

## TYPE 300 T. BEAM

### DESIGN OF PRESTRESS CONCRETE BASS BEAMS TYPE 3047 AND 3067

#### 1. DESIGN CRITERIA

##### 1.2 ULTIMATE LIMIT STATES

The design criteria for prestress beams will be based on serviceability limit states only. Ultimate loads can be used as a check.

##### 1.2 SERVICEABILITY LIMIT STATES

The design of the beams are based on acceptable deflections and cracking as specified in CP110. The different classes of Tables 33,34 and 35 refer.

#### 2. DESIGN PROCEDURE FOR SIMPLY SUPPORTED BEAMS

##### 2.1 PROPERTIES

Type 3047 is a T-Beam with a 500mm wide flange 50 to 40 mm thick and a rib 250 mm deep and 100 to 110 mm wide.

fcu	60	N/sq mm
fci	35	N/sq mm
E	36	kN/sq mm

Table 33 0.2 Limiting crack width 0.1 or 0.2

Table 33 0 Allowed increase in stress

Table 36 0.5 Allow comp stress factor of 0.5 or 0.4 at transfer

	3067	TOPPING
Depth m	0.300	0.300
Area sq m	0.0484500	0.0698500
I m x 4	0.0004000	0.0003800
Yt m	0.1007600	0.1057500
Yb m	0.1992400	0.1942500
Zt m x 3	-0.0039698	-0.0035934
Zb m x 3	0.0020076	0.0019562
b mm	100	100
Table 14	1.00	1.0
Centroid of wires from bottom	0.050500	0.050500
e of wires	0.148740	0.143750
d	0.250	0.250

WIRES Dia dx is depth from top

First (Bottom) 7 mm dx = 276.5

Second (Middle) 7 mm dx = 249.5

Third (Top) two 7 mm dx = 222.5

Aps 230.91 sq mm

Fpu -357.91 kN

fpi -250.53 kN

fpf -225.48 kN

##### 2.2 DESIGN OF BASS BEAMS DURING SCREEDING

The beams are designed unpropped to carry the weight of the screeding.

###### 2.2.1 ASSUMPTIONS

JACK LOSS ASSUMED TO BE 70 %

LOSSES DUE TO CREEP ETC ARE ASSUMED TO BE 30 %

CRACK WIDTH 0.2

DESIGN CLASS 3

###### 2.2.2 LIMITS

Allowable comp stress -19.8 N/sq mm

Allowable tensile stress 6.9 N/sq mm Allow max 15

Not applicable

###### 2.2.3 EXAMPLES (SEE APPENDIX 19 AND 20)

APPENDIX 19 3047 11m Beam

APPENDIX 20 3067 13m Beam (12.8)

A live load of 1 kN/sq m was used as well as the weight of the wet concrete.

Any spans beyond the 11 m for 3047 and 13 m for 3067 will need to be checked individually.

##### 2.3 DESIGN OF BASS BEAMS WITH LIVE LOADS

The beams are designed with UDL only to give an indication of its Load-span capabilities. Each case needs to be separately checked for specific loadings.

###### 2.3.1 ASSUMPTIONS

JACK LOSS ASSUMED TO BE 70 %

LOSSES DUE TO CREEP ETC ARE ASSUMED TO BE 30 %

CRACK WIDTH 0.2

DESIGN CLASS 3

###### 2.3.2 LIMITS

Allowable comp stress -19.8 N/sq mm

Allowable tensile stress 6.9 N/sq mm Allow max 15

NOT APPLICABLE

SPAN Pi/A PIE/Zit Pie/Zib SF\*X M SW MOMENT

0.0	-5.2	9.4	-18.6	0.0	0.0	0.0
0.5	-5.2	9.4	-18.6	2.4	-0.1	2.2
0.9	-5.2	9.4	-18.6	4.7	-0.5	4.2
1.4	-5.2	9.4	-18.6	7.1	-1.1	6.0
1.8	-5.2	9.4	-18.6	9.4	-1.9	7.5
2.3	-5.2	9.4	-18.6	11.8	-2.9	8.8
2.7	-5.2	9.4	-18.6	14.1	-4.2	9.9
3.2	-5.2	9.4	-18.6	16.5	-5.8	10.7
3.6	-5.2	9.4	-18.6	18.8	-7.5	11.3
4.1	-5.2	9.4	-18.6	21.2	-9.5	11.7
4.5	-5.2	9.4	-18.6	23.5	-11.8	11.8
5.0	-5.2	9.4	-18.6	25.9	-14.2	11.7

