

DURA[®] UBG – U Bridge Girder

Description

DURA[®] UBG – U bridge girders are prefabricated using the revolutionary composite material of ultra-high performance concrete and high-carbon-high-tensile steel fibers (UHPdC). It is an excellent solution for bridge engineers looking for a cost effective, fast construction, light-weight and high-durability option for bridge span range of 16 to 60 m.

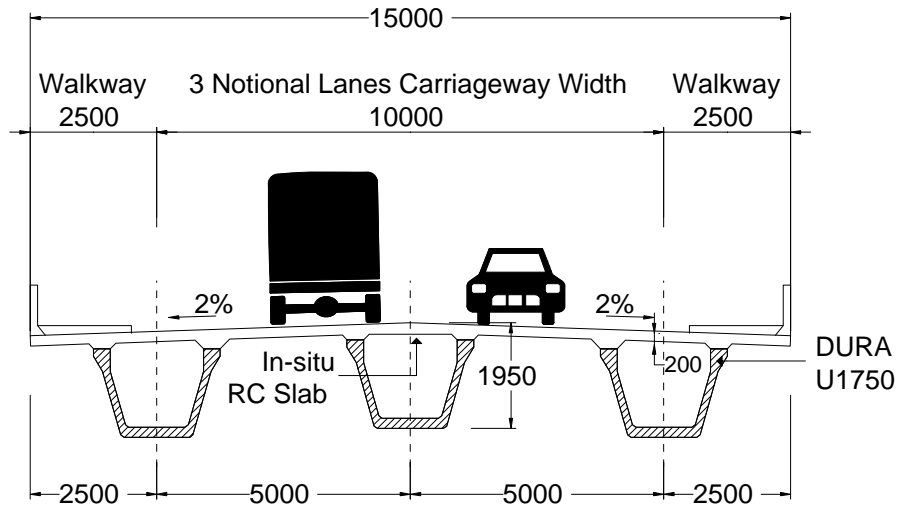
Figure 1 gives an example of a single span bridge with a total bridge span of 40 m and total width of 15 m. The proposed bridge consists of two 2.5 m wide walkways (parapet inclusive). The intermediate portion of the bridge consists of 3 notional lanes carriageway and is 10 m wide. If using Dura method, only **THREE** pieces of **DURA[®] U1750BG** are needed to composite with a 200 mm thick cast in-situ R.C. slab. The **DURA[®] U1750BG** are spaces 5 m apart c/c. In contrast, if using conventional method, seven pieces of the super tee girders are needed in order to has similar structural performance.

Features

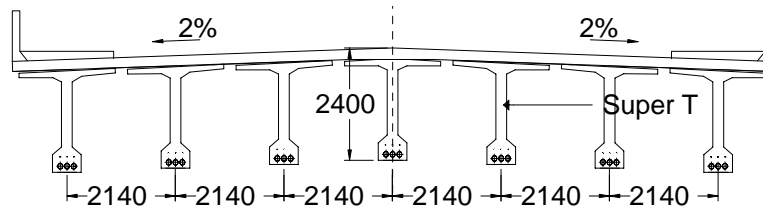
- The UHPdC used for **DURA[®] UBG** has characteristic compressive strength range between 120 to 140 MPa; characteristic flexural strength of 20 MPa and characteristic cracking strength of 7.5 MPa.
- **DURA[®] UBG** eliminate the used of conventional steel reinforcing bars and stirrups, except at regions where jointing detail are required for composite construction. All steel fibers used are made from high carbon steel wires with tensile strength of minimum 2300 MPa.
- Except **DURA[®] U1000BG** is pretensioned girder, **DURA[®] U1250BG**, **U1750BG** and **U2250BG** are assembled using post-tensioning methods on several segmental pieces of the same kind. For example, Figure 2 shows a 40 m span **DURA[®] U1750BG** generally composed of five segments (i.e three identical 8 m long intermediate segments and two 8 m long anchorage segments). Each 8 m long intermediate segment and each 8 m long anchorage segment weight approximately 17 tons and 20 tons, respectively.

