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Design Note No. DN3

Span Tables for Simply Supported Composite Beams

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1. Introduction

This design note contains span tables covering various primary and secondary beam spans with common design floor loadings. It is intended that these tables will be used by Engineers to assist in the preliminary design of a composite steel and concrete floor system. The solutions provided may be conservative, but can be refined during the final design process.

2. Design Criteria

These tables were generated using CompPanel® version 3.0 software. This software assists in the design of simply supported beams in accordance with Australian Standard AS/NZS 2327: 2017.

2.1 Design Variables

The following factors represent the variables in the design charts

- **Design Loads** Standard offices
  Premium offices
  Standard retail
  Premium retail
  Plant rooms
  Compactus areas
  Carparking
- **Secondary Beam Spans** from 8 to 17m
- **Primary Beam Spans** from 8 to 12m.

2.2 Fixed Design Variables

The design variables that have been fixed in these tables are:

- **300PLUS®** Grade beams – as these are widely recognised as being the most economical
- **Re-entrant profiled steel decking** – this is the traditional decking type in Australia
- **1.0mm decking** – as this is commonly available and generally result in more economical floor system than 0.75mm thick decking
- **2.8m secondary beam spacing** – common span for 1.0mm re-entrant decking
- **Slab thickness** – the slab thickness tabulated for each load condition is considered the most economical for that particular design load
- **Deflection criteria** – the criteria adopted is that commonly required in practice for the design loading. Eg. a premium retail has incremental deflection criteria of span/500 while a standard retail has an incremental deflection criterion of span/300.
- Incremental Deflection – is the sum of the creep and In-service shrinkage based on 300μ strain and the short term live load ($\Psi s.Q$).
- Maximum Camber of 50mm – the camber is determined by summing the deflection due to self weight of the wet concrete, ponding and steel beam and rounding down to the nearest 5mm
- No Propping – to maximise speed of construction

These criteria will suit preliminary design for most applications. However should the design variables be significantly different from those available in the tables the preliminary design should be produced from first principles using AS/NZS 2327 and design tools such as CompPanel.

3. Design Charts

The design information provided by the charts in Table 1 to Table 4 include the following:

- Secondary and primary beam sizes
- No of 19mm diameter x 95mm shear studs
- Beam camber
- Slab thickness
- Concrete strength.

These values will enable a designer to develop a preliminary design suitable for costing typical bays.

4. Supporting Design Aids and Tools

Numerous design aids and tools are available to support these charts including CompPanel and CompPen®.

4.1 CompPanel

CompPanel has the capacity to check other design options not covered by these tables including, trapezoidal decks, edge beams, non prismatic sections, varying slab widths, propped construction and load combinations.

4.2 Floor Vibrations

These tables do not cover a check on floor vibrations. A separate check will need to be performed to determine the acceptability of the floor for floor vibrations. Users of this technical note are directed to AS/NZS 2327 :2017 Section 6.4 and the SCI Publication – "SCI P354 - Design of floors for vibration: A new approach".

