Project: Sample Project
Problem: IT Beam

SUMMARY REPORT

Design Code Used: ACI 318-19

NON-DEFAULT OPTION SETTINGS

** ON ** G2: Use PCI Standard Design Practice, TR-7-05 (ACI codes only)
** ON ** P1: Vary user defined losses along beam
** ON ** F1: Check minimum strength at critical sections only
** OFF ** F8: Use a rectangular stress block at concrete ultimate strain
** ON ** F10: Use the cracking moment for minimum flexural strength (ACI and NZ codes for non-prestressed bea
** ON ** S8: Calculate pre-tensioned bursting steel requirements
** 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	Cast-in-Place Pour
Concrete Density, Wt	150 lb/ft^3	150 lb/ft^3
Compressive Strength, f'c	7000.0 psi	4000.0 psi
Flexural Modulus of Rupture, fr	627.50 psi	474.34 psi
Modulus of Elasticity, Ec	5.072E+6 psi	3.834E+6 psi
Strength at Transfer, f'c	4000.0 psi	
Modulus of Rupture at Transfer, fr	474.34 psi	
Modulus of Elast. at Transfer, Ec	3.834E+6 psi	
Strength at Initial Lifting, f'c	4000.0 psi	
Modulus of Rupture at Lifting, fr	474.34 psi	
Modulus of Elast. at Lifting, Ec	3.834E+6 psi	

Precast concrete is flowable

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

Cement Content	610 lb/yd^3	Age at Transfer	0.75 days
Air Content	5.00 %	Age at Erection	30 days
Slump	8.00 in	Age at Cast-in-Place Pour	50 days
Aggregate Mix	0.40 fines/total	Age Cast-in-Place is Composite	53 days
Aggregate Size	0.50 in	Age Construction is Complete	60 days
Basic Shrinkage Strain	0.000780 in/in		
Curing Method	Moist	Relative Humidity in Service	70 %
Concrete Hydration Rate	Normal	Ambient Temperature in Service	20 deg
		Exposure in Service	Exter

PRECAST BEAM LAYOUT

Seg. No.	Segment Length From ft	To ft	Length ft	Section Identification Folder Name	Section Name	Section Type	Offset Lateral in	Offset Vertical in
1	0.000	44.000	44.000	ITs	IT Beam	Inverted Tee	0.00	0.00

CAST-IN-PLACE POUR LAYOUT

Seg. No.	Segment Length From ft	To ft	Length ft	Slab/Topping Parameters Thick. in	Width in	Offset in	Haunch Parameters Thick. in	Width in	Offset in	Vert. Offset in	Composite Interfa Width in	Offset in	Total Width Actual in	Effect.* in
1	0.000	44.000	44.000	3.00	60.00	0.00	1.00	24.00	0.00	0.00	20.00	0.00	60.00	60.00

* effective width of cast-in-place pour used to determine flexural strength.

Beam is UNSHORED during the cast-in-place pour and superimposed dead load.

Span Length at Transfer = 44.000 ft, Centre of Supports, Left @ 0.000 ft, Right @ 44.000 ft
Span Length in Service = 43.500 ft, Centre of Supports, Left @ 0.250 ft, Right @ 43.750 ft
Total Beam Length = 44.000 ft, Bearing Length, Left = 6.00 in, Right = 6.00 in

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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 in^2	I in^4	yb in	Section Height in	Section Width in	Shear Width in	Volume / Surface in	Section Moduli Sb in^3	St in^3
1	910.9	101753	15.47	36.00	36.00	20.00	6.40	-6576	4957

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

Seg. No.	Section Properties Ac in^2	Ic in^4	yb in	Section Height in	Section Moduli Sb in^3	St in^3	Sbc in^3	Stc in^3
1	1065.1	170431	18.77	40.00	-9079	9893	9893	8029

Note: Sb & St = bottom and top of the precast beam, Sbc & Stc = bottom and top of the cast-in-place pour.