5.4	-5.2	9.4	-18.6	28.3	-17.0	11.3
5.9	-5.2	9.4	-18.6	30.6	-19.9	10.7
6.3	-5.2	9.4	-18.6	33.0	-23.1	9.9
6.8	-5.2	9.4	-18.6	35.3	-26.5	8.8
7.2	-5.2	9.4	-18.6	37.7	-30.1	7.5
7.7	-5.2	9.4	-18.6	40.0	-34.0	6.0
8.1	-5.2	9.4	-18.6	42.4	-38.1	4.2
8.6	-5.2	9.4	-18.6	44.7	-42.5	2.2
9.0	-5.2	9.4	-18.6	47.1	-47.1	0.0

AFTER LOSSES

	M/zit	M/zib	Top	Bott	Top	Bott
	0.0	0.0	4.2	-23.7	3.8	-21.4
	-0.6	1.1	3.7	-22.6	3.2	-20.2
	-1.1	2.1	3.1	-21.6	2.7	-19.2
	-1.5	3.0	2.7	-20.7	2.3	-18.4
	-1.9	3.8	2.3	-20.0	1.9	-17.6
	-2.2	4.4	2.0	-19.3	1.6	-17.0
	-2.5	4.9	1.7	-18.8	1.3	-16.4
	-2.7	5.3	1.5	-18.4	1.1	-16.0
	-2.8	5.6	1.4	-18.1	0.9	-15.7
	-2.9	5.8	1.3	-17.9	0.9	-15.6
	-3.0	5.9	1.3	-17.9	0.8	-15.5
	-2.9	5.8	1.3	-17.9	0.9	-15.6
	-2.8	5.6	1.4	-18.1	0.9	-15.7
	-2.7	5.3	1.5	-18.4	1.1	-16.0
	-2.5	4.9	1.7	-18.8	1.3	-16.4
	-2.2	4.4	2.0	-19.3	1.6	-17.0
	-1.9	3.8	2.3	-20.0	1.9	-17.6
	-1.5	3.0	2.7	-20.7	2.3	-18.4
	-1.1	2.1	3.1	-21.6	2.7	-19.2
	-0.6	1.1	3.7	-22.6	3.2	-20.2
	0.0	0.0	4.2	-23.7	3.8	-21.4

Allowable comp stress % fci -17.5 N/sq mm  
 Allowable tensile stress fti 3.5 N/sq mm

After losses

top 4.2 N/sq mm 3.8  
 bottom -23.7 N/sq mm -21.4

**APPENDIX 18 REV 1**

JOB INPUT INFORMATION

VARIABLES

SPAN	13.0 m	BEAM DEPTH	300 mm
		SCREED	0 mm
		BOTTOM DIA	7 mm
JACK LOSS	70 % (70 TO 80%)	MIDDLE DIA	7 mm
CREEP ETC LOSS	30 % (10 TO 30 %)	TOP DIA	7 mm
CRACK WIDTH	0.1 (0.1 OR 0.2)	DESIGN CLAS	1 (1,2,3)
UDL kN/sq m	:	UDL kN/m i.e. per beam	
	: BEAM SW	1.16 kN/m	
		: TOPPING	0.00 kN/m
FINISHES	0.0 kN/sq m	: FINISHES	0.00 kN/m
		: LIVE	0.50 kN/m
LIVE	1.0 kN/sq m	: TOTAL	1.66 kN/m