Table 1 – Office Floors

Span (m)	Spacing (m)	Standard Offices Q = 3 + 1.5			Premium Offices Q = 4 + 1.5		
		Beam 300PLUS®	Camber (mm)	Nos studs per beam	Beam 300PLUS®	Camber (mm)	No. studs per beam
Secondary Beams							
8	2.8	310UB40.4	25	21	310UB40.4	25	21
9	2.8	310UB46.2	40	23	310UB46.2	40	30
10	2.8	360UB50.7	40	26	360UB50.7	40	34
11	2.8	410UB53.7	45	28	410UB53.7	45	36
12	2.8	460UB67.1	40	31	460UB67.1	40	31
13	2.8	460UB74.6	50	34	460UB74.6	50	41
14	2.8	530UB82.0	50	42	530UB82.0	50	42
15	2.8	610UB101	40	50	610UB101	40	50
16	2.8	610UB113	45	50	610UB113	45	50
17	2.8	700WB115	45	58	700WB115	45	58
Primary Beams							
8	8	460UB74.6	20	28	460UB82.1	20	28
8	9	530UB82.0	0	28	530UB92.4	0	28
8	10	530UB92.4	0	28	610UB101	0	28
8	11	610UB101	0	28	610UB101	0	28
8	12	610UB101	0	28	610UB101	0	28
8	13	610UB101	0	28	610UB101	0	33
8	14	610UB113	0	28	610UB125	0	28
8	15	610UB125	0	28	610UB125	0	33
8	16	700WB115	0	28	700WB115	0	29
8	17	700WB115	0	28	700WB130	0	28
8.4	8	460UB67.1	25	34	460UB74.6	20	34
8.4	9	460UB74.6	25	34	460UB82.1	25	34
8.4	10	460UB82.1	25	34	530UB82.0	20	34
8.4	11	530UB82.0	20	34	530UB92.4	20	34
8.4	12	530UB92.4	20	34	530UB92.4	20	38
8.4	13	610UB101	0	30	610UB101	0	34
8.4	14	610UB101	0	34	610UB113	0	34
8.4	15	610UB101	20	34	610UB113	0	38
8.4	16	610UB113	20	34	610UB125	0	34
8.4	17	610UB125	0	34	610UB125	0	42
9	8	530UB82.0	25	32	530UB92.4	20	32
9	9	530UB92.4	25	32	610UB101	0	32
9	10	610UB101	20	32	610UB101	20	32
9	11	610UB101	20	32	610UB113	0	33
9	12	610UB125	0	30	610UB125	0	33
9	13	610UB125	20	30	700WB115	0	32
9	14	700WB115	0	32	700WB130	0	32
9	15	700WB130	0	32	700WB130	0	32
9	16	700WB130	0	32	700WB130	0	45
9	17	700WB130	0	37	700WB150	0	35
10	8	610UB101	20	40	610UB101	20	40
10	9	610UB101	25	40	610UB113	20	36
10	10	610UB125	20	36	610UB125	20	36
10	11	610UB125	25	36	700WB115	20	40
10	12	700WB115	20	40	700WB130	0	40
10	13	700WB130	20	40	700WB130	20	40
10	14	700WB130	20	40	700WB150	0	36
10	15	700WB150	20	36	700WB150	20	51
10	16	700WB173	0	36	700WB173	0	36
10	17	700WB173	20	36	700WB173	20	49
11	8	610UB101	30	46	610UB113	25	44
11	9	610UB125	25	44	700WB115	25	46
11	10	700WB115	25	46	700WB115	25	46
11	11	700WB130	25	46	700WB130	25	46
11	12	700WB130	25	46	700WB150	20	44
11	13	700WB150	25	44	700WB150	25	55
11	14	700WB173	20	44	700WB173	20	44
11	15	700WB173	20	44	700WB173	20	63
11	16	700WB173	25	49	800WB168	20	77
11	17	800WB168	20	53	800WB192	0	44
12	8	610UB125	35	50	700WB115	30	54
12	9	700WB130	30	54	700WB130	30	54
12	10	700WB130	30	54	700WB130	30	54
12	11	700WB150	30	50	700WB150	30	50
12	12	700WB173	25	50	700WB173	25	50
12	13	700WB173	30	50	800WB168	25	50
12	14	800WB168	25	50	800WB168	25	89
12	15	800WB192	25	50	800WB192	25	51
12	16	800WB192	25	50	900WB175	25	54
12	17	800WB192	25	81	900WB218	20	50

Assumptions:

120 mm Slab, F'c =25 MPa, 2400 kg/m2 on decking with pan width 200mm, Un-propped, 10mm ponding allowance
Incremental Defl limit < Span / 300, Total Defl limit < Span / 250

