	
R*	4.52		4.52					kN	
M*	0.00	3.39	0.00	3.39	1500	0.00	0	kNm	
V*	4.52	0.00	-4.52	4.52	0			kN	Span /
δdl	0.00	3.11	0.00	3.11	1500	0.00	0	mm	965
δll	0.00	1.33	0.00	1.33	1500	0.00	0	mm	2259
δdl+Ψs*δll	0.00	4.44	0.00	4.44	1500	0.00	0	mm	676

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

Page:  
Project No.: 2109031  
Designed: BE

3000x200x80 Concrete Sleeper 5 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (3000x200x80 Concrete Sleeper 5 KPa 2N10): Concrete simple beam

Description =	77mm (D) x 200mm (W) beam	lx =	7.608883333 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	3000 mm	Ag =	15400 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	0.63			Dead load (pdl) =			
Live load (wll) =	0.35			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	3000			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	1.28	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1500 mm

**1.20\*G+1.50\*Q analysed**

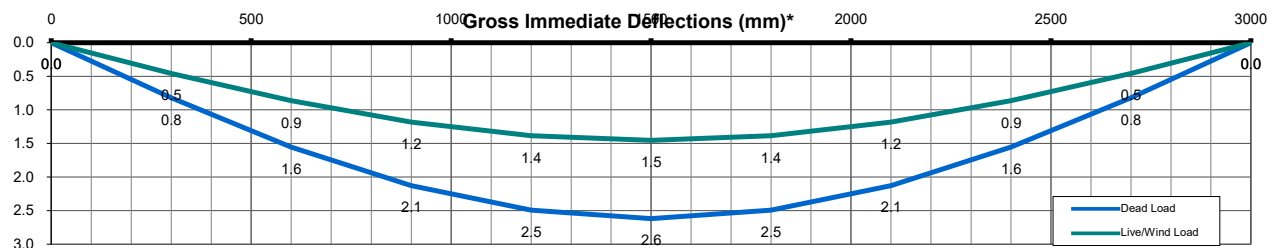
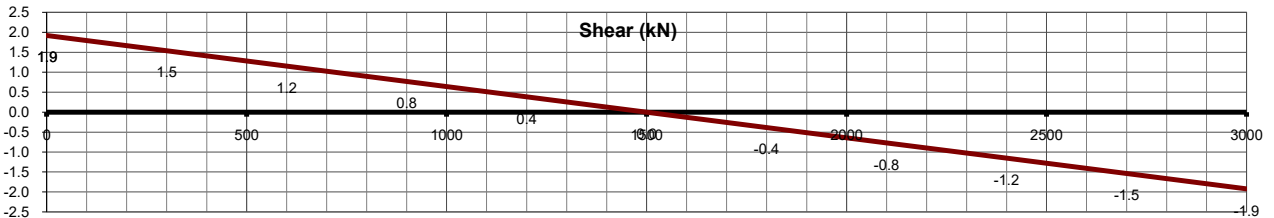
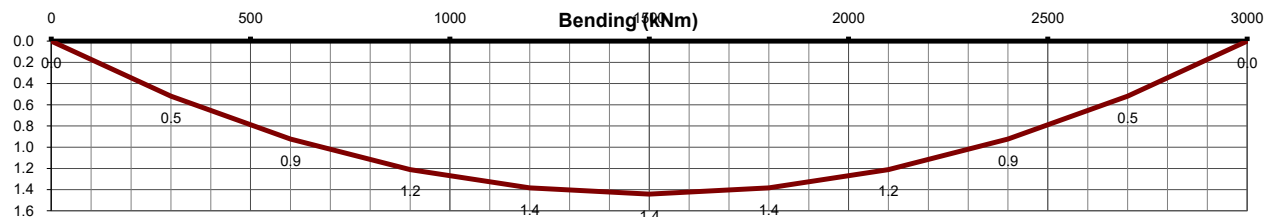
	Left	At x	Right	Max	At	Min	At	Units
Rdl	0.95		0.95					kN
Rll	0.53		0.53					kN
R*	1.92		1.92					kN
M*	0.00	1.44	0.00	1.44	1500	0.00	0	kNm
V*	1.92	0.00	-1.92	1.92	0			kN
δdl	0.00	2.62	0.00	2.62	1500	0.00	0	mm
δll	0.00	1.45	0.00	1.45	1500	0.00	0	mm
δdl+Ψs*δll	0.00	4.07	0.00	4.07	1500	0.00	0	mm