Project: Sample Project
Problem: IT Beam

UNCRACKED SECTION PROPERTIES SUMMARY

	Net Precast Section at Transfer (based on Eci) (include rebar,deduct strand)			Transformed Precast Section at Transfer (based on Eci) (include rebar and strand)			Transformed Precast Section at 28 Days (based on Ec) (include rebar and strand)			Transformed Composite Section at 28 Days (based on Ec) (include rebar and strand)		
x ft	A in^2	I in^4	yb in	A in^2	I in^4	yb in	A in^2	I in^4	yb in	Ac in^2	Ic in^4	ybc in
0.000	906.3	101146	15.53	910.9	101757	15.47	910.9	101756	15.47	1065.1	170436	18.77
0.250	906.3	101144	15.53	914.5	102233	15.43	913.5	102099	15.44	1067.7	171000	18.74
1.555	906.3	101137	15.53	933.2	104682	15.20	926.9	103872	15.27	1081.1	173925	18.55
3.730	934.8	108141	15.70	969.5	112818	15.28	953.0	109713	15.33	1107.2	179669	18.53
5.905	945.7	111115	15.84	980.4	115904	15.42	960.8	111924	15.44	1115.0	181345	18.59
7.862	945.7	111115	15.84	980.4	115904	15.42	960.8	111924	15.44	1115.0	181345	18.59
10.037	945.7	111115	15.84	980.4	115904	15.42	960.8	111924	15.44	1115.0	181345	18.59
12.213	945.7	111115	15.84	980.4	115904	15.42	960.8	111924	15.44	1115.0	181345	18.59
14.170	945.7	111115	15.84	980.4	115904	15.42	960.8	111924	15.44	1115.0	181345	18.59
16.345	945.7	111115	15.84	980.4	115904	15.42	960.8	111924	15.44	1115.0	181345	18.59
18.520	945.7	111115	15.84	980.4	115904	15.42	960.8	111924	15.44	1115.0	181345	18.59
20.477	945.7	111115	15.84	980.4	115904	15.42	960.8	111924	15.44	1115.0	181345	18.59
22.000	945.7	111115	15.84	980.4	115904	15.42	960.8	111924	15.44	1115.0	181345	18.59
22.652	945.7	111115	15.84	980.4	115904	15.42	960.8	111924	15.44	1115.0	181345	18.59
23.523	945.7	111115	15.84	980.4	115904	15.42	960.8	111924	15.44	1115.0	181345	18.59
25.480	945.7	111115	15.84	980.4	115904	15.42	960.8	111924	15.44	1115.0	181345	18.59
27.655	945.7	111115	15.84	980.4	115904	15.42	960.8	111924	15.44	1115.0	181345	18.59
29.830	945.7	111115	15.84	980.4	115904	15.42	960.8	111924	15.44	1115.0	181345	18.59
31.788	945.7	111115	15.84	980.4	115904	15.42	960.8	111924	15.44	1115.0	181345	18.59
33.962	945.7	111115	15.84	980.4	115904	15.42	960.8	111924	15.44	1115.0	181345	18.59
36.138	945.7	111115	15.84	980.4	115904	15.42	960.8	111924	15.44	1115.0	181345	18.59
38.095	945.7	111115	15.84	980.4	115904	15.42	960.8	111924	15.44	1115.0	181345	18.59
40.270	934.8	108141	15.70	969.5	112818	15.28	953.0	109713	15.33	1107.2	179669	18.53
42.445	906.3	101137	15.53	933.2	104682	15.20	926.9	103872	15.27	1081.1	173925	18.55
43.750	906.3	101144	15.53	914.5	102233	15.43	913.5	102099	15.44	1067.7	171000	18.74
44.000	906.3	101146	15.53	910.9	101757	15.47	910.9	101756	15.47	1065.1	170436	18.77

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

PRESTRESSING STEEL TENDONS

ID	Qty	Grade ksi	Type *	Strand Size	Offsets ** X ft	Offsets ** Y in	End Offset & Type *** Left ft		End Offset & Type *** Right ft		Tendon Area in^2	Jacking Force Pj kip	Jacking Force %fpu
1	10.000	270.0	LRS	0.5" (1/2)	0.000	2.00	0.000	B	0.000	B	1.530	289.17	0.70
					44.000	2.00							
2	10.000	270.0	LRS	0.5" (1/2)	0.000	4.00	0.000	B	0.000	B	1.530	289.17	0.70
					44.000	4.00							
3	10.000	270.0	LRS	0.5" (1/2)	0.000	6.00	0.000	B	0.000	B	1.530	289.17	0.70
					44.000	6.00							

* 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 : PCI Simplified Method (Zia)
Calculated Losses: Initial = 6.4%, Final = 11.0%
Maximum Total Prestress Forces: Pj(jacking) = 867.51 kip,
Pi(transfer) = 812.32 kip,
Pe(effective) = 772.09 kip @ x = 22.000 ft,

LONGITUDINAL REINFORCING STEEL

ID	Qty	Steel Grade ksi	Bar Size C=coated	Bar Area in^2	End Location & Type From ft	*	To ft	*	Bar Spacing in	Cross Spacing in	Vertical Offset in	Offset ** Reference
1	4.000	60.0	# 9	4.000	2.000	SE	42.000	SE	6.00	-	3.00	Top of Precast Beam
2	2.000	60.0	# 9	2.000	2.000	SE	42.000	SE	12.00	-	3.00	Bottom of Precast Beam

* Straight Embeddment (SE), Fully Developed (FD), Standard Hook (SH), Headed Bar (HB)
** Offsets are measured up from the bottom or down from the top
See the "Development Length" text report for details of the bar and wire development lengths

SHEAR STIRRUPS

From ft	To ft	Grade ksi		Size	# of Legs	Total Area in^2	Spacing in
0.000	1.000	60.0	*	# 4	2	0.40	2.00
1.000	8.000	60.0	*	# 4	2	0.40	6.00
8.000	16.000	60.0	*	# 4	2	0.40	10.00
16.000	28.000	60.0	*	# 4	2	0.40	18.00
28.000	36.000	60.0	*	# 4	2	0.40	10.00
36.000	43.000	60.0	*	# 4	2	0.40	6.00
43.000	44.000	60.0	*	# 4	2	0.40	2.00

* Useable steel strength limited by selected code.