Table 2 – Retail Floors

Span (m)	Spacing (m)	Standard Retail Q = 5 + 1, non reducible			Premium Retail Q = 5 + 2.5, non reducible		
		Beam 300PLUS®	Camber (mm)	Nos studs per beam	Beam 300PLUS®	Camber (mm)	No. studs per beam
Secondary Beams							
8	2.8	310UB40.4	25	26	360UB44.7	20	26
9	2.8	310UB46.2	40	40	360UB56.7	25	32
10	2.8	360UB56.7	35	40	460UB67.1	20	28
11	2.8	410UB53.7	45	50	460UB67.1	30	44
12	2.8	460UB67.1	40	51	530UB82.0	25	37
13	2.8	460UB74.6	50	51	610UB101	20	40
14	2.8	530UB82.0	50	63	610UB101	30	46
15	2.8	610UB101	40	50	700WB115	25	50
16	2.8	610UB113	45	57	700WB115	35	54
17	2.8	700WB115	45	58	700WB150	30	56
Primary Beams							
8	8	530UB82.0	0	53	610UB101	0	28
8	9	530UB92.4	0	61	610UB113	0	35
8	10	610UB101	0	37	610UB125	0	39
8	11	610UB113	0	51	700WB115	0	39
8	12	610UB125	0	53	700WB130	0	31
8	13	700WB115	0	49	700WB130	0	57
8	14	700WB130	0	37	700WB150	0	47
8	15	700WB130	0	65	700WB173	0	31
8	16	700WB150	0	51	700WB173	0	51
8	17	700WB173	0	31	800WB192	0	28
8.4	8	460UB82.1	20	54	610UB101	0	30
8.4	9	610UB101	0	30	610UB113	0	29
8.4	10	610UB101	0	30	610UB125	0	29
8.4	11	610UB101	0	36	700WB115	0	30
8.4	12	610UB101	0	56	700WB115	0	36
8.4	13	610UB113	0	76	700WB115	0	56
8.4	14	610UB125	0	70	700WB130	0	42
8.4	15	700WB115	0	62	700WB130	0	72
8.4	16	700WB130	0	44	700WB150	0	58
8.4	17	700WB130	0	70	700WB173	0	40
9	8	610UB101	0	35	700WB115	0	32
9	9	610UB101	0	73	700WB115	0	41
9	10	610UB125	0	63	700WB130	0	37
9	11	700WB115	0	65	700WB150	0	37
9	12	700WB130	0	51	700WB173	0	30
9	13	700WB150	0	47	700WB173	0	51
9	14	700WB173	0	31	800WB168	0	69
9	15	700WB173	0	57	800WB192	0	39
9	16	800WB168	0	75	900WB175	0	41
9	17	800WB192	0	37	900WB175	0	61
10	8	610UB113	20	79	700WB130	0	40
10	9	700WB115	0	51	700WB150	0	36
10	10	700WB130	0	47	700WB150	0	67
10	11	700WB150	0	47	700WB173	0	49
10	12	700WB173	0	36	800WB168	0	79
10	13	700WB173	0	73	800WB192	0	49
10	14	800WB192	0	36	900WB175	0	51
10	15	800WB192	0	57	900WB175	0	83
10	16	900WB175	0	53	900WB218	0	39
10	17	900WB175	0	79	900WB218	0	63
11	8	700WB115	20	63	700WB173	0	44
11	9	700WB130	20	65	700WB173	0	44
11	10	700WB150	0	75	800WB168	0	53
11	11	700WB173	0	55	800WB192	0	44
11	12	800WB168	0	89	900WB175	0	47
11	13	800WB192	0	55	900WB175	0	83
11	14	900WB175	0	55	900WB218	0	44
11	15	900WB218	0	44	900WB218	0	69
11	16	900WB218	0	45	900WB257	0	44
11	17	900WB218	0	67	900WB257	0	61
12	8	700WB150	20	55	800WB168	0	50
12	9	700WB173	20	51	800WB192	0	50
12	10	800WB168	0	95	900WB175	0	54
12	11	800WB192	0	69	900WB218	0	50
12	12	900WB175	0	65	900WB218	0	53
12	13	900WB218	0	50	900WB257	0	50
12	14	900WB218	0	61	900WB257	0	53
12	15	900WB257	0	50	900WB282	0	50
12	16	900WB257	0	57	900WB282	0	81
12	17	900WB282	0	50	1000WB296	0	61