Span / 1146  
2062  
737

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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Concrete Sleeper Retaining Wall

Sunset Sleepers
Barrason's Engineers

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Project No.: 2109031
Designed: BE

3000x200x80 Concrete Sleeper 5 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (3000x200x80 Concrete Sleeper 5 KPa 2N10) 77mm (D) x 200mm (W) beam, f'c=40MPa
Reinf't: 2.0-N10 bottom, ku = 0.36
Strength: (+ve M) M\* = 1.4kNm < øMu0 = 2.3kNm OK (0.63)
Cracking: fscr = 191MPa < Fscr = 362MPa & fscr1 = 191MPa < Fscr1 = 400MPa OK (0.48,0.53)
Ast.min: Ast.min = 43mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.27)

Geometry S.Wt = 0.39 kN/m L/D ratio = 39.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 77 mm
Web width (W) = 200 mm, (S)lab
Flange width (Bf) = 200 mm
Flange thickness (Tf) = 0 mm



Comp.
Tension

Side cover = 30 mm Formwork = S (S)tandard,(R)igid
Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2
Fully enclosed = N (Y)es,(N)o Exposure bottom = B1 Tab 4.10.3.2
Gross area (Ag) = 15400 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (M)annual, (L)eft, Position (X) from analysis, (R)ight

Refer to the analysis output

Table with 5 columns: Parameter, Left, Max+, Right, Units. Rows include M\*, Ms1\*, Ms\*, Ast req'd, Ast, and Reinf't req'd.

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm
Bar cts/No/mm² = 2 No
Yield strength (fsy) = 500 MPa
Bottom cover to ligs = 30 mm
Steel area (Ast) = 157 mm²
Ductility class = N (N)ormal,(L)ow,(A)uto
Reinf't ductility class = N (N)ormal,(L)ow
Depth to bottom steel layer (ds.max) = 42 mm
Depth to bottom steel (ds) = 42 mm
D-ds = 35 mm
No. bars = 2.0 No.
Bar centres = 130 mm
Max bars per layer = 4
Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm
Bar cts/No/mm² = 0 No
Yield strength (fsy) = 500 MPa
Top cover to ligs = 50 mm
Steel area (Asc) = 0 mm²
Ductility class = A (N)ormal,(L)ow,(A)uto
Reinf't ductility class = N (N)ormal,(L)ow
Depth to top steel layer = 56 mm
Depth to top steel = 56 mm
D-ds = 21 mm
No. bars = 0.0 No.
Bar centres = 0 mm
Max bars per layer = 1
Max bars pers 2nd layer = 0
Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm
Tensile steel area (As) = 157 mm² ds = 42 mm
Comp. steel area (Ac) = 0 mm² dc = 56 mm
Ultimate Moment (Mu) = 2.8 kNm ku = 0.357
Design capacity (øMu0) = 2.3 kNm ø = 0.800 Table 2.2.2
Ast.min = 43 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 191 MPa Max. stress (Fscr) = 362 MPa OK (0.53)
Steel stress (fscr1) = 191 MPa Max. stress (Fscr1) = 400 MPa OK (0.48)



Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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3000x200x80 Concrete Sleeper 10 KPa 2N10

CONCRETE MEMBER V5.02

Barrasons Engineers

Section: (3000x200x80 Concrete Sleeper 10 KPa 2N10) 77mm (D) x 200mm (W) beam, f'c=40MPa  
 Reinf't: 2.0-N10 bottom, ku = 0.36  
 Strength: (+ve M) M\* = 1.5kNm < øMuo = 2.3kNm OK (0.67)  
 Cracking: fscr = 185MPa < Fscr = 362MPa & fscr1 = 185MPa < Fscr1 = 400MPa OK (0.46,0.51)  
 Ast.min: Ast.min = 43mm² < Ast = 157mm² (Minimum of Deemed and actual) OK (0.27)

Geometry S.Wt = 0.39 kN/m L/D ratio = 39.0

Concrete strength (f'c) = 40 MPa

Depth (D) = 77 mm  
 Web width (W) = 200 mm, (S)lab  
 Flange width (Bf) = 200 mm  
 Flange thickness (Tf) = 0 mm