INTERFACE SHEAR TIES

Project: Sample Project
Problem: IT Beam

From ft	To ft	Grade ksi		Size	# of Legs	Total Area in^2	Spacing in
0.000	1.000	60.0	*	# 4	2	0.40	2.00
1.000	8.000	60.0	*	# 4	2	0.40	6.00
8.000	16.000	60.0	*	# 4	2	0.40	10.00
16.000	28.000	60.0	*	# 4	2	0.40	18.00
28.000	36.000	60.0	*	# 4	2	0.40	10.00
36.000	43.000	60.0	*	# 4	2	0.40	6.00
43.000	44.000	60.0	*	# 4	2	0.40	2.00

* Useable steel strength limited by selected code.

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] 948.77 lb/ft full length
DL - Before Topping D: DL, General	Erection to Final Service No Load Distribution	DT 1a: [V] 28000 lb @ 1 ft DT 1b: [V] 28000 lb @ 7 ft DT 2a: [V] 28000 lb @ 13 ft DT 2b: [V] 28000 lb @ 19 ft DT 3a: [V] 28000 lb @ 25 ft DT 3b: [V] 28000 lb @ 31 ft DT 4a: [V] 28000 lb @ 37 ft DT 4b: [V] 28000 lb @ 43 ft
DL - After Topping D: DL, General	CIP Placement to Final Service No Load Distribution	DT 1a: [V] 2000 lb @ 1 ft DT 1b: [V] 2000 lb @ 7 ft DT 2a: [V] 2000 lb @ 13 ft DT 2b: [V] 2000 lb @ 19 ft DT 3a: [V] 2000 lb @ 25 ft DT 3b: [V] 2000 lb @ 31 ft DT 4a: [V] 2000 lb @ 37 ft DT 4b: [V] 2000 lb @ 43 ft
* CIP Weight D: DL, Cast-in-Place Concrete	CIP Placement to Final Service No Load Distribution	Segment #0: [V] 212.486 lb/ft full length
LL L: LL, General	Final Service stage only No Load Distribution	DT 1a: [V] 14000 lb @ 1 ft DT 1b: [V] 14000 lb @ 7 ft DT 2a: [V] 14000 lb @ 13 ft DT 2b: [V] 14000 lb @ 19 ft DT 3a: [V] 14000 lb @ 25 ft DT 3b: [V] 14000 lb @ 31 ft DT 4a: [V] 14000 lb @ 37 ft DT 4b: [V] 14000 lb @ 43 ft

* 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 + 1.00F + 1.00T + 1.00L + 1.00L1 + 1.00Lr + 1.00R + 1.00S + 1.00Ws + 0.60Wu
 SLS Deflect : 1.00P + 1.00D + 1.00F + 1.00T + 1.00L + 1.00L1 + 1.00Lr + 1.00R + 1.00S
 FLS Fatigue : 1.00P + 1.00D + 1.00F + 1.00L + 1.00L1 + 1.00Lr

Ultimate (Strength) Limit State (ULS) Combinations (searched collectively to obtain envelope)
  1: ULS Combo 1 : 1.40D + 1.40F
  2: ULS Combo 2 : 1.20D + 1.20F + 1.20T + 1.60L + 1.60L1 + 0.50Lr
  3: ULS Combo 3 : 1.20D + 1.20F + 1.20T + 1.60L + 1.60L1 + 0.50S
  4: ULS Combo 4 : 1.20D + 1.20F + 1.20T + 1.60L + 1.60L1 + 0.50R
  5: ULS Combo 5 : 1.20D + 0.50L + 1.00L1 + 1.60Lr
  6: ULS Combo 6 : 1.20D + 0.50L + 1.00L1 + 1.60S
  7: ULS Combo 7 : 1.20D + 0.50L + 1.00L1 + 1.60R
  8: ULS Combo 8 : 1.20D + 1.60Lr + 0.80Ws + 0.50Wu
  9: ULS Combo 9 : 1.20D + 1.60S + 0.80Ws + 0.50Wu
 10: ULS Combo 10 : 1.20D + 1.60R + 0.80Ws + 0.50Wu
 11: ULS Combo 11 : 1.20D + 0.50L + 1.00L1 + 0.50Lr + 1.60Ws + 1.00Wu
 12: ULS Combo 12 : 1.20D + 0.50L + 1.00L1 + 0.50S + 1.60Ws + 1.00Wu
 13: ULS Combo 13 : 1.20D + 0.50L + 1.00L1 + 0.50R + 1.60Ws + 1.00Wu
 14: ULS Combo 14 : 1.20D + 0.50L + 1.00L1 + 0.20S + 1.40Es + 1.00Eu
 15: ULS Combo 15 : 0.90D + 1.60L + 1.60L1 + 0.50Lr
 16: ULS Combo 16 : 0.90D + 1.60Ws + 1.00Wu
 17: ULS Combo 17 : 0.90D + 0.90F + 1.40Es + 1.00Eu

