

2.3.1 HIGHWAY BRIDGES

2.3.1.3 SUPER-TEES

Sheet 1

GENERAL DESCRIPTION

Super-Tees are precast, prestressed box girder sections with top flanges and come in two basic configurations – open-flange and closed-flange. They have now been standardised by RTA NSW, as shown in *Standard Sections*.

They are used in conjunction with a deck slab which acts compositely with the girders. The wide flanges reduce or eliminate the formwork requirement for the insitu deck slab. The flanges also provide significant resistance to lateral bending. The box section of the closed-flange configuration provides an optimised structural cross section and maximum torsional rigidity.

Super-Tees are suitable for long spans, ranging from 15 to 37 m. Austroads has limitations on span-to-depth ratio, beyond which deflection and vibration characteristics have to be analysed.

COMPONENT DETAILS

Open-flange Super-Tees

Five standard depths are available and are designated T1 to T5. Section profile is shown in *Standard Sections*, while section properties are shown in *Sheet 2*.

150-mm-thick internal diaphragms are required together with end blocks at each end. Although external end diaphragms are necessary, external intermediate diaphragms are not required, thereby producing a pleasing appearance. Lost formwork for a composite deck is required to bridge the open box section, as is some suitable detail to drain the void.

Variable lengths are available as are skewed ends. However, such lengths in small quantities are more expensive to produce in the open-flange configuration. Prestressing strand is placed horizontally with debonding located only in the bottom flange, and concrete of strength grade S50 is typically used. Either 2 or 4 strands may be incorporated in the top of the beam to control stress at transfer. Concrete strength at time of transfer should not exceed 37 MPa.

Closed-flange Super-Tees

Five standard depths are available and are designated T1 to T5. Section profile is shown in *Standard Sections*, while section properties are shown in *Sheet 2*.

Internal diaphragms are not necessary and because the void is filled with a medium-density polystyrene material it does not require draining. External end diaphragms are used, but no intermediate external diaphragms are required.

Variable lengths and skewed ends are available and are economical to produce. The web thickness and bottom flange can be easily adjusted for strength and durability requirements.

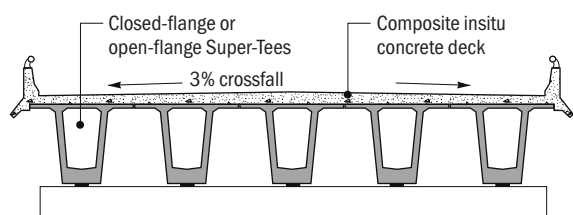
The closed box section results in an optimised structural shape with maximum torsional rigidity. After erection, they provide an immediate safe working platform and allow immediate placement of deck reinforcement. Location of prestressing strand and concrete strength for closed-flange sections are similar to those for open-flange profiles.

Deck Concrete

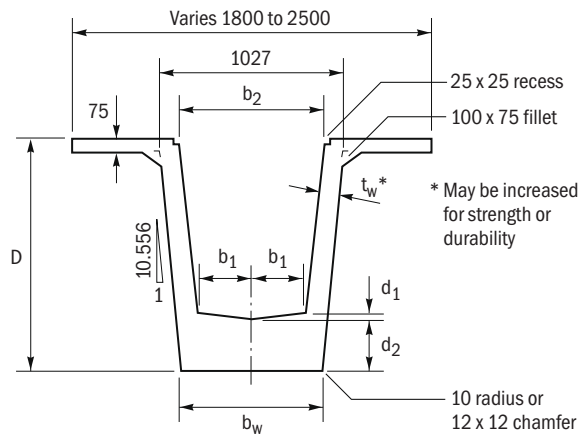
It is important to use a high-quality concrete in the deck in conjunction with best placing and curing practices. A typical deck concrete is strength grade S40.

Typical deck thicknesses range from 160 to 200 mm.

