Project: Sample Project
Problem: Hollowcore Slab

SUMMARY REPORT

Design Code Used: CSA A23.3-19

NON-DEFAULT OPTION SETTINGS

** ON ** P1: Vary user defined losses along beam
** OFF ** F8: Use a rectangular stress block at concrete ultimate strain
** ON ** S10: Use the ultimate section capacity for horizontal shear (moment region check)
** OFF ** D3: Have Concise Beam calculate long-term deflection multipliers for prestressed Beams

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CONCRETE MATERIAL PROPERTIES

	Precast Beam
Concrete Density, Wt	2400 kg/m^3
Compressive Strength, f'c	42.0 MPa
Flexural Modulus of Rupture, fr	3.89 MPa
Modulus of Elasticity, Ec	30151 MPa
Strength at Transfer, f'c	24.0 MPa
Modulus of Rupture at Transfer, fr	2.94 MPa
Modulus of Elast. at Transfer, Ec	24587 MPa
Strength at Initial Lifting, f'c	24.0 MPa
Modulus of Rupture at Lifting, fr	2.94 MPa
Modulus of Elast. at Lifting, Ec	24587 MPa

PRECAST CONCRETE MIX, SCHEDULE, AND SERVICE ENVIRONMENT
(schedule from time of casting precast beam at 0 days)

Cement Content	410 kg/m^3	Age at Transfer	0.75 days
Air Content	5.00 %	Age at Erection	40 days
Slump	0.0 mm	Age at Cast-in-Place Pour	50 days
Aggregate Mix	0.40 fines/total	Age Cast-in-Place is Composite	53 days
Aggregate Size	12.0 mm	Age Construction is Complete	143 days
Basic Shrinkage Strain	0.000780 mm/mm		
Curing Method	Moist	Relative Humidity in Service	70 %
Concrete Hydration Rate	Normal	Ambient Temperature in Service	20 deg
		Exposure in Service	Inter

PRECAST BEAM LAYOUT

Seg. No.	Segment Length From (m)	To (m)	Length (m)	Section Identification Folder Name	Section Name	Section Type	Offset Lateral (mm)	Offset Vertical (mm)
1	0.000	10.000	10.000	Ultra-Span	1048	Hollowcore	0.0	0.0

Beam is part of a slab.

Span Length at Transfer = 10.000 m,   Centre of Supports, Left @   0.000 m,   Right @ 10.000 m
Span Length during Lift = 10.000 m,   Centre of Supports, Left @   0.000 m,   Right @ 10.000 m
 Span Length in Service =   9.950 m,   Centre of Supports, Left @   0.025 m,   Right @   9.975 m
      Total Beam Length = 10.000 m,   Bearing Length, Left =   50.0 mm,   Right =   50.0 mm

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GROSS PRECAST SECTION PROPERTIES (NON-COMPOSITE)
(based on Ec of the precast beam - transformed area of rebar and strand NOT included)

Seg. No.	Section Properties A (mm^2)	I (mm^4)	yb (mm)	Section Height (mm)	Section Width (mm)	Shear Width (mm)	Volume / Surface (mm)	Section Moduli Sb (mm^3)	St (mm^3)
1	167167	1.342E+9	127.0	254.0	1219.2	267.0	55.63	-10.564E+6	10.564E+6