Assumptions:

120 mm Slab, F'c =25 Mpa, 2400 kg/m2 on decking with pan width 200mm, Un-propped, 10mm ponding allowance
Standard Grade Retail: Incremental Defl limit < Span / 300, Total Defl limit < Span / 250
Premium Grade Retail: Incremental Defl limit < Span / 500, Total Defl limit < Span / 300,

Table 3 – Plant room and Compactus Floors

Span (m)	Spacing (m)	Plant Room Q = 7.5 + 1, non reducible			Compactus / Library Q = 10 + 1, non reducible		
		Beam 300PLUS®	Camber (mm)	Nos studs per beam	Beam 300PLUS®	Camber (mm)	No. studs per beam
Secondary Beams							
8	2.8	360UB50.7	20	23	460UB67.1	0	24
9	2.8	410UB53.7	25	30	530UB82.0	0	31
10	2.8	460UB67.1	25	30	460UB74.6	20	42
11	2.8	460UB82.1	30	36	530UB82.0	20	46
12	2.8	530UB82.0	30	42	610UB101	20	38
13	2.8	610UB101	25	38	610UB101	25	60
14	2.8	610UB101	40	54	610UB125	30	60
15	2.8	610UB125	40	60	700WB130	25	60
16	2.8	700WB130	35	64	700WB150	30	74
17	2.8	700WB130	45	75	700WB173	30	84
Primary Beams							
8	8	610UB113	0	38	700WB115	0	40
8	9	700WB115	0	40	700WB130	0	43
8	10	700WB130	0	43	700WB150	0	43
8	11	700WB130	0	43	700WB173	0	43
8	12	700WB150	0	43	700WB173	0	63
8	13	700WB173	0	43	800WB168	0	85
8	14	700WB173	0	45	800WB192	0	59
8	15	800WB168	0	59	900WB175	0	51
8	16	800WB192	0	43	900WB218	0	43
8	17	900WB175	0	43	900WB218	0	43
8.4	8	610UB101	0	41	610UB125	0	45
8.4	9	610UB113	0	43	700WB115	0	45
8.4	10	610UB125	0	45	700WB130	0	49
8.4	11	700WB115	0	45	700WB130	0	63
8.4	12	700WB130	0	49	700WB150	0	65
8.4	13	700WB130	0	55	700WB173	0	53
8.4	14	700WB150	0	51	700WB173	0	97
8.4	15	700WB173	0	49	800WB192	0	49
8.4	16	700WB173	0	63	900WB175	0	49
8.4	17	800WB168	0	69	900WB175	0	57
9	8	700WB115	0	42	700WB130	0	65
9	9	700WB130	0	48	700WB173	0	57
9	10	700WB150	0	47	700WB173	0	75
9	11	700WB173	0	47	800WB168	0	117
9	12	700WB173	0	67	800WB192	0	93
9	13	800WB192	0	47	900WB218	0	72
9	14	800WB192	0	65	900WB218	0	72
9	15	900WB175	0	57	900WB218	0	72
9	16	900WB218	0	47	900WB257	0	72
9	17	900WB218	0	47	900WB257	0	73
10	8	700WB150	0	54	700WB173	0	56
10	9	700WB173	0	56	800WB168	0	89
10	10	700WB173	0	61	800WB192	0	79
10	11	800WB192	0	56	900WB218	0	56
10	12	800WB192	0	73	900WB218	0	56
10	13	900WB218	0	56	900WB218	0	87
10	14	900WB218	0	56	900WB257	0	56
10	15	900WB218	0	59	900WB257	0	93
10	16	900WB257	0	56	900WB282	0	75
10	17	900WB257	0	56	1000WB296	0	56
11	8	700WB173	0	66	800WB168	0	105
11	9	800WB168	0	62	800WB192	0	109
11	10	800WB192	0	66	900WB218	0	66
11	11	800WB192	0	115	900WB218	0	69
11	12	900WB218	0	66	900WB257	0	66
11	13	900WB218	0	66	900WB257	0	91
11	14	900WB257	0	66	900WB282	0	85
11	15	900WB257	0	66	1000WB296	0	66
11	16	900WB257	0	113	1000WB296	0	93
11	17	900WB282	0	87	1000WB322	0	85
12	8	800WB192	0	76	900WB218	0	78
12	9	800WB192	0	101	900WB218	0	78
12	10	900WB218	0	78	900WB257	0	78
12	11	900WB218	0	78	900WB257	0	111
12	12	900WB257	0	78	900WB282	0	117
12	13	900WB257	0	89	1000WB296	0	78
12	14	900WB282	0	79	1000WB322	0	78
12	15	1000WB296	0	78	1200WB317	0	78
12	16	1000WB296	0	91	1200WB317	0	93
12	17	1000WB322	0	79	1200WB342	0	89