Advantages of DURA[®] UBG

- The total number of prestress **DURA[®] UBG** needed can be halved when compared to conventional designs (refer to Figure 1). Thus, immediate savings for the superstructural cost can be attained;
- At least 20% of immediate savings can be attained for the substructure and foundation cost due to the lighter superstructure (especially on difficult ground condition);
- Indirect cost saving may be realized where shallower bridge beams are needed. Figure 1 shows the conventional super T girders has a total depth of 2400 mm whereas the **DURA[®]** method has a total depth of 1950 mm. The reduction of girder depth can lead to indirect cost saving resulting from minimal cut and fill of the embankment or approach bridge levels.
- **DURA[®]** bridge system is at least 3 times more durable than conventional method as the UHPdC used consist significant amount of discrete high strength steel fibers to stitch cracks (if any) and the girders are designed based on uncracked approach at SLS (thus significantly increasing the life span of the infrastructure);
- Ease of handling (due to ultra-light weight when compare to conventional beams) and fast in construction;
- Due to the absence of conventional steel reinforcements, **DURA[®]** girders can be designed and produced in much slenderer and efficient sections, with no concern for classical issues such as minimum concrete cover, to prevent corrosion of steel reinforcement;
- No waterproofing needed as **DURA[®]** is a highly impermeable material;
- Its natural high quality finish due to the ultra-packed nature of the concrete matrix eliminates the need for painting or protective coating (thus leading to further long term savings in cost). Micro-organism such as mould and algae will also not grow easily on this surface;
- **DURA[®] UBG** is a highly GREEN product which supports the visionary of sustainable construction by reducing the overall CO₂ emission, primary energy consumption and global warming potential of at least 25%.



DURA METHOD WITH DURA U1750BG



CONVENTIONAL METHOD WITH SUPER TEE GIRDER

Figure 1 – Example of a 15m wide and 40 m single span highway bridge.

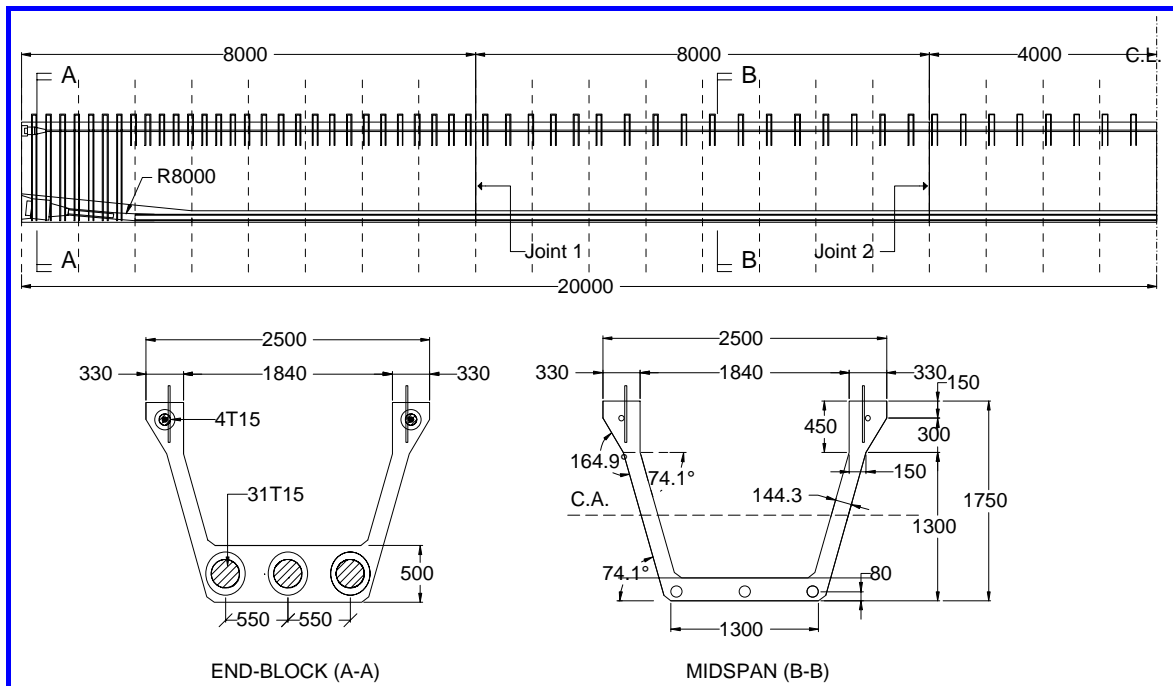


Figure 2 – Segmental detail of DURA[®] U1750BG.