UNCRACKED SECTION PROPERTIES SUMMARY

x (m)	Net Precast Section at Transfer (based on Eci) (include rebar,deduct strand) A (mm^2)	I (mm^4)	yb (mm)	Transformed Precast Section at Transfer (based on Eci) (include rebar and strand) A (mm^2)	I (mm^4)	yb (mm)	Transformed Precast Section at 28 Days (based on Ec) (include rebar and strand) A (mm^2)	I (mm^4)	yb (mm)
0.000	166268	1.338E+9	127.3	167173	1.342E+9	127.0	167172	1.342E+9	127.0
0.025	166268	1.339E+9	127.3	167428	1.343E+9	126.9	167373	1.343E+9	126.9
0.300	166268	1.337E+9	127.3	170302	1.363E+9	126.0	169643	1.358E+9	126.2
1.219	166268	1.336E+9	127.3	173582	1.384E+9	124.7	172232	1.375E+9	125.2
2.214	166268	1.336E+9	127.3	173582	1.384E+9	124.7	172232	1.375E+9	125.2
3.209	166268	1.336E+9	127.3	173582	1.384E+9	124.7	172232	1.375E+9	125.2
4.204	166268	1.336E+9	127.3	173582	1.384E+9	124.7	172232	1.375E+9	125.2
5.000	166268	1.336E+9	127.3	173582	1.384E+9	124.7	172232	1.375E+9	125.2
5.199	166268	1.336E+9	127.3	173582	1.384E+9	124.7	172232	1.375E+9	125.2
5.796	166268	1.336E+9	127.3	173582	1.384E+9	124.7	172232	1.375E+9	125.2
6.791	166268	1.336E+9	127.3	173582	1.384E+9	124.7	172232	1.375E+9	125.2
7.786	166268	1.336E+9	127.3	173582	1.384E+9	124.7	172232	1.375E+9	125.2
8.781	166268	1.336E+9	127.3	173582	1.384E+9	124.7	172232	1.375E+9	125.2
9.700	166268	1.337E+9	127.3	170302	1.363E+9	126.0	169643	1.358E+9	126.2
9.975	166268	1.339E+9	127.3	167428	1.343E+9	126.9	167373	1.343E+9	126.9
10.000	166268	1.338E+9	127.3	167173	1.342E+9	127.0	167172	1.342E+9	127.0

These section properties can used to calculate uncracked concrete stresses using the following guidelines.
- Net Precast Section at Transfer properties are used with the initial prestress after transfer (after elastic shortening loss).
- Transformed Precast Section at Transfer properties are used with the precast beam self-weight.

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- Transformed Precast Section at 28 Days properties are used with external loads applied to the non-composite precast beam.

PRESTRESSING STEEL TENDONS

ID	Qty	Grade MPa	Type *	Strand Size	Offsets ** X m	Offsets ** Y mm	End Offset & Type *** Left m		End Offset & Type *** Right m		Tendon Area mm^2	Jacking Force Pj kN	Jacking Force %fpu
1	8.000	1860	LRS	13 (1/2")	0.000	45.0	0.000	B	0.000	B	789.60	1028.06	0.70
					10.000	45.0							
2	2.000	1860	LRS	09 (3/8")	0.000	210.0	0.000	B	0.000	B	109.60	142.70	0.70
					10.000	210.0							

* Low-Relaxation Strand (LRS), Stress-Relieved Strand (SRS), Plain Bar (PB), Deformed Bar (DB), Single Wire (SW)
** X = distance from left end of beam, Y = height of strand center from casting bedFully Bonded (B), Debonded (D), Cut (C), Full Developed (F)
*** Fully Bonded (B), Debonded (D), Cut (C), Full Developed (F)
See the "Development Length" text report for details of the strand transfer and development lengths

Prestress Loss Method Used : ACI 209 Detailed Method (CPCI)
Calculated Losses: Initial = 5.4%, Final = 18.2%
Maximum Total Prestress Forces: Pj(jacking) = 1170.76 kN,
Pi(transfer) = 1108.00 kN,
Pe(effective) = 957.48 kN @ x = 5.000 m,

HOLLOWCORE CONCRETE CORE FILL

Core *	Fill Ranges
0	Filled from 0.000 to 0.300 m & 9.700 to 10.000 m
1	Filled from 0.000 to 0.300 m & 9.700 to 10.000 m
2	Filled from 0.000 to 0.300 m & 9.700 to 10.000 m
3	Filled from 0.000 to 0.300 m & 9.700 to 10.000 m
4	Filled from 0.000 to 0.300 m & 9.700 to 10.000 m

* Numbered left to right
- Fill Shear Strength Method: CTA TB 85B1 (Anderson)(shear strength of precast and composite section as per code)
- Strength Equation: Vcore = Φ·C·1/6·sqrt(f'c)·Acore, where C = 1.00
- Compressive Strength of Concrete Fill, f'c = 20.7 MPa