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

Station	SLS (stress) Load Combination			ULS Load Envelopes					
	Moment	Moment		Shear			Moment		
x ft	Sustained kip.ft	Total Load kip.ft		Total Load kip		Govern. Combo.	Total Load kip.ft		Govern. Combo.
		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
0.250	-0.04	-0.04	-0.04	-0.41	-0.26	1 15	-0.05	-0.03	1 15
0.250	-0.04	-0.04	-0.04	130.73	263.91	15 2	-0.05	-0.03	1 15
1.555	171.89	171.89	237.20	102.37	203.69	15 2	154.70	310.76	15 2
3.730	416.53	416.53	573.19	100.09	200.66	15 2	374.87	750.49	15 2

Project: Sample Project
Problem: IT Beam

5.905	655.68	655.68	903.69	97.82	197.63	15	2	590.11	1183.63	15	2
7.862	840.34	840.34	1158.49	68.78	136.50	15	2	756.30	1517.45	15	2
10.037	1003.80	1003.80	1382.85	66.50	133.47	15	2	903.42	1811.04	15	2
12.213	1161.77	1161.77	1601.72	64.23	130.44	15	2	1045.59	2098.04	15	2
14.170	1264.14	1264.14	1742.52	35.18	69.31	15	2	1137.73	2282.38	15	2
16.345	1346.42	1346.42	1855.25	32.91	66.28	15	2	1211.78	2429.83	15	2
18.520	1423.21	1423.21	1962.49	30.64	63.25	15	2	1280.88	2570.69	15	2
20.477	1443.29	1443.29	1989.29	1.59	2.48	15	1	1298.96	2605.55	15	2
22.000	1444.64	1444.64	1990.64	0.00	0.00	15	2	1300.17	2607.16	15	2
22.652	1444.39	1444.39	1990.39	-1.06	-0.68	1	15	1299.95	2606.87	15	2
23.523	1443.29	1443.29	1989.29	-2.48	-1.59	1	15	1298.96	2605.55	15	2
25.480	1423.21	1423.21	1962.49	-63.25	-30.64	2	15	1280.88	2570.69	15	2
27.655	1346.42	1346.42	1855.25	-66.28	-32.91	2	15	1211.78	2429.83	15	2
29.830	1264.14	1264.14	1742.52	-69.31	-35.18	2	15	1137.73	2282.38	15	2
31.788	1161.77	1161.77	1601.72	-130.44	-64.23	2	15	1045.59	2098.04	15	2
33.962	1003.80	1003.80	1382.85	-133.47	-66.50	2	15	903.42	1811.04	15	2
36.138	840.34	840.34	1158.49	-136.50	-68.78	2	15	756.30	1517.45	15	2
38.095	655.68	655.68	903.69	-197.63	-97.82	2	15	590.11	1183.63	15	2
40.270	416.53	416.53	573.19	-200.66	-100.09	2	15	374.87	750.49	15	2
42.445	171.89	171.89	237.20	-203.69	-102.37	2	15	154.70	310.76	15	2
43.750	-0.04	-0.04	-0.04	-263.91	-130.73	2	15	-0.05	-0.03	1	15
43.750	-0.04	-0.04	-0.04	0.26	0.41	15	1	-0.05	-0.03	1	15
44.000	0.00	0.00	0.00	0.00	0.00	1	1	0.00	0.00	1	1

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

Load Group or Envelope	During CIP Pour		In Service			
	Left	Right	Left		Right	
	Vertical kip	Vertical kip	Vertical[*] kip	Torsion[*] kip.ft	Vertical[*] kip	Torsion[*] kip.ft
Unfactored Load Group Effects						
Beam Weight [D]	20.87	20.87	20.87	0.00	20.87	0.00
DL - Before Topp	112.00	112.00	112.00	0.00	112.00	0.00
DL - After Toppi	8.00	8.00	8.00	0.00	8.00	0.00
CIP Weight [D]	4.67	4.67	4.67	0.00	4.67	0.00
LL [L]			56.00	0.00	56.00	0.00
Load Envelope Effects						
SLS DL			145.55	0.00	145.55	0.00
SLS Sustain			145.55	0.00	145.55	0.00
SLS Minimum	145.55	145.55	145.55	0.00	145.55	0.00
SLS Maximum	145.55	145.55	201.55	0.00	201.55	0.00
ULS Minimum			130.99 [15]	0.00 [1]	130.99 [15]	0.00 [1]
ULS Maximum			264.26 [2]	0.00 [1]	264.26 [2]	0.00 [1]

* Governing ULS Load Combination (below)