Assumptions:

150mm Slab, F'c =32 Mpa, 2400 kg/m2 on decking with pan width 200mm, Un-propped, 10mm ponding allowance
Plant Room: Incremental Defl limit < Span / 300, Total Defl limit < Span / 250,
Compactus / Library: Incremental Defl limit < Span / 300, Total Defl limit < Span / 250,

Table 4 - Carparks

Span (m)	Spacing (m)	Carparks Q = 2.5 + 0.1		
		Beam 300PLUS	Camber (mm)	No. studs per beam
Secondary Beams				
8	2.8	310UB40.4	30	21
9	2.8	310UB46.2	40	23
10	2.8	360UB50.7	45	26
11	2.8	410UB53.7	50	28
12	2.8	460UB67.1	45	31
13	2.8	460UB82.1	50	33
14	2.8	530UB92.4	45	38
15	2.8	610UB101	45	46
16	2.8	610UB113	50	50
17	2.8	700WB115	50	62
Primary Beams				
8	8	460UB74.6	25	27
8	9	460UB82.1	25	29
8	10	530UB82.0	20	30
8	11	530UB92.4	20	32
8	12	530UB92.4	20	32
8	13	610UB101	0	34
8	14	610UB101	20	34
8	15	610UB113	0	34
8	16	610UB125	0	34
8	17	610UB125	0	34
8.4	8	460UB67.1	25	30
8.4	9	460UB67.1	30	30
8.4	10	460UB74.6	30	32
8.4	11	460UB82.1	30	34
8.4	12	530UB82.0	25	36
8.4	13	530UB92.4	25	38
8.4	14	610UB101	20	36
8.4	15	610UB101	20	40
8.4	16	610UB101	20	40
8.4	17	610UB113	20	40
9	8	530UB82.0	25	32
9	9	530UB92.4	25	36
9	10	530UB92.4	30	36
9	11	610UB101	20	39
9	12	610UB101	25	39
9	13	610UB125	20	39
9	14	610UB125	20	39
9	15	700WB115	20	40
9	16	700WB130	0	40
9	17	700WB130	20	40
10	8	530UB92.4	35	38
10	9	610UB101	25	42
10	10	610UB101	30	42
10	11	610UB125	25	44
10	12	610UB125	30	44
10	13	700WB115	25	46
10	14	700WB130	25	49
10	15	700WB130	25	49
10	16	700WB150	20	44
10	17	700WB150	25	45
11	8	610UB101	35	44
11	9	610UB113	35	44
11	10	610UB125	35	48
11	11	700WB115	30	50
11	12	700WB130	25	56
11	13	700WB130	30	56
11	14	700WB150	25	52
11	15	700WB150	30	52
11	16	700WB173	25	52
11	17	700WB173	25	53
12	8	610UB125	40	52
12	9	700WB115	35	54
12	10	700WB130	35	60
12	11	700WB130	35	60
12	12	700WB150	35	62
12	13	700WB173	30	62
12	14	700WB173	35	62
12	15	800WB168	30	62
12	16	800WB192	25	62
12	17	800WB192	30	65