Comp.  
Tension

Side cover = 30 mm Formwork = S (Standard),(R)igid  
 Concrete weight = 25.0 kN/m³ Exposure top = B2 Tab 4.10.3.2  
 Fully enclosed = N (Yes),(N)o Exposure bottom = B1 Tab 4.10.3.2  
 Gross area (Ag) = 15400 mm² Side = B1 Tab 4.10.3.2

Analysis: simple beam at midspan (Max +ve M)

Analysis values = X (Manual, (L)eft, Position (X) from analysis, (R)ight)

Refer to the analysis output

	Left	Max+	Right	Units
M*	0.0	1.5	0.0	kNm
Ms1*	0.0	1.1	0.0	kNm
Ms*	0.0	1.1	0.0	kNm
Ast req'd	0	100	0	mm²
Ast	157	157	157	mm²
Reinf't req'd	-	1.3-N10	-	

Reinforcement

Ligs = No ligs

Bottom steel = 2.0-N10

Bar size = 10 mm  
 Bar cts/No/mm² = 2 No  
 Yield strength (fsy) = 500 MPa  
 Bottom cover to ligs = 30 mm  
 Steel area (Ast) = 157 mm²  
 Ductility class = N (Normal),(L)ow,(A)uto  
 Reinf't ductility class = N (Normal),(L)ow  
 Depth to bottom steel layer (ds.max) = 42 mm  
 Depth to bottom steel (ds) = 42 mm  
 D-ds = 35 mm  
 No. bars = 2.0 No.  
 Bar centres = 130 mm  
 Max bars per layer = 4  
 Layers required = 1

Top steel = 0.0-N12

Bar size = 12 mm  
 Bar cts/No/mm² = 0 No  
 Yield strength (fsy) = 500 MPa  
 Top cover to ligs = 50 mm  
 Steel area (Asc) = 0 mm²  
 Ductility class = A (Normal),(L)ow,(A)uto  
 Reinf't ductility class = N (Normal),(L)ow  
 Depth to top steel layer = 56 mm  
 Depth to top steel = 56 mm  
 D-ds = 21 mm  
 No. bars = 0.0 No.  
 Bar centres = 0 mm  
 Max bars per layer = 1  
 Max bars pers 2nd layer = 0  
 Layers required = 0

Strength in +ve bending at midspan (Max +ve M) for beams - Cl 8.1

Design width (W) = 200 mm Design flange (bef) = 200 mm  
 Tensile steel area (As) = 157 mm² ds = 42 mm  
 Comp. steel area (Ac) = 0 mm² dc = 56 mm  
 Ultimate Moment (Mu) = 2.8 kNm ku = 0.357  
 Design capacity (øMuo) = 2.3 kNm ø = 0.800 Table 2.2.2  
 Ast.min = 43 mm²

Crack control in +ve bending at midspan (Max +ve M) for beams - Cl 8.6

Steel stress (fscr) = 185 MPa Max. stress (Fscr) = 362 MPa OK (0.51)  
 Steel stress (fscr1) = 185 MPa Max. stress (Fscr1) = 400 MPa OK (0.46)





Concrete Sleeper Retaining Wall

Sunset Sleepers  
Barrason's Engineers

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Designed: BE

3000x200x80 Concrete Sleeper 10 KPa 2N10

ANALYSIS V5.02

Barrasons Engineers

Geometry for (3000x200x80 Concrete Sleeper 10 KPa 2N10): Concrete simple beam

Description =	77mm (D) x 200mm (W) beam	lx =	7.60888333 x10 <sup>6</sup> mm <sup>4</sup>
Span (L) =	3000 mm	Ag =	15400 mm <sup>2</sup>
Span type =	S (S)imple,(E)xt,(I)nt,(C)ant,(P)rop,(F)ixed,(O)ther	Density =	25 kN/m <sup>3</sup>
Material type =	C (T)imber,(S)teel,(C)onc.,(SC)comp. steel,(O)ther	E =	33351 MPa

Loading

Uniform loads (kN/m)				Point loads (kN)			
Uniform loads	UDL	Partial 1	Partial 2	Point loads	PL 1	PL 2	PL 3
Dead load (wdl) =	0.25			Dead load (pdl) =			
Live load (wll) =	0.70			Live load (pll) =			
Start from LHS (mm) =	0			Pos. from LHS (mm) =			
End from LHS (mm) =	3000			Ultimate load (p*) =	0.00	0.00	0.00
S.Wt =	0.00	kN/m		Include S.Wt =	N (Y)es,(N)o		
Ultimate load (w*) =	1.35	0.00	0.00	Strength loadcase =	C (D)ead Only,(C)omb.		
Live Load type =	Permanent (Concrete)						
Short term LL (Ψsu) =	1.00	(Ψsp) =	1.00				
Long term LL (Ψlu) =	1.00	(Ψlp) =	1.00				
Actual LL (Ψsa) =	1.00	(Ψla) =	1.00				