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

Location	x ft	Stress psi	Limit * psi	Overstress Notice	
STRESSES AT TRANSFER					
Critical Compression					
Top of Beam	0.000	-1	2800	0%	
Bottom of Beam	41.792	2220	2800	0%	
					Longitudinal Tensile Rebar (in^2) **
Critical Tension					Required / Provided / Additional
Top of Beam	41.792	-872	-379	130%	3.0 / 0.6 / 2.4
Bottom of Beam	0.000	2	-379	0%	
STRESSES DURING CAST-IN-PLACE POUR					
Critical Compression					
Top of Beam	22.000	2317	4200	0%	
Bottom of Beam	41.792	1701	4200	0%	
Critical Tension					
Top of Beam	42.010	-350	-627	0%	
Bottom of Beam	22.000	-212	-627	0%	
STRESSES IN SERVICE					
Critical Compression					
Top of Beam	22.000	2966	4200	0%	
Bottom of Beam	41.792	1416	4200	0%	
Top of CIP Pour	22.000	585	2400	0%	
Critical Tension					
Top of Beam	42.010	-182	-1004	0%	Class U, not cracked
Bottom of Beam	22.000	-938	-1004	0%	Class T, cracking controlled
Top of CIP Pour	43.750	-0	-474	0%	
STRESSES IN SERVICE (SUSTAINED LOADS ONLY)					
Critical Compression					
Top of Beam	22.000	2337	3150	0%	
Bottom of Beam	41.792	1533	3150	0%	

* Tensile stress limit in service for the precast beam is for Class T (controlled cracking). Beyond this limit crack control is required.
* Tensile stress limit shown for the CIP pour is the flexural cracking strength, for reference only. 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 =	-474 psi	-474 psi	-627 psi

Project: Sample Project
Problem: IT Beam

Strength Required for Transfer, f'ci = 3171.7 psi (f'c specified = 4000.0 psi)

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 ft Column	Net @ Transfer in A	Net @ Erection in B	Net @ Completion in C	Net Sust. @ Final in D	Net Total @ Final in E	Sustained Growth+LL in E - C	LL alone in E - D	Net Total Deflection L/E *	Sustained Growth+LL L/(E-C) *	LL alone L/(E-D)
0.000	0.000	-0.009	-0.005	0.000	0.006	0.010	0.005	1040	572	1202
0.250	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0
1.555	0.085	0.047	0.023	-0.006	-0.032	-0.055	-0.026	16502	9542	20072
3.730	0.194	0.113	0.047	-0.029	-0.098	-0.145	-0.069	5347	3600	7589
5.905	0.288	0.162	0.054	-0.068	-0.178	-0.232	-0.110	2926	2246	4738
7.862	0.362	0.193	0.050	-0.112	-0.257	-0.307	-0.146	2029	1701	3586
10.037	0.432	0.218	0.037	-0.163	-0.346	-0.383	-0.182	1510	1363	2865
12.213	0.489	0.235	0.021	-0.214	-0.430	-0.451	-0.215	1214	1157	2423
14.170	0.531	0.245	0.006	-0.256	-0.498	-0.504	-0.242	1048	1036	2157
16.345	0.565	0.252	-0.010	-0.294	-0.561	-0.552	-0.267	930	946	1952
18.520	0.589	0.256	-0.021	-0.321	-0.608	-0.587	-0.287	858	889	1820
20.477	0.601	0.257	-0.027	-0.335	-0.632	-0.605	-0.297	826	863	1759
22.000	0.603	0.258	-0.029	-0.338	-0.638	-0.609	-0.299	818	857	1745
22.652	0.603	0.258	-0.028	-0.338	-0.636	-0.608	-0.299	820	858	1748
23.523	0.601	0.257	-0.027	-0.335	-0.632	-0.605	-0.297	826	863	1759
25.480	0.589	0.256	-0.021	-0.321	-0.608	-0.587	-0.287	858	889	1820
27.655	0.565	0.252	-0.010	-0.294	-0.561	-0.552	-0.267	930	946	1952
29.830	0.531	0.245	0.006	-0.256	-0.498	-0.504	-0.242	1048	1036	2157
31.788	0.489	0.235	0.021	-0.214	-0.430	-0.451	-0.215	1214	1157	2423
33.962	0.432	0.218	0.037	-0.163	-0.346	-0.383	-0.182	1510	1363	2865
36.138	0.362	0.193	0.050	-0.112	-0.257	-0.307	-0.146	2029	1701	3586
38.095	0.288	0.162	0.054	-0.068	-0.178	-0.232	-0.110	2926	2246	4738
40.270	0.194	0.113	0.047	-0.029	-0.098	-0.145	-0.069	5347	3600	7589
42.445	0.085	0.047	0.023	-0.006	-0.032	-0.055	-0.026	16502	9542	20072
43.750	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0
44.000	0.000	-0.009	-0.005	0.000	0.006	0.010	0.005	1040	572	1202

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

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	-0.2637	-0.1786	-0.0897	0.0153	0.1106	0.2003	0.0953
Right	0.2637	0.1786	0.0897	-0.0153	-0.1106	-0.2003	-0.0953

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 in B	Composite in	Completion in C	Final in D	to Compl. in C - B	to Final in D - C	to Final in D - B
Creep		-0.0194	-0.0279	-0.0297	-0.1532	-0.0102	-0.1235	-0.1337
Shrink.		-0.0217	-0.0341	-0.0372	-0.1588	-0.0155	-0.1216	-0.1371
Total		-0.0411	-0.0620	-0.0668	-0.3119	-0.0257	-0.2451	-0.2708

Elastic Shortening = -0.1128 in

FLEXURAL DESIGN CHECK IN FINAL SERVICE

	Design Moment	Cracking Moment	Minimum * Flexural	Design Strength	Depth in Compression	Net Tensile	Flexural	Ø	Warnings
x	Mu	Mcr	Strength	ØMn	c	Strain	Class.		& Notes
ft	kip.ft	kip.ft	kip.ft	kip.ft	in				