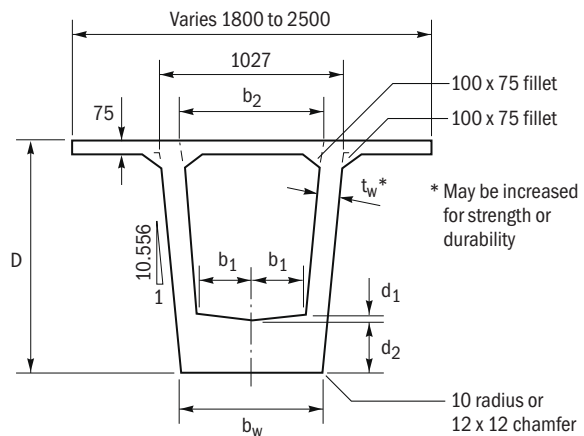
TYPICAL ARRANGEMENT



STANDARD SECTIONS



OPEN-FLANGE SUPER-TEES



CLOSED-FLANGE SUPER-TEES

VARIABLE DIMENSIONS

Beam type	Depth, D (mm)	Width, b _w (mm)	t _w (mm)	b ₁ (mm)	b ₂ (mm)	d ₁ (mm)	d ₂ (mm)	Typical spans (m)
T1	750	899	100	379	840	72	240	15 to 20
T2	1000	852	100	354	840	67	240	17 to 23
T3	1200	814	100	337	840	64	260	18 to 27
T4	1500	757	100	308	840	58	260	22 to 33
T5	1800	700	120	265	800	50	320	28 to 37

COMPARATIVE ASSESSMENT OF FEATURES

Feature	Closed-flange	Open-flange
Costly to manufacture variable-length girders	NO	YES
Costly to manufacture in small quantities	NO	YES
Web thickness easily adjusted	YES	NO
Bottom flange depth easily adjusted	YES	NO
Requires internal diaphragms	NO	YES
Requires external end diaphragms	YES	YES
Requires intermediate external diaphragms	NO	NO
Requirement for void drainage	NO	YES
Optimised structural section	YES	NO
Maximum torsional rigidity	YES	NO
Minimum initial mass	NO	YES
Requires additional deck formwork	NO	YES
Immediate and safe work platform	YES	NO
Immediate placement of deck reinforcement	YES	NO
Easy to check and inspect inner surfaces	NO	YES