APPLIED LOADS

Load Group & Type	Stages Applied & Distribution	Load Details ** (left to right)
* Beam Weight D: DL, Factory Produced	Transfer to Final Service No Load Distribution	Segment #0: [V] 3.934 kN/m full length
* Filled Cores D: DL, Factory Produced	Transfer to Final Service No Load Distribution	Core Fill, 0 to 0.3 m: [V] 3.316 kN/m x= 0 to 0.3 m Core Fill, 9.7 to 10 m: [V] 3.316 kN/m x= 9.7 to 10 m
DL D: DL, General	Completion to Final Service No Load Distribution	SDL: [V] 1.2 kN/m^2 full length, 1.219 m wide
LL L: LL, General	Final Service stage only No Load Distribution	LL: [V] 4.8 kN/m^2 full length, 1.219 m wide

* indicates load groups generated automatically by Concise Beam.
** [V] Vertical Load, [M] Moment, [T] Torsion.

LOAD COMBINATIONS

Serviceability (SLS) & Fatigue (FLS) Limit State Combinations (used individually)
 SLS Stress : 1.00P + 1.00D + 1.00D1 + 1.00T + 1.00L + 1.00L1 + 1.00L2 + 1.00C + 1.00S + 1.00W
 SLS Deflect : 1.00P + 1.00D + 1.00D1 + 1.00T + 1.00L + 1.00L1 + 1.00L2 + 1.00C + 1.00S
 FLS Fatigue : 1.00P + 1.00D + 1.00D1 + 1.00L + 1.00C

Ultimate (Strength) Limit State (ULS) Combinations (searched collectively to obtain envelope)
  1: ULS Combo 1 : 1.40D + 1.40D1 + 1.25T
  2: ULS Combo 2 : 1.25D + 1.50D1 + 1.25T + 1.50L + 1.50L1 + 1.25L2 + 1.00C + 1.00S
  3: ULS Combo 3 : 1.25D + 1.50D1 + 1.25T + 1.50L + 1.50L1 + 1.25L2 + 1.00C + 0.40W
  4: ULS Combo 4 : 1.25D + 1.50D1 + 1.25T + 1.00L + 1.00L1 + 1.00L2 + 1.50C + 1.00S
  5: ULS Combo 5 : 1.25D + 1.50D1 + 1.25T + 1.00L + 1.00L1 + 1.00L2 + 1.50C + 0.40W
  6: ULS Combo 6 : 1.25D + 1.50D1 + 1.25T + 1.00L + 1.50L1 + 0.50L2 + 1.00C + 1.50S
  7: ULS Combo 7 : 1.25D + 1.50D1 + 1.25T + 1.50S + 0.40W
  8: ULS Combo 8 : 1.25D + 1.50D1 + 1.25T + 0.50L + 1.00L1 + 0.50L2 + 1.00C + 1.40W
  9: ULS Combo 9 : 1.25D + 1.50D1 + 1.25T + 0.50S + 1.40W
 10: ULS Combo 10 : 1.00D + 1.00D1 + 0.50L + 1.00L1 + 0.50L2 + 1.00C + 0.25S + 1.00E
 11: ULS Combo 11 : 0.90D + 0.90D1 + 1.50L + 1.50L1 + 1.25L2 + 0.50S
 12: ULS Combo 12 : 0.90D + 0.90D1 + 1.40W

COMBINED ANALYSIS IN SERVICE - LOAD COMBINATION RESULTS
(external loads only)

Station	SLS (stress) Load Combination Moment	ULS Load Envelopes Moment	Shear	Moment