Example

Refer to pages 6 & 7

← Select for B1

← Select for B2

← Select for PB1

← Select for PB2

← Select for PB3

Assumptions:

130mm Slab, F'c = 40MPa, 2400 kg/m2 on decking with pan width 200mm,
Un-propped, 10mm ponding allowance
Incremental Defl limit < Span / 300, Total Defl limit < Span / 250.

Example
The following example illustrates how the preceding tables can be used for preliminary designs.

Consider the carpark layout below, using Table 4 determine preliminary beam sizing for both the primary and secondary beams.

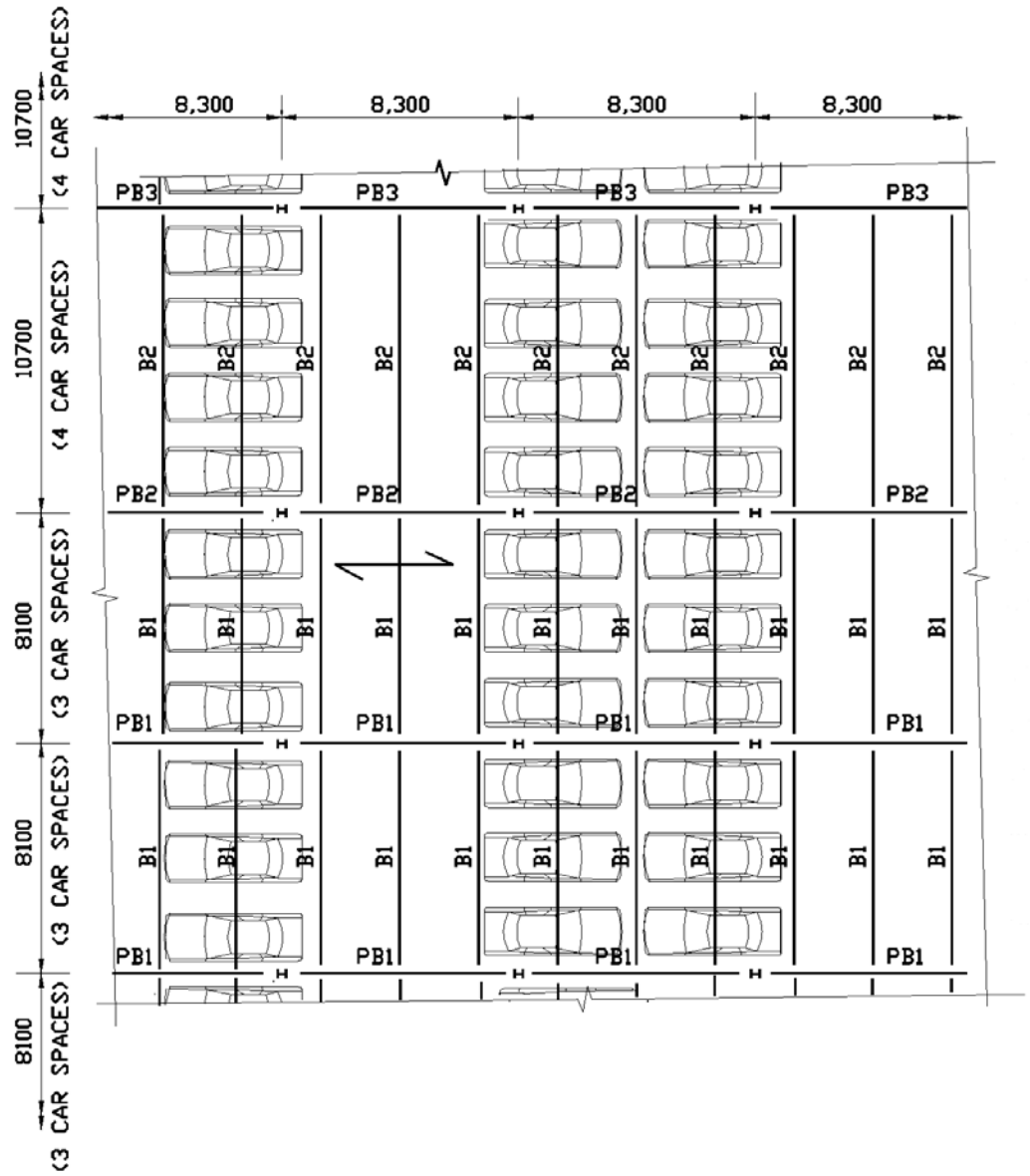

Figure 1 – Typical framing plan of Carpark Interior Bays

Summary of beam designs

Beam Mark	300PLUS® Beam Size	Camber mm	No. of Studs
B1	310UB40.4	30	21
B2	410UB53.7	50	28
PB1	460UB67.1	25	30
PB2	460UB74.6	30	32
PB3	460UB82.1	30	34

5.1 Selecting the beams

Determine the most appropriate table for the floor usage/loading. In this case it is obviously Table 4. Beam sizes can be determined by reading directly off the span and spacing. Interpolation and engineering judgment should be exercised to obtain the appropriate preliminary design.

Secondary Beams:

B1 : Span = 8.1m, spacing = 2.8m
Therefore read for 8m span –
310 UB 40.4 with 30mm camber and 21 studs.

B2 : Span = 10.7m, spacing = 2.8m
Therefore read for 11m span –
410 UB 53.7 with 50mm camber and 28 studs.

Primary Beams:

PB1 : Span = 8.3m, spacing = 8.1m
Therefore read for 8.4m span & 8m spacing –
460 UB 67.1 with 25mm camber and 30 studs.

PB2: Span = 8.3m

$$\text{Spacing} = \frac{8.1 + 10.7}{2} = 9.4\text{m} \quad \text{say } 10\text{m}$$

Therefore read for 8.4m span & 10m spacing –
460 UB 74.6 with 30mm camber and 32 studs.

PB3 : Span = 8.3m, spacing = 10.7m