2.3.1 HIGHWAY BRIDGES

2.3.1.3 SUPER-TEES

Sheet 2

SECTION PROPERTIES – OPEN-FLANGE SUPER-TEES

Section	Type	Depth, D (mm)	Area, A (mm ²)	I _x (mm ⁴)	y _b (mm)	Unit Z _t (mm ³)	Deck Z _t (mm ³)	Z _b (mm ³)	Mass (t/m)
	T1	750	4.139 x 10 ⁵	2.471 x 10 ¹⁰	312	5.648 x 10 ⁷	-	7.909 x 10 ⁷	1.076
	T2	1000	4.495 x 10 ⁵	5.203 x 10 ¹⁰	416	8.907 x 10 ⁷	-	1.251 x 10 ⁸	1.169
	T3	1200	4.915 x 10 ⁵	8.309 x 10 ¹⁰	500	1.187 x 10 ⁸	-	1.661 x 10 ⁸	1.278
	T4	1500	5.336 x 10 ⁵	1.445 x 10 ¹¹	644	1.688 x 10 ⁸	-	2.246 x 10 ⁸	1.387
	T5	1800	6.698 x 10 ⁵	2.477 x 10 ¹¹	796	2.466 x 10 ⁸	-	3.112 x 10 ⁸	1.741
	T1	750	4.364 x 10 ⁵	2.814 x 10 ¹⁰	333	6.749 x 10 ⁷	-	8.448 x 10 ⁷	1.035
	T2	1000	4.720 x 10 ⁵	5.845 x 10 ¹⁰	442	1.047 x 10 ⁸	-	1.323 x 10 ⁸	1.227
	T3	1200	5.140 x 10 ⁵	9.253 x 10 ¹⁰	529	1.379 x 10 ⁸	-	1.749 x 10 ⁸	1.336
	T4	1500	5.561 x 10 ⁵	1.590 x 10 ¹¹	677	1.932 x 10 ⁸	-	2.350 x 10 ⁸	1.446
	T5	1800	6.923 x 10 ⁵	2.680 x 10 ¹¹	827	2.755 x 10 ⁸	-	3.240 x 10 ⁸	1.800
	T1	750	4.589 x 10 ⁵	3.123 x 10 ¹⁰	352	7.480 x 10 ⁷	-	8.880 x 10 ⁷	1.193
	T2	1000	4.945 x 10 ⁵	6.428 x 10 ¹⁰	466	1.203 x 10 ⁸	-	1.381 x 10 ⁸	1.286
	T3	1200	5.365 x 10 ⁵	1.012 x 10 ¹¹	556	1.571 x 10 ⁸	-	1.821 x 10 ⁸	1.395
	T4	1500	5.786 x 10 ⁵	1.724 x 10 ¹¹	707	2.175 x 10 ⁸	-	2.437 x 10 ⁸	1.504
	T5	1800	7.148 x 10 ⁵	2.871 x 10 ¹¹	857	3.043 x 10 ⁸	-	3.351 x 10 ⁸	1.858
Composite properties									
	T1	750	7.368 x 10 ⁵	7.271 x 10 ¹⁰	536	3.393 x 10 ⁸	1.942 x 10 ⁸	1.357 x 10 ⁸	-
	T2	1000	7.724 x 10 ⁵	1.338 x 10 ¹¹	690	4.318 x 10 ⁸	2.848 x 10 ⁸	1.939 x 10 ⁸	-
	T3	1200	8.144 x 10 ⁵	2.001 x 10 ¹¹	806	5.079 x 10 ⁸	3.612 x 10 ⁸	2.482 x 10 ⁸	-
	T4	1500	8.565 x 10 ⁵	3.188 x 10 ¹¹	994	6.294 x 10 ⁸	4.783 x 10 ⁸	3.209 x 10 ⁸	-
	T5	1800	9.927 x 10 ⁵	5.008 x 10 ¹¹	1146	7.656 x 10 ⁸	6.151 x 10 ⁸	4.371 x 10 ⁸	-
	T1	750	8.119 x 10 ⁵	8.332 x 10 ¹⁰	572	4.685 x 10 ⁸	2.205 x 10 ⁸	1.456 x 10 ⁸	-
	T2	1000	8.475 x 10 ⁵	1.503 x 10 ¹¹	733	5.638 x 10 ⁸	3.221 x 10 ⁸	2.049 x 10 ⁸	-
	T3	1200	8.895 x 10 ⁵	2.227 x 10 ¹¹	855	6.447 x 10 ⁸	4.083 x 10 ⁸	2.606 x 10 ⁸	-
	T4	1500	9.316 x 10 ⁵	3.514 x 10 ¹¹	1049	7.788 x 10 ⁸	5.396 x 10 ⁸	3.350 x 10 ⁸	-
	T5	1800	1.068 x 10 ⁶	5.494 x 10 ¹¹	1205	9.226 x 10 ⁸	6.906 x 10 ⁸	4.561 x 10 ⁸	-