DESIGN OF BASS BEAMS IN POSITION PRIOR TO SCREEDING

SPAN	13.0 m	BEAM LENGTH	13.0 m
CENTROID OF BEAM FROM LE	6.50	RATIO L	0.50
CENTROID OF BEAM FROM RI	6.50	RATIO R	0.50

TOTAL W	21.6 kN
LEFT SUPPORT	10.8 kN
RIGHT SUPPORT	10.8 kN

APPENDIX 18 REV 1

Allowable comp stress	-19.8 N/sq mm
Allowable tensile stress	0.0 N/sq mm Allow max 15
MAIN TOP	3.0 N/sq mm -5.9
SPAN BOTTOM	16.6 N/sq mm 0.9

**APPENDIX 19 REV 1**

JOB INPUT INFORMATION

VARIABLES

SPAN	11.0 m	BEAM DEPTH	300 mm
		SCREED	50 mm
		BOTTOM DIA	7 mm
JACK LOSS	70 % (70 TO 80%)	MIDDLE DIA	7 mm
CREEP ETC LOSS	30 % (10 TO 30 %)	TOP DIA	0 mm
CRACK WIDTH	0.2 (0.1 OR 0.2)	DESIGN CLAS	3 (1,2,3)
UDL kN/sq m	:	UDL kN/m i.e. per beam	
	: BEAM SW	1.16 kN/m	
		: TOPPING	0.60 kN/m
FINISHES	0.0 kN/sq m	: FINISHES	0.00 kN/m
		: LIVE	0.50 kN/m
LIVE	1.0 kN/sq m	: TOTAL	2.26 kN/m

DESIGN OF BASS BEAMS DURING SCREEDING

SPAN 11.0 m	BEAM LENGTH 11.0 m
CENTROID OF BEAM FROM LE	5.50 RATIO L 0.50
CENTROID OF BEAM FROM RI	5.50 RATIO R 0.50
TOTAL SW	12.8 kN TOTAL W 24.9 kN
TOTAL SCREED	6.6 kN
LEFT SUPPORT	12.4 kN
RIGHT SUPPORT	12.4 kN
Allowable comp stress	-19.8 N/sq mm
Allowable tensile stress	6.5 N/sq mm Allow max 15
MAIN TOP	2.4 N/sq mm -6.3
SPAN BOTTOM	11.9 N/sq mm 5.2

**APPENDIX 20**

REV 1

JOB INPUT INFORMATION

VARIABLES

SPAN	12.8 m	BEAM DEPTH	300 mm
		SCREED	50 mm
		BOTTOM DIA	7 mm
JACK LOSS	70 % (70 TO 80%)	MIDDLE DIA	7 mm
CREEP ETC LOSS	30 % (10 TO 30 %)	TOP DIA	7 mm
CRACK WIDTH	0.2 (0.1 OR 0.2)	DESIGN CLAS	3 (1,2,3)
UDL kN/sq m		UDL kN/m i.e. per beam	
	BEAM SW	1.16 kN/m	
FINISHES	0.0 kN/sq m	TOPPING	0.60 kN/m
		FINISHES	0.00 kN/m
LIVE	1.0 kN/sq m	LIVE	0.50 kN/m
		TOTAL	2.26 kN/m

DESIGN OF BASS BEAMS DURING SCREEDING

SPAN 12.8 m	BEAM LENGTH 12.8 m
CENTROID OF BEAM FROM LE	6.40 RATIO L 0.50
CENTROID OF BEAM FROM RI	6.40 RATIO R 0.50
TOTAL SW	14.9 kN TOTAL W 29.0 kN
TOTAL SCREED	7.7 kN
LEFT SUPPORT	14.5 kN
RIGHT SUPPORT	14.5 kN
Allowable comp stress	-19.8 N/sq mm
Allowable tensile stress	6.5 N/sq mm Allow max 15
MAIN TOP	3.0 N/sq mm -8.7
SPAN BOTTOM	-16.6 N/sq mm 6.5

**APPENDIX 21**

JOB INPUT INFORMATION

VARIABLES

SPAN	8.0 m	BEAM DEPTH	300 mm
		SCREED	50 mm
		BOTTOM DIA	7 mm
JACK LOSS	70 % (70 TO 80%)	MIDDLE DIA	7 mm
CREEP ETC LOSS	30 % (10 TO 30 %)	TOP DIA	0 mm
CRACK WIDTH	0.2 (0.1 OR 0.2)	DESIGN CLAS	3 (1,2,3)
UDL kN/sq m		UDL kN/m i.e. per beam	
	BEAM SW	1.16 kN/m	
FINISHES	0.0 kN/sq m	TOPPING	0.60 kN/m
		FINISHES	0.00 kN/m
LIVE	6.0 kN/sq m	LIVE	3.00 kN/m
		TOTAL	4.76 kN/m

