

DURA[®] PBG – Pedestrian Bridge Girder

Description

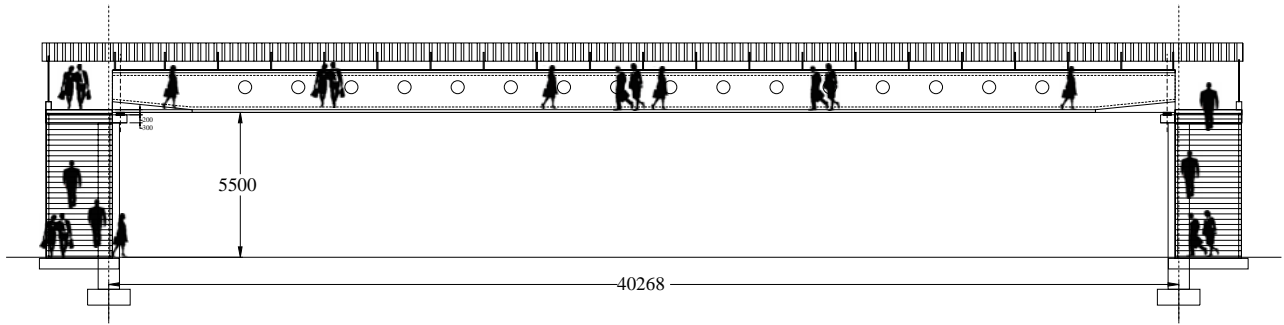
DURA[®] PBG is prefabricated using the revolutionary composite material of ultra-high performance concrete and high-carbon-high-tensile steel fibres (UHPdC). It is an excellent solution for bridge engineers looking for a cost effective, light-weight and high-durability option for girders with a span range of 20 to 50 meters.

Features