SECTION PROPERTIES – CLOSED-FLANGE SUPER-TEES

Section	Type	Depth, D (mm)	Area, A (mm ²)	I _x (mm ⁴)	y _b (mm)	Unit Z _t (mm ³)	Deck Z _t (mm ³)	Z _b (mm ³)	Mass (t/m)
	T1	750	4.833 x 10 ⁵	3.406 x 10 ¹⁰	369	8.947 x 10 ⁷	-	9.225 x 10 ⁷	1.257
	T2	1000	5.189 x 10 ⁵	6.976 x 10 ¹⁰	488	1.363 x 10 ⁸	-	1.428 x 10 ⁸	1.349
	T3	1200	5.609 x 10 ⁵	1.095 x 10 ¹¹	582	1.770 x 10 ⁸	-	1.882 x 10 ⁸	1.458
	T4	1500	6.030 x 10 ⁵	1.853 x 10 ¹¹	737	2.430 x 10 ⁸	-	2.514 x 10 ⁸	1.568
	T5	1800	7.362 x 10 ⁵	3.036 x 10 ¹¹	883	3.309 x 10 ⁸	-	3.440 x 10 ⁸	1.914
	T1	750	5.058 x 10 ⁵	3.661 x 10 ¹⁰	385	1.002 x 10 ⁸	-	9.521 x 10 ⁷	1.315
	T2	1000	5.414 x 10 ⁵	7.461 x 10 ¹⁰	508	1.517 x 10 ⁸	-	1.469 x 10 ⁸	1.408
	T3	1200	5.834 x 10 ⁵	1.168 x 10 ¹¹	604	1.959 x 10 ⁸	-	1.933 x 10 ⁸	1.517
	T4	1500	6.255 x 10 ⁵	3.327 x 10 ¹¹	763	2.671 x 10 ⁸	-	2.577 x 10 ⁸	1.626
	T5	1800	7.587 x 10 ⁵	5.205 x 10 ¹¹	909	3.596 x 10 ⁸	-	3.527 x 10 ⁸	1.973
	T1	750	5.283 x 10 ⁵	3.894 x 10 ¹⁰	398	1.108 x 10 ⁸	-	9.771 x 10 ⁷	1.374
	T2	1000	5.639 x 10 ⁵	7.909 x 10 ¹⁰	526	1.669 x 10 ⁸	-	1.503 x 10 ⁸	1.466
	T3	1200	6.059 x 10 ⁵	1.235 x 10 ¹¹	625	2.147 x 10 ⁸	-	1.978 x 10 ⁸	1.575
	T4	1500	6.480 x 10 ⁵	2.074 x 10 ¹¹	788	2.911 x 10 ⁸	-	2.633 x 10 ⁸	1.685
	T5	1800	7.812 x 10 ⁵	3.365 x 10 ¹¹	933	3.882 x 10 ⁸	-	3.605 x 10 ⁸	2.031
Composite properties									
	T1	750	8.062 x 10 ⁵	7.465 x 10 ¹⁰	551	3.742 x 10 ⁸	2.077 x 10 ⁸	1.356 x 10 ⁸	-
	T2	1000	8.418 x 10 ⁵	1.385 x 10 ¹¹	712	4.810 x 10 ⁸	3.092 x 10 ⁸	1.994 x 10 ⁸	-
	T3	1200	8.838 x 10 ⁵	2.080 x 10 ¹¹	834	5.680 x 10 ⁸	3.953 x 10 ⁸	2.495 x 10 ⁸	-
	T4	1500	9.259 x 10 ⁵	3.327 x 10 ¹¹	1028	7.054 x 10 ⁸	5.267 x 10 ⁸	3.235 x 10 ⁸	-
	T5	1800	1.059 x 10 ⁶	5.242 x 10 ¹¹	1184	8.512 x 10 ⁸	6.756 x 10 ⁸	4.426 x 10 ⁸	-
	T1	750	8.813 x 10 ⁵	8.455 x 10 ¹⁰	583	5.058 x 10 ⁸	2.303 x 10 ⁸	1.451 x 10 ⁸	-
	T2	1000	9.169 x 10 ⁵	1.536 x 10 ¹¹	750	6.154 x 10 ⁸	3.416 x 10 ⁸	2.046 x 10 ⁸	-
	T3	1200	9.589 x 10 ⁵	2.287 x 10 ¹¹	877	7.070 x 10 ⁸	4.369 x 10 ⁸	2.609 x 10 ⁸	-
	T4	1500	1.001 x 10 ⁶	3.622 x 10 ¹¹	1077	8.567 x 10 ⁸	5.816 x 10 ⁸	3.362 x 10 ⁸	-
	T5	1800	1.134 x 10 ⁶	5.686 x 10 ¹¹	1237	1.010 x 10 ⁹	7.451 x 10 ⁸	4.597 x 10 ⁸	-