DURA[®] UBG

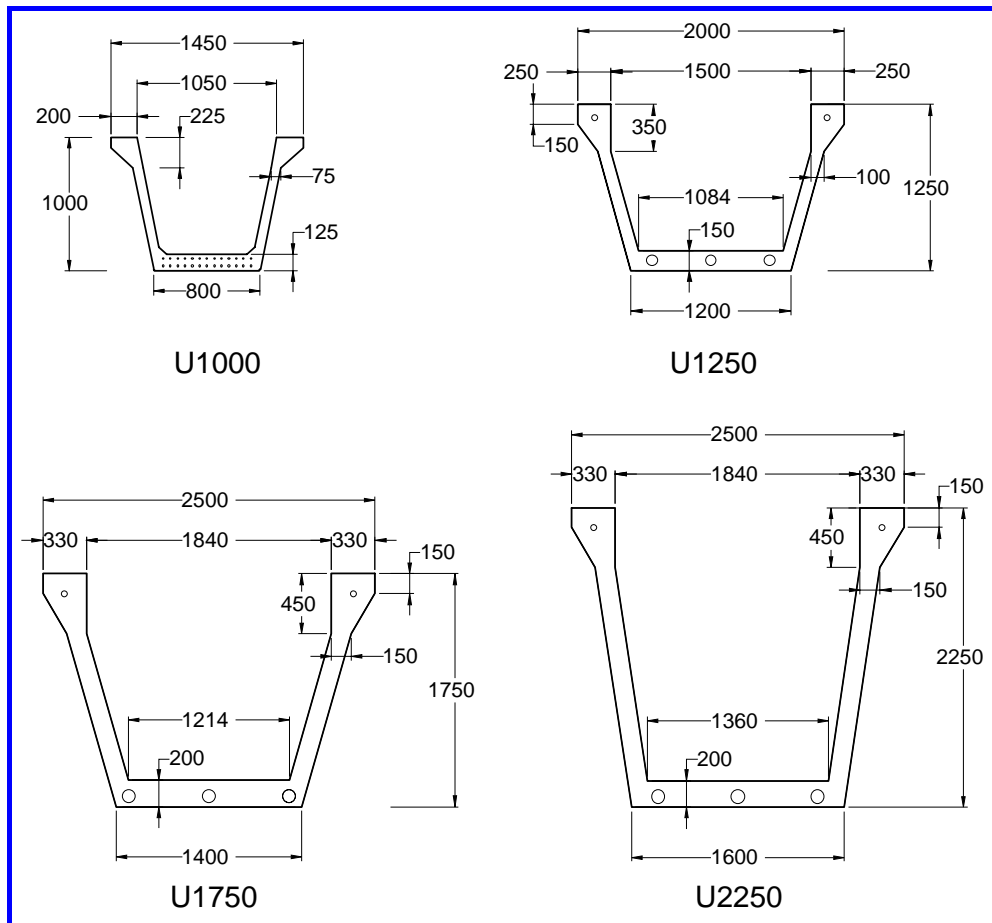


Figure 3 – Cross-sectional detail of DURA[®] UBG.

Table 1: Technical Data for Prestressed DURA[®] U Bridge Girders.

		Unit	U1000BG	U1250BG	U1750BG	U2250BG
Prestressing Method			Pre-Tension	Post-Tension		
Length	L	m	16 ~ 23	24 ~ 36	37 ~ 45	46 ~ 60
Nos. of Segment		pcs	1	2 ~ 3	5 ~ 6	8 ~ 10
Weight	W	kN/m	6.7	11.8	21.2	30
Sectional Area	A _g	x 10 ³ mm ²	283	517	909.3	1274
Neutral Axis	y _{top}	mm	589	745	1019	1296
	y _{bot}	mm	411	505	731	954
Moment of Inertia	I _{xx}	x 10 ⁹ mm ⁴	35.2	102.1	338.1	728.31
Section Modulus	Z _{top}	x 10 ⁶ mm ³	59.81	137.13	331.66	562.06
	Z _{bot}	x 10 ⁶ mm ³	85.55	202.08	462.75	763.26
Web Thickness	B _w	mm	150	200	300	300
Depth	D	mm	1000	1250	1750	2250

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