Project: Sample Project
Problem: IT Beam

0.000	0.00	476.57	0.00	1.91	0.08	1.3759	Tension	0.75	
0.250	0.00	689.75	0.00	217.36	0.57	0.1967	Tension	0.75	
0.250	-0.05	-210.18	0.00	-22.71	0.63	0.0254	Tension	0.75	
0.250	0.00	690.01	0.00	217.36	0.57	0.1967	Tension	0.75	
0.250	-0.05	-209.99	0.00	-22.71	0.63	0.0254	Tension	0.75	
1.555	310.76	1632.16	1958.59	1163.73	3.32	0.0313	Tension	0.75	
3.730	750.49	1930.99	2317.18	1953.98	7.19	0.0129	Tension	0.80	1
5.905	1183.63	1891.37	2269.64	2897.88	10.22	0.0081	Tension	0.87	
7.862	1517.45	1857.04	2228.45	3192.03	11.19	0.0072	Tension	0.90	
10.037	1811.04	1826.94	2192.32	3192.85	11.19	0.0072	Tension	0.90	
12.213	2098.04	1797.37	2156.84	3193.60	11.19	0.0072	Tension	0.90	
14.170	2282.38	1778.44	2134.13	3194.09	11.19	0.0072	Tension	0.90	
16.345	2429.83	1763.34	2116.00	3194.47	11.19	0.0072	Tension	0.90	
18.520	2570.69	1748.77	2098.52	3194.81	11.19	0.0072	Tension	0.90	
20.477	2605.55	1745.25	2094.29	3194.91	11.19	0.0072	Tension	0.90	
22.000	2607.16	1745.11	2094.13	3194.92	11.19	0.0072	Tension	0.90	
22.652	2606.87	1745.14	2094.16	3194.92	11.19	0.0072	Tension	0.90	
23.523	2605.55	1745.25	2094.29	3194.91	11.19	0.0072	Tension	0.90	
25.480	2570.69	1748.77	2098.52	3194.81	11.19	0.0072	Tension	0.90	
27.655	2429.83	1763.34	2116.00	3194.47	11.19	0.0072	Tension	0.90	
29.830	2282.38	1778.44	2134.13	3194.09	11.19	0.0072	Tension	0.90	
31.788	2098.04	1797.37	2156.84	3193.60	11.19	0.0072	Tension	0.90	
33.962	1811.04	1826.94	2192.32	3192.85	11.19	0.0072	Tension	0.90	
36.138	1517.45	1857.04	2228.45	3192.03	11.19	0.0072	Tension	0.90	
38.095	1183.63	1891.37	2269.64	2897.88	10.22	0.0081	Tension	0.87	
40.270	750.49	1930.99	2317.18	1953.98	7.19	0.0129	Tension	0.80	1
42.445	310.76	1632.16	1958.59	1163.73	3.32	0.0313	Tension	0.75	
43.750	0.00	689.75	0.00	217.36	0.57	0.1967	Tension	0.75	
43.750	-0.05	-210.18	0.00	-22.71	0.63	0.0254	Tension	0.75	
44.000	0.00	476.57	0.00	1.91	0.08	1.3759	Tension	0.75	
Points of Maximum and Minimum Factored Moment									
22.000	2607.16	1745.11	2094.13	3194.92	11.19	0.0072	Tension	0.90	
43.750	-0.05	-210.18	0.00	-22.71	0.63	0.0254	Tension	0.75	
Points of Maximum Ratio of Factored Moment to Design Strength									
22.000	2607.16	1745.11	2094.13	3194.92	11.19	0.0072	Tension	0.90	
43.750	-0.05	-210.18	0.00	-22.71	0.63	0.0254	Tension	0.75	

Warnings & Notes	
Note [1]	Some rebar have been disregarded due to potential slippage within their development length. See Flexural Design Detail Report and Help file's Technical Background for more information.
*	Minimum Flexural Strength is lesser of 1.2 Mcr or 2.0 Mu [ACI 318-19::9.6.2] (only checked at critical points).
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