Results at midspan (Max +ve M)

Position of result (x) = 1500 mm

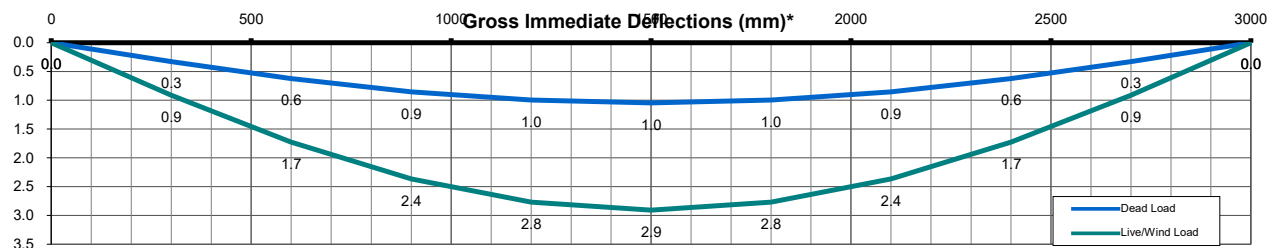
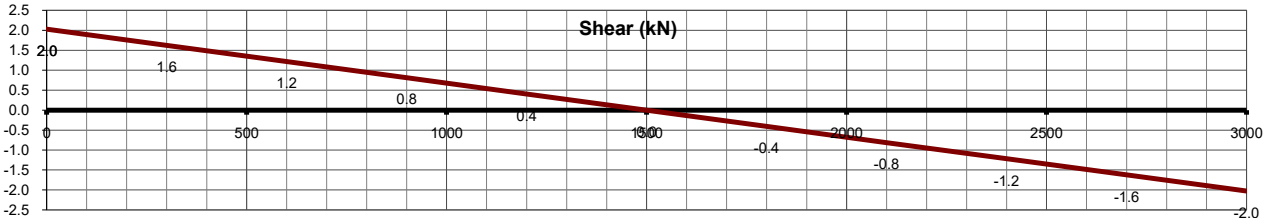
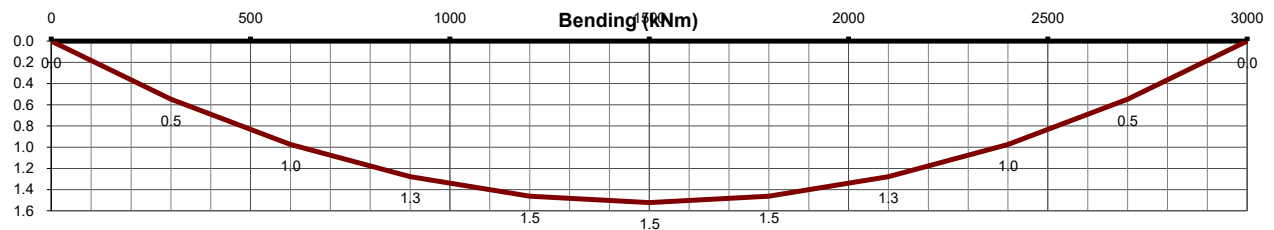
1.20\*G+1.50\*Q analysed

	Left	At x	Right	Max	At	Min	At	Units	
Rdl	0.38		0.38					kN	
Rll	1.05		1.05					kN	
R*	2.03		2.03					kN	
M*	0.00	1.52	0.00	1.52	1500	0.00	0	kNm	
V*	2.03	0.00	-2.03	2.03	0			kN	Span /
δdl	0.00	1.05	0.00	1.05	1500	0.00	0	mm	2864
δll	0.00	2.91	0.00	2.91	1500	0.00	0	mm	1031
δdl+Ψs*δll	0.00	3.96	0.00	3.96	1500	0.00	0	mm	758

δPlI/δTot.II = 0.00

Graphs

\* Deflections are Gross Ig immediate - assessment of long term effects to be considered



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