POINT LOADS PER BEAM

POSITION FROM LEFT

EQUIVALENT UDL

LOAD 1	0 kN	0 m	0.00
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DESIGN OF BASS BEAMS WITH LIVE LOADS

SPAN 8.0 m	BEAM LENGTH 8.0 m
CENTROID OF BEAM FROM LE	4.00 RATIO L 0.50
CENTROID OF BEAM FROM RI	4.00 RATIO R 0.50
POINT LOAD 1	RATIO L 1.00
	RATIO R 0.00
TOTAL SW	9.3 kN TOTAL DL 14.1 kN
TOTAL SCREED	4.8 kN TOTAL LL 24.0 kN
TOTAL FINISHES	0.0 kN TOTAL 38.1 kN
TOTAL LIVE LOAD	24.0 kN
LEFT SUPPORT	7.1 12.0 0.0 19.1 kN
RIGHT SUPPORT	7.1 12.0 0.0 19.1 kN

**APPENDIX 22**

JOB INPUT INFORMATION

VARIABLES

SPAN	11.0 m	BEAM DEPTH	300 mm
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JACK LOSS	70 % (70 TO 80%)	SCREED	50 mm
CREEP ETC LOSS	30 % (10 TO 30 %)	BOTTOM DIA	7 mm
CRACK WIDTH	0.2 (0.1 OR 0.2)	MIDDLE DIA	7 mm
		TOP DIA	0 mm
		DESIGN CLAS	3 (1,2,3)
UDL kN/sq m		UDL kN/m i.e. per beam	
	BEAM SW	1.16 kN/m	
FINISHES	0.0 kN/sq m	TOPPING	0.60 kN/m
		FINISHES	0.00 kN/m
LIVE	1.5 kN/sq m	LIVE	0.75 kN/m
		TOTAL	2.51 kN/m

POINT LOADS PER BEAM	POSITION FROM LEFT	EQUIVALENT UDL
LOAD 1	0 kN	0 m
		0.00

#### DESIGN OF BASS BEAMS WITH LIVE LOADS

SPAN	11.0 m	BEAM LENGTH	11.0 m
CENTROID OF BEAM FROM LE	5.50	RATIO L	0.50
CENTROID OF BEAM FROM RI	5.50	RATIO R	0.50
POINT LOAD 1		RATIO L	1.00
		RATIO R	0.00
TOTAL SW	12.8 kN	TOTAL DL	19.4 kN
TOTAL SCREED	6.6 kN	TOTAL LL	8.3 kN
TOTAL FINISHES	0.0 kN	TOTAL	27.6 kN
TOTAL LIVE LOAD	8.3 kN		
LEFT SUPPORT	9.7	4.1	0.0
RIGHT SUPPORT	9.7	4.1	0.0

#### APPENDIX 23

##### JOB INPUT INFORMATION

SPAN	8.0 m	BEAM DEPTH	300 mm
		SCREED	50 mm
		BOTTOM DIA	7 mm
JACK LOSS	70 % (70 TO 80%)	MIDDLE DIA	7 mm
CREEP ETC LOSS	30 % (10 TO 30 %)	TOP DIA	7 mm
CRACK WIDTH	0.2 (0.1 OR 0.2)	DESIGN CLAS	3 (1,2,3)

UDL kN/sq m		UDL kN/m i.e. per beam	
	BEAM SW	1.16 kN/m	
FINISHES	0.0 kN/sq m	TOPPING	0.60 kN/m
		FINISHES	0.00 kN/m
LIVE	10.0 kN/sq m	LIVE	5.00 kN/m
		TOTAL	6.76 kN/m