	Design	Vertical	Concrete	Required	Strength Provided		Warnings	
	Shear	Prestress	Strength	Stirrups	Stirrups	Total	& Notes	
x	Vu	Vp	ØVc	ØVs	ØVs	ØVn		
ft	kip	kip	kip	kip	kip	kip		
0.000	0.00	0.00	-88.40	0.00	-324.00	-412.40	1	3
0.250	0.00	0.00	166.38	0.00	324.13	490.52	1	3
0.250	263.56	0.00	166.38	97.18	324.13	490.52	1	3
1.555	203.69	0.00	231.47	15.59	108.00	339.48	1	
3.730	200.66	0.00	264.77	15.59	107.97	372.74	1	
5.905	197.63	0.00	253.33	15.61	108.27	361.61	1	
7.862	136.50	0.00	146.32	15.61	108.28	254.59	1	
10.037	133.47	0.00	123.57	15.61	64.97	188.53	1	
12.213	130.44	0.00	107.08	23.36	64.97	172.04	1	
14.170	69.31	0.00	88.63	15.61	64.97	153.60	1	
16.345	66.28	0.00	88.63	15.61	36.09	124.72	1	
18.520	63.25	0.00	88.63	15.61	36.09	124.72	1	
20.477	2.48	0.00	88.63	0.00	36.09	124.72		
22.000	0.00	0.00	88.63	0.00	36.09	124.72		
22.000	0.00	0.00	-88.63	0.00	-36.09	-124.72		
22.652	-1.06	0.00	-88.63	0.00	-36.09	-124.72		
23.523	-2.48	0.00	-88.63	0.00	-36.09	-124.72		
25.480	-63.25	0.00	-88.63	-15.61	-36.09	-124.72	1	
27.655	-66.28	0.00	-88.63	-15.61	-36.09	-124.72	1	
29.830	-69.31	0.00	-88.63	-15.61	-64.97	-153.60	1	
31.788	-130.44	0.00	-107.08	-23.36	-64.97	-172.04	1	
33.962	-133.47	0.00	-123.57	-15.61	-64.97	-188.53	1	
36.138	-136.50	0.00	-146.32	-15.61	-108.28	-254.59	1	
38.095	-197.63	0.00	-253.33	-15.61	-108.27	-361.61	1	
40.270	-200.66	0.00	-264.77	-15.59	-107.97	-372.74	1	
42.445	-203.69	0.00	-231.47	-15.59	-108.00	-339.48	1	
43.750	-263.56	0.00	-166.38	-97.18	-324.13	-490.52	1	3
43.750	0.00	0.00	166.38	0.00	324.13	490.52	1	3
44.000	0.00	0.00	88.40	0.00	324.00	412.40	1	3

Warnings & Notes	
Note [1]	Transverse shear steel is required. See the Shear Transvese Reinforcing Design Check report.
Note [3]	Design shear force at critical section near support used [ACI 318-19::7.4.3.2/9.4.3.2].
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

	Shear Steel	Shear Steel	Shear Steel	Stirrup	Stirrup Spacing		Warnings
	Grade	Required	Provided	Provided	Provided	Max. Allow	& Notes
x	fy	Av/s	Av/s	Av	s	s	
ft	ksi	in^2/ft	in^2/ft	in^2	in	in	

Project: Sample Project
Problem: IT Beam

0.000	60.0	1.458	2.400	0.400	2.00	-	2	4
0.250	60.0	1.458	2.400	0.400	2.00	-	2	4
0.250	60.0	1.458	2.400	0.400	2.00	6.67	2	4
1.555	60.0	0.115	0.800	0.400	6.00	24.00		5
3.730	60.0	0.115	0.800	0.400	6.00	24.00		5
5.905	60.0	0.115	0.800	0.400	6.00	24.00		5
7.862	60.0	0.115	0.800	0.400	6.00	24.00		5
10.037	60.0	0.115	0.480	0.400	10.00	24.00		5
12.213	60.0	0.173	0.480	0.400	10.00	24.00		5
14.170	60.0	0.115	0.480	0.400	10.00	24.00		5
16.345	60.0	0.115	0.267	0.400	18.00	24.00		5
18.520	60.0	0.115	0.267	0.400	18.00	24.00		5
20.477	60.0	0.000	0.267	0.400	18.00	-		
22.000	60.0	0.000	0.267	0.400	18.00	-		
22.000	60.0	0.000	0.267	0.400	18.00	-		
22.652	60.0	0.000	0.267	0.400	18.00	-		
23.523	60.0	0.000	0.267	0.400	18.00	-		
25.480	60.0	0.115	0.267	0.400	18.00	24.00		5
27.655	60.0	0.115	0.267	0.400	18.00	24.00		5
29.830	60.0	0.115	0.480	0.400	10.00	24.00		5
31.788	60.0	0.173	0.480	0.400	10.00	24.00		5
33.962	60.0	0.115	0.480	0.400	10.00	24.00		5
36.138	60.0	0.115	0.800	0.400	6.00	24.00		5
38.095	60.0	0.115	0.800	0.400	6.00	24.00		5
40.270	60.0	0.115	0.800	0.400	6.00	24.00		5
42.445	60.0	0.115	0.800	0.400	6.00	24.00		5
43.750	60.0	1.458	2.400	0.400	2.00	6.67	2	4
43.750	60.0	1.458	2.400	0.400	2.00	-	2	4
44.000	60.0	1.458	2.400	0.400	2.00	-	2	4

Warnings & Notes	
Note [2]	Amount of shear steel required represents minimum for bursting [PCI Handbook, 7th ed. 5.2.4].
Note [4]	Design shear force at critical section near support used [ACI 318-19::7.4.3.2/9.4.3.2].
Note [5]	Required stirrup spacing represents maximum code requirements [ACI 318-19::9.7.6.2.2].
Note	Shear steel requirements for pre-tension bursting have 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).
**	Allowable reduction within flexural compression zone [ACI 318-19::9.5.4.5]. Limited to half the Total and Al minimum.