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x	Sustained	Total Load t.m		Total Load kN		Govern. Combo.		Total Load t.m		Govern. Combo.	
m	t.m	min	max	min	max	min	max	min	max	min	max
0.000	0.00	0.00	0.00	0.00	0.00	1	1	0.00	0.00	1	1
0.025	0.00	0.00	0.00	-0.49	-0.20	2	11	0.00	0.00	2	11
0.025	0.00	0.00	0.00	24.99	78.38	11	2	0.00	0.00	2	11
0.300	0.74	0.74	1.54	22.83	72.97	11	2	0.67	2.12	11	2
1.219	2.89	2.89	6.01	18.37	58.70	11	2	2.60	8.29	11	2
2.214	4.69	4.69	9.76	13.53	43.25	11	2	4.22	13.46	11	2
3.209	5.94	5.94	12.37	8.70	27.80	11	2	5.35	17.07	11	2
4.204	6.65	6.65	13.84	3.87	12.36	11	2	5.98	19.10	11	2
5.000	6.82	6.82	14.21	0.00	0.00	11	1	6.14	19.61	11	2
5.199	6.81	6.81	14.19	-3.09	-0.97	2	11	6.13	19.58	11	2
5.796	6.65	6.65	13.84	-12.36	-3.87	2	11	5.98	19.10	11	2
6.791	5.94	5.94	12.37	-27.80	-8.70	2	11	5.35	17.07	11	2
7.786	4.69	4.69	9.76	-43.25	-13.53	2	11	4.22	13.46	11	2
8.781	2.89	2.89	6.01	-58.70	-18.37	2	11	2.60	8.29	11	2
9.700	0.74	0.74	1.54	-72.97	-22.83	2	11	0.67	2.12	11	2
9.975	0.00	0.00	0.00	-78.38	-24.99	2	11	0.00	0.00	2	11
9.975	0.00	0.00	0.00	0.20	0.49	11	2	0.00	0.00	2	11
10.000	0.00	0.00	0.00	0.00	0.00	1	1	0.00	0.00	1	1

SUPPORT REACTIONS DURING HANDLING
(+ve = upwards, counter-clockwise)

Load Group or Envelope	Initial Lifting Left Vertical kN	Initial Lifting Right Vertical kN	Erection Lifting Left Vertical kN	Erection Lifting Right Vertical kN
Unfactored Load Group Effects				
Beam Weight [D]	19.67	19.67	19.67	19.67
Filled Cores [D]	0.99	0.99	0.99	0.99
Load Envelope Effects				
SLS Minimum	20.67	20.67	20.67	20.67
SLS Maximum	20.67	20.67	20.67	20.67

REACTIONS ON FINAL SUPPORTS
(+ve = upwards, counter-clockwise)

Load Group or Envelope	During CIP Pour Left Vertical kN	During CIP Pour Right Vertical kN	In Service Left Vertical[*] kN	In Service Left Torsion[*] t.m	In Service Right Vertical[*] kN	In Service Right Torsion[*] t.m
Unfactored Load Group Effects						
Beam Weight [D]	19.67	19.67	19.67	0.00	19.67	0.00
Filled Cores [D]	0.99	0.99	0.99	0.00	0.99	0.00
DL [D]			7.32	0.00	7.32	0.00
LL [L]			29.26	0.00	29.26	0.00
Load Envelope Effects						
SLS DL			27.98	0.00	27.98	0.00
SLS Sustain			27.98	0.00	27.98	0.00
SLS Minimum	20.67	20.67	27.98	0.00	27.98	0.00
SLS Maximum	20.67	20.67	57.24	0.00	57.24	0.00
ULS Minimum			25.18 [11]	0.00 [1]	25.18 [11]	0.00 [1]
ULS Maximum			78.87 [2]	0.00 [1]	78.87 [2]	0.00 [1]

* Governing ULS Load Combination (below)

UNCRACKED CONCRETE STRESS RESULTS
(+ve = compression, -ve = tension)

Location	x m	Stress MPa	Limit * MPa	Overstress Notice	Longitudinal Tensile Rebar (mm^2) ** Required	Provided	Additional
STRESSES AT TRANSFER							
Critical Compression							
Top of Beam	5.000	4.76	14.40	0%			
Bottom of Beam	8.781	11.15	14.40	0%			
Critical Tension							
Top of Beam	0.000	0.00	-2.45	0%			
Bottom of Beam	0.000	0.01	-2.45	0%			
STRESSES DURING INITIAL LIFTING							
Critical Compression							
Top of Beam	5.000	4.76	14.40	0%			
Bottom of Beam	8.781	11.15	14.40	0%			
Critical Tension							
Top of Beam	0.000	0.00	-2.45	0%			
Bottom of Beam	0.000	0.01	-2.45	0%			
STRESSES DURING ERECTION LIFTING							
Critical Compression							
Top of Beam	5.000	4.76	25.20	0%			
Bottom of Beam	8.781	10.11	25.20	0%			
Critical Tension							
Top of Beam	0.000	0.00	-3.24	0%			
Bottom of Beam	0.000	0.01	-3.24	0%			
STRESSES IN SERVICE							
Critical Compression							