POINT LOADS PER BEAM	POSITION FROM LEFT	EQUIVALENT UDL
LOAD 1	0 kN	0 m
		0.00

#### DESIGN OF BASS BEAMS WITH LIVE LOADS

SPAN	8.0 m	BEAM LENGTH	8.0 m
CENTROID OF BEAM FROM LE	4.00	RATIO L	0.50
CENTROID OF BEAM FROM RI	4.00	RATIO R	0.50
POINT LOAD 1		RATIO L	1.00
		RATIO R	0.00
TOTAL SW	9.3 kN	TOTAL DL	14.1 kN
TOTAL SCREED	4.8 kN	TOTAL LL	40.0 kN
TOTAL FINISHES	0.0 kN	TOTAL	54.1 kN
TOTAL LIVE LOAD	40.0 kN		
LEFT SUPPORT	7.1	20.0	0.0
RIGHT SUPPORT	7.1	20.0	0.0

#### APPENDIX 24

##### JOB INPUT INFORMATION

SPAN	12.0 m	BEAM DEPTH	300 mm
		SCREED	50 mm
		BOTTOM DIA	7 mm
JACK LOSS	70 % (70 TO 80%)	MIDDLE DIA	7 mm
CREEP ETC LOSS	30 % (10 TO 30 %)	TOP DIA	7 mm
CRACK WIDTH	0.2 (0.1 OR 0.2)	DESIGN CLAS	3 (1,2,3)

UDL kN/sq m		UDL kN/m i.e. per beam	
	BEAM SW	1.16 kN/m	
FINISHES	0.0 kN/sq m	TOPPING	0.60 kN/m
		FINISHES	0.00 kN/m
LIVE	1.5 kN/sq m	LIVE	0.75 kN/m

: TOTAL 2.51 kN/m

POINT LOADS PER BEAM	POSITION FROM LEFT	EQUIVALENT UDL
LOAD 1	0 kN	0 m
		0.00

**DESIGN OF BASS BEAMS WITH LIVE LOADS**

SPAN 12.0 m	BEAM LENGTH 12.0 m		
CENTROID OF BEAM FROM LE	6.00	RATIO L	0.50
CENTROID OF BEAM FROM RI	6.00	RATIO R	0.50
POINT LOAD 1		RATIO L	1.00
		RATIO R	0.00
TOTAL SW	14.0 kN	TOTAL DL	21.2 kN
TOTAL SCREED	7.2 kN	TOTAL LL	9.0 kN
TOTAL FINISHES	0.0 kN	TOTAL	30.2 kN
TOTAL LIVE LOAD	9.0 kN		
LEFT SUPPORT	10.6 4.5	0.0	15.1 kN
RIGHT SUPPORT	10.6 4.5	0.0	15.1 kN

**APPENDIX 25**

4.3.7 DEFLECTIONS OF BEAMS

4.3.7.1 CLASS 1 AND CLASS 2 MEMBERS

Deflections may be calculated using elastic analysis

4.3.7.2 CLASS 3 MEMBERS

As per Class 2 and Class 3 if permanent load < 25 % of design imposed load

Where permanent load exceeds 25 % then Tables 7 and 8 only i.e. span/20 for effective depth

SPAN	UDL	6	3047	INITIAL	FINAL
8.0					
Elastic deflection due to Prestress			-15		-11
$P.e.l./8EI$					
Elastic deflection due to self wt			4		4
$5wl^4/384EI$					
Elastic deflection due to topping					2
$5wl^4/384EI$					
Elastic deflection due to UDL					11
$5wl^4/384EI$					
Elastic deflection due to P					0
Elastic deflect due to creep					-2
	-11 Hogging at transfer				
	-6 Prior to loading				
	5 Final deflection				

**APPENDIX 15**

SPAN	UDL	1.5	3047	INITIAL	FINAL
11.0					
Elastic deflection due to Prestress			-28		-20
$P.e.l./8EI$					
Elastic deflection due to self wt			15		15
$5wl^4/384EI$					
Elastic deflection due to topping					8
$5wl^4/384EI$					
Elastic deflection due to UDL					10
$5wl^4/384EI$					
Elastic deflection due to P					0
Elastic deflect due to creep					-2
	-13 Hogging at transfer				
	1 Prior to loading				
	11 Final deflection				