Therefore read for 8.4m span & 11m spacing –
460 UB 82.1 with 30mm camber and 34 studs.

5.2 Comments

5.2.1 Primary beams

The primary beam sizes have been determined by applying the point loads from the secondary such that they are symmetrical about the center-line. In most cases this will give a conservative result which can be refined in the final design. cases this will give a conservative result which can be refined in the final design.

5.2.2 Secondary Edge beams

The design of secondary edge beams where decking is perpendicular to the beam, is usually more economical as a non-composite beam.

The use of a non-composite beam eliminates shrinkage and creep deflection in consideration of the more onerous Total deflection limit of - Span/500 The savings in shear studs and additional reinforcement usually outweighs the cost of the heavier beam required.

5.2.3 Primary Edge beams

Primary edge beams where the decking is parallel to the beam are usually designed as composite edge beams, with reduced effective width of the concrete flange.

These beams have not been included in these tables because of the varying façade load due to many different systems and materials.

Design tools such as CompPanel can readily check such beams with point and uniformly distributed loads.

5.2.4 Moment Capacity

The bare steel section moment capacity $\emptyset M_s$ has been used for the strength check during this construction stage. It is the responsibility of the user to ensure that lateral restraint is available to allow the beam under consideration to achieve this value or that the member capacity $\emptyset M_b$ is not exceeded.

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