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Top of Beam	5.000	13.18	25.20	0%	
Bottom of Beam	0.622	8.01	25.20	0%	
Critical Tension					
Top of Beam	0.000	0.00	-3.24	0%	Not cracked
Bottom of Beam	5.000	-1.23	-3.24	0%	Not cracked
STRESSES IN SERVICE (SUSTAINED LOADS ONLY)					
Critical Compression					
Top of Beam	5.000	6.40	18.90	0%	
Bottom of Beam	0.622	9.50	18.90	0%	

* Tensile stress limit in service for the precast beam is for a non-corrosive environment. For a corrosive environment halve the limit. Beyond this limit crack control is required.
** See the detailed Uncracked Stress reports for full extent of tensile reinforcing required to control cracking during transfer and handling.

	At Transfer	During Lifting	In Service
Modulus of Rupture, fr =	-2.94 MPa	-2.94 MPa	-3.89 MPa

Strength Required for Transfer, f'ci = 18.6 MPa (f'c specified = 24.0 MPa)
Strength Required for Initial Lifting, f'c = 18.6 MPa (f'c assumed = 24.0 MPa)

Beam not cracked, cracking controlled, or crack depth less than concrete cover.

DEFLECTION ESTIMATE AT ALL STAGES

	Net Deflection					Change in Deflection		Span/Deflection Ratio		
Location x m Column	Net @ Transfer mm A	Net @ Erection mm B	Net @ Completion mm C	Net Sust. @ Final mm D	Net Total @ Final mm E	Sustained Growth+LL mm E - C	LL alone mm E - D	Net Total Deflection L/E *	Sustained Growth+LL L/(E-C) *	LL alone L/(E-D)
0.000	0.0	-0.2	-0.2	-0.2	0.0	0.2	0.1	304	231	345
0.025	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
0.300	1.5	2.4	2.6	1.8	0.2	-2.4	-1.6	5602	4188	6258
1.219	5.2	9.0	9.7	6.3	-0.5	-10.2	-6.7	1589	980	1479
2.214	8.0	13.8	14.6	8.5	-3.1	-17.7	-11.6	1174	563	859
3.209	9.7	16.8	17.3	9.2	-6.1	-23.5	-15.3	1086	424	651
4.204	10.6	18.3	18.7	9.2	-8.2	-26.9	-17.4	1077	369	570
5.000	10.8	18.6	19.0	9.2	-8.8	-27.8	-18.0	1079	358	552
5.199	10.8	18.6	19.0	9.2	-8.7	-27.7	-18.0	1079	358	553
5.796	10.6	18.3	18.7	9.2	-8.2	-26.9	-17.4	1077	369	570
6.791	9.7	16.8	17.3	9.2	-6.1	-23.5	-15.3	1086	424	651
7.786	8.0	13.8	14.6	8.5	-3.1	-17.7	-11.6	1174	563	859
8.781	5.2	9.0	9.7	6.3	-0.5	-10.2	-6.7	1589	980	1479
9.700	1.5	2.4	2.6	1.8	0.2	-2.4	-1.6	5602	4188	6258
9.975	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
10.000	0.0	-0.2	-0.2	-0.2	0.0	0.2	0.1	304	231	345

Col. A	Net deflection at transfer includes prestress camber and beam weight on temporary supports.
Col. B	Net deflection at erection includes prestress camber and all dead loads applied before the cast-in-place pour plus long-time deflection growth of the prestressing and beam weight up to erection.
Col. C	Net deflection at completion of construction includes prestress camber and all dead loads plus long-time deflection growth of the prestressing and dead load up to completion.
Col. D	Net sustained deflection at final includes prestress camber, all dead loads, and sustained live loads, plus long-time deflection growth.
Col. E	Net total deflection at final includes prestress camber, all dead loads, and all live loads, plus long-time deflection growth.
Note	Deflection/camber is measured from the cast shape of the beam before release of prestressing.
Note	Sustained deflection or growth includes dead loads and sustained live loads.
Note	Deflection growth is estimated by use of the PCI suggested multipliers - see the Deflection Multipliers report.
*	Span/deflection ratio is minimized with or without the inclusion of live load.

Span/Deflection Limits: Sustained Load Growth + LL = L / 480 for non-structural attachments
Sustained Load Growth + LL = L / 240 otherwise **
LL alone = L / 360 for floors *
LL alone = L / 180 for roofs *
* See the Vibration Check in Service report for more specific vibration guidelines
** May be exceeded for prestressed beams if total net deflection does not exceed limit.

UNRESTRAINED SUPPORT ROTATIONS AT ALL STAGES
(+ve = clockwise rotation)

	Net Rotation					Change in Rotation	
Support Location Column	Net @ Transfer degrees A	Net @ Erection degrees B	Net @ Completion degrees C	Net DL @ Final degrees D	Net Total @ Final degrees E	DL growth + LL degrees E - C	LL alone degrees E - D
Left	-0.2803	-0.4949	-0.5400	-0.3765	-0.0447	0.4953	0.3318
Right	0.2803	0.4949	0.5400	0.3765	0.0447	-0.4953	-0.3318

UNRESTRAINED LONGITUDINAL CHANGE OF LENGTH DUE TO CREEP AND SHRINKAGE
(-ve = shortening, +ve = elongation)

	Total Change of Length (after elastic shortening)					Difference in Change		
	Erection mm B	Composite	Completion mm C	Final mm D		to Compl. mm C - B	to Final mm D - C	to Final mm D - B
Creep	-2.06	-2.24	-2.85	-4.30		-0.80	-1.45	-2.25
Shrink.	-2.02	-2.28	-3.05	-3.79		-1.02	-0.75	-1.77
Total	-4.08	-4.52	-5.90	-8.10		-1.82	-2.20	-4.02

Elastic Shortening = -2.54 mm

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FLEXURAL DESIGN CHECK IN FINAL SERVICE

x m	Design Moment Mf t.m	Cracking Moment Mcr t.m	Minimum * Flexural Resistance t.m	Resistance Provided Mr t.m	Depth in Compression c mm	Compression Depth Ratio c / d	Warnings & Notes
0.000	0.00	4.20	0.00	0.01	0.4	0.002	
0.025	0.00	4.74	0.00	0.58	1.5	0.007	
0.025	-0.00	-4.22	0.00	-0.21	1.4	0.007	
0.025	0.00	4.75	0.00	0.58	1.5	0.007	
0.025	-0.00	-4.21	0.00	-0.21	1.4	0.007	
0.300	2.12	10.47	2.83	6.28	16.2	0.077	
1.219	8.29	16.84	11.05	14.87	41.1	0.197	
2.214	13.46	17.02	17.95	23.83	82.2	0.393	
3.209	17.07	17.14	20.56	23.85	82.1	0.393	
4.204	19.10	17.20	20.65	23.85	82.0	0.392	
5.000	19.61	17.22	20.67	23.85	82.0	0.392	
5.199	19.58	17.22	20.66	23.85	82.0	0.392	
5.796	19.10	17.20	20.65	23.85	82.0	0.392	
6.791	17.07	17.14	20.56	23.85	82.1	0.393	
7.786	13.46	17.02	17.95	23.83	82.2	0.393	
8.781	8.29	16.84	11.05	14.87	41.1	0.197	
9.700	2.12	10.47	2.83	6.28	16.2	0.077	
9.975	0.00	4.74	0.00	0.58	1.5	0.007	
9.975	-0.00	-4.22	0.00	-0.21	1.4	0.007	
10.000	0.00	4.20	0.00	0.01	0.4	0.002	
Points of Maximum and Minimum Factored Moment							
5.000	19.61	17.22	20.67	23.85	82.0	0.392	
0.025	-0.00	-4.22	0.00	-0.21	1.4	0.007	
Points of Maximum Ratio of Factored Moment to Provided Resistance							
5.000	19.61	17.22	20.67	23.85	82.0	0.392	
0.025	-0.00	-4.22	0.00	-0.21	1.4	0.007	
Points of Maximum Ratio of Minimum Resistance to Provided Resistance							
5.000	19.61	17.22	20.67	23.85	82.0	0.392	
0.000	0.00	-4.19	0.00	-0.01	0.4	0.002	

Warnings & Notes

*	Minimum Flexural Resistance is lesser of 1.2 Mcr or 4/3 Mf [CSA A23.3-19::18.7]
Note	A 1% overstress is allowed without a warning to allow for accuracy of numerical methods (Option G3).

See the Flexural Design Details text report for more details.

SHEAR DESIGN CHECK IN FINAL SERVICE

x m	Design Shear Vf kN	Vertical Prestress Vp kN	Concrete Resistance Vc kN	Core Fill Resistance Vc (core) kN	Required Stirrups Vs kN	Resistance Provided Stirrups Vs kN	Total Vr kN	Warnings & Notes
0.000	0.00	0.00	-54.75	-74.49	0.00	0.00	-129.24	3
0.025	0.00	0.00	54.75	74.49	0.00	0.00	129.24	3
0.025	74.18	0.00	102.04	74.49	0.00	0.00	176.53	3
0.300	72.97	0.00	104.58	74.49	0.00	0.00	179.07	
0.300	72.97	0.00	104.58	0.00	0.00	0.00	104.58	
1.219	58.70	0.00	112.55	0.00	0.00	0.00	112.55	
2.214	43.25	0.00	103.64	0.00	0.00	0.00	103.64	
3.209	27.80	0.00	98.36	0.00	0.00	0.00	98.36	
4.204	12.36	0.00	95.79	0.00	0.00	0.00	95.79	
5.000	0.00	0.00	95.41	0.00	0.00	0.00	95.41	
5.000	0.00	0.00	-95.41	0.00	0.00	0.00	-95.41	
5.199	-3.09	0.00	-95.37	0.00	0.00	0.00	-95.37	
5.796	-12.36	0.00	-95.79	0.00	0.00	0.00	-95.79	
6.791	-27.80	0.00	-98.36	0.00	0.00	0.00	-98.36	
7.786	-43.25	0.00	-103.64	0.00	0.00	0.00	-103.64	
8.781	-58.70	0.00	-112.55	0.00	0.00	0.00	-112.55	
9.700	-72.97	0.00	-104.58	0.00	0.00	0.00	-104.58	
9.700	-72.97	0.00	-104.58	-74.49	0.00	0.00	-179.07	
9.975	-74.18	0.00	-102.04	-74.49	0.00	0.00	-176.53	3
9.975	0.00	0.00	95.25	74.49	0.00	0.00	169.74	3
10.000	0.00	0.00	95.25	74.49	0.00	0.00	169.74	3

Warnings & Notes

Note [3]	Design shear force at critical section near support used [CSA A23.3-19::11.3.2].
Note	Beam is part of a slab.
Note	A 1% overstress is allowed without a warning to allow for accuracy of numerical methods (Option G3).

See the Shear Design Check Details text report for more details.

SHEAR TRANSVERSE REINFORCING DESIGN CHECK IN FINAL SERVICE

x m	Shear Steel Grade fy MPa	Shear Steel Required Av/s mm^2/m	Shear Steel Provided Av/s mm^2/m	Stirrup Provided Av mm^2	Stirrup Spacing Provided s mm	Stirrup Spacing Max. Allow s mm	Warnings & Notes
0.000	400	0	0	0.00	0.0	-	4
0.025	400	0	0	0.00	0.0	-	4
0.025	400	0	0	0.00	0.0	-	4
0.300	400	0	0	0.00	0.0	-	
0.300	400	0	0	0.00	0.0	-	
1.219	400	0	0	0.00	0.0	-	
2.214	400	0	0	0.00	0.0	-	

Project: Sample Project
Problem: Hollowcore Slab

3.209	400	0	0	0.00	0.0	-		
4.204	400	0	0	0.00	0.0	-		
5.000	400	0	0	0.00	0.0	-		
5.000	400	0	0	0.00	0.0	-		
5.199	400	0	0	0.00	0.0	-		
5.796	400	0	0	0.00	0.0	-		
6.791	400	0	0	0.00	0.0	-		
7.786	400	0	0	0.00	0.0	-		
8.781	400	0	0	0.00	0.0	-		
9.700	400	0	0	0.00	0.0	-		
9.700	400	0	0	0.00	0.0	-		
9.975	400	0	0	0.00	0.0	-	4	
9.975	400	0	0	0.00	0.0	-	4	
10.000	400	0	0	0.00	0.0	-	4	

Warnings & Notes	
Note [4]	Design shear force at critical section near support used [CSA A23.3-19::11.3.2].
Note	Beam is part of a slab.
Note	Shear steel requirements for pre-tension bursting have NOT been included (calculation option S8).
Note	A 1% overstress is allowed without a warning to allow for accuracy of numerical methods (calculation option G3).
*	Portion of the total stirrup area required to resist torsional shear flow (one leg around periphery).
See the Shear Design Check Details text report for more details.	

LONGITUDINAL TENSION REINFORCING COMBINED DESIGN CHECK IN FINAL SERVICE
(+ve = compression, -ve = tension)

			Force in Reinforcing at Bottom of Beam				Force in Reinforcing at Top of Beam				Warnings
x	d *	Theta Angle	Flexure	Net Shear	Net Force	Resistance	Flexure	Net Shear	Net Force	Resistance	& Notes
m	mm	degrees	kN	kN	kN	kN	kN	kN	kN	kN	
0.000	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
0.025	208.4	32.5	-0.03	0.00	-0.03	-29.90	0.03	922.61	0.00	-5.43	
0.025	208.4	28.7	-0.03	0.00	-0.03	-29.90	0.03	922.61	0.00	-5.43	
0.300	202.4	28.6	-102.80	0.00	-102.80	-358.80	102.80	847.29	0.00	-65.18	
0.300	202.4	28.6	-102.80	-133.92	-236.72	-358.80	102.80	847.29	0.00	-65.18	
1.219	192.5	28.3	-422.43	-109.10	-531.53	-982.47	422.43	576.57	0.00	-164.14	
2.214	188.1	28.6	-701.88	-79.26	-781.14	-1321.79	701.88	320.31	0.00	-183.47	
3.209	188.1	28.9	-889.82	-50.47	-940.29	-1321.79	889.82	132.37	0.00	-183.47	
4.204	188.1	29.0	-996.04	-22.32	-1018.36	-1321.79	996.04	26.15	0.00	-183.47	
5.000	188.1	29.0	-1022.19	0.00	-1022.19	-1321.79	1022.19	0.00	0.00	-183.47	
5.000	188.1	29.0	-1022.19	0.00	-1022.19	-1321.79	1022.19	0.00	0.00	-183.47	
5.199	188.1	29.0	-1020.56	-1.63	-1022.19	-1321.79	1020.56	1.63	0.00	-183.47	
5.796	188.1	29.0	-996.04	-22.32	-1018.36	-1321.79	996.04	26.15	0.00	-183.47	
6.791	188.1	28.9	-889.82	-50.47	-940.29	-1321.79	889.82	132.37	0.00	-183.47	
7.786	188.1	28.6	-701.88	-79.26	-781.14	-1321.79	701.88	320.31	0.00	-183.47	
8.781	192.5	28.3	-422.43	-109.10	-531.53	-982.47	422.43	576.57	0.00	-164.14	
9.700	202.4	28.6	-102.80	-133.92	-236.72	-358.80	102.80	847.29	0.00	-65.18	
9.700	202.4	28.6	-102.80	0.00	-102.80	-358.80	102.80	847.29	0.00	-65.18	
9.975	208.4	28.7	-0.03	0.00	-0.03	-29.90	0.03	922.61	0.00	-5.43	
9.975	208.4	29.0	-0.03	0.00	-0.03	-29.90	0.03	922.61	0.00	-5.43	
10.000	208.8	29.0	0.00	0.00	0.00	-1.32	0.00	920.64	0.00	-0.18	

Warnings & Notes	
Note	A 1% overstress is allowed without a warning to allow for accuracy of numerical methods (Option G3).
*	Greater of dv or actual flexural moment arm.