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

HORIZONTAL SHEAR DESIGN CHECK BY SECTION

x ft	Horizontal Shear Vu kip	Strength with no ties kip	Maximum Limit ØVnh Max kip	Required Ties Av/s in^2/ft	Tie Size Provided Av in^2	Spacing Required s in	Spacing Provided s in	Strength Required ØVnh kip	Strength Provided ØVnh kip	Warnings & Notes
0.000	0.00	43.20	270.00	0.000	0.40	-	2.00	0.00	270.00	3
0.250	0.00	43.22	270.11	0.000	0.40	-	2.00	0.00	270.11	3
0.250	263.56	43.22	432.18	0.949	0.40	5.06	2.00	263.56	432.18	1 3 4
1.555	203.69	43.20	432.01	0.566	0.40	8.49	6.00	203.69	287.59	1 4
3.730	166.30	43.19	269.93	0.320	0.40	14.99	6.00	166.30	205.15	1
5.905	135.37	43.31	270.68	0.200	0.40	16.00	6.00	157.00	205.72	1 2
7.862	88.64	43.31	270.70	0.200	0.40	16.00	6.00	157.00	205.73	1 2
10.037	86.67	43.31	270.70	0.200	0.40	16.00	10.00	157.00	179.74	1 2
12.213	84.70	43.31	270.70	0.200	0.40	16.00	10.00	157.00	179.74	1 2
14.170	45.01	43.31	270.70	0.200	0.40	16.00	10.00	157.00	179.74	1 2
16.345	43.04	43.31	270.70	0.000	0.40	-	18.00	43.04	162.42	
18.520	41.07	43.31	270.70	0.000	0.40	-	18.00	41.07	162.42	
20.477	1.61	43.31	270.70	0.000	0.40	-	18.00	1.61	162.42	
22.000	0.00	43.31	270.70	0.000	0.40	-	18.00	0.00	162.42	
22.652	-0.69	-43.31	-270.70	0.000	0.40	-	18.00	-0.69	-162.42	
23.523	-1.61	-43.31	-270.70	0.000	0.40	-	18.00	-1.61	-162.42	
25.480	-41.07	-43.31	-270.70	0.000	0.40	-	18.00	-41.07	-162.42	
27.655	-43.04	-43.31	-270.70	0.000	0.40	-	18.00	-43.04	-162.42	
29.830	-45.01	-43.31	-270.70	0.200	0.40	16.00	10.00	-157.00	-179.74	1 2
31.788	-84.70	-43.31	-270.70	0.200	0.40	16.00	10.00	-157.00	-179.74	1 2
33.962	-86.67	-43.31	-270.70	0.200	0.40	16.00	10.00	-157.00	-179.74	1 2
36.138	-88.64	-43.31	-270.70	0.200	0.40	16.00	6.00	-157.00	-205.73	1 2
38.095	-135.37	-43.31	-270.68	0.200	0.40	16.00	6.00	-157.00	-205.72	1 2
40.270	-166.30	-43.19	-269.93	0.320	0.40	14.99	6.00	-166.30	-205.15	1
42.445	-203.69	-43.20	-432.01	0.566	0.40	8.49	6.00	-203.69	-287.59	1 4
43.750	-263.56	-43.22	-432.18	0.949	0.40	5.06	2.00	-263.56	-432.18	1 3 4
43.750	0.00	43.22	270.11	0.000	0.40	-	2.00	0.00	270.11	3
44.000	0.00	43.20	270.00	0.000	0.40	-	2.00	0.00	270.00	3

Warnings & Notes	
Note [1]	Ties required [ACI 318-19::16.4.4.2].
Note [2]	Ties required represent minimum requirement [ACI 318-19::16.4.6.1].
Note [3]	Design shear force at critical section near support used [ACI 318-19::7.4.3.2/9.4.3.2].
Note [4]	Shear resistance based on shear friction [ACI 318-19::16.4.4.1/22.9.4].
Note	Top of precast beam is considered intentionally roughened.
Note	A 1% overstress is allowed without a warning to allow for accuracy of numerical methods (Option G3).

HORIZONTAL SHEAR DESIGN CHECK BY MOMENT REGION

Region of Beam x ft	Shear Length lv ft	Peak Moment M kip.ft	Horizontal Shear Fh kip	Strength with no ties kip	Maximum Limit ØVnh Max kip	Tie Area * Required Acs in^2	Tie Area Provided Acs in^2	Maximum Spacing s in	Warnings & Notes
0.250 to 22.000	21.750	2607.16	693.60	313.20	1957.48	4.35	12.84	16.00	2
22.000 to 43.750	21.750	2607.16	693.60	313.20	1957.48	4.35	12.84	16.00	2

Project: Sample Project
Problem: IT Beam

Warnings & Notes	
Note [2]	Ties required represent minimum requirement [ACI 318-19::16.4.6.1].
*	Required ties should be distributed in proportion to distribution of shear force (or stirrups).
Note	Top of precast beam is considered intentionally roughened.
Note	Horizontal shear force represents the ultimate flexural capacity of the section (Option S10).
Note	A 1% overstress is allowed without a warning to allow for accuracy of numerical methods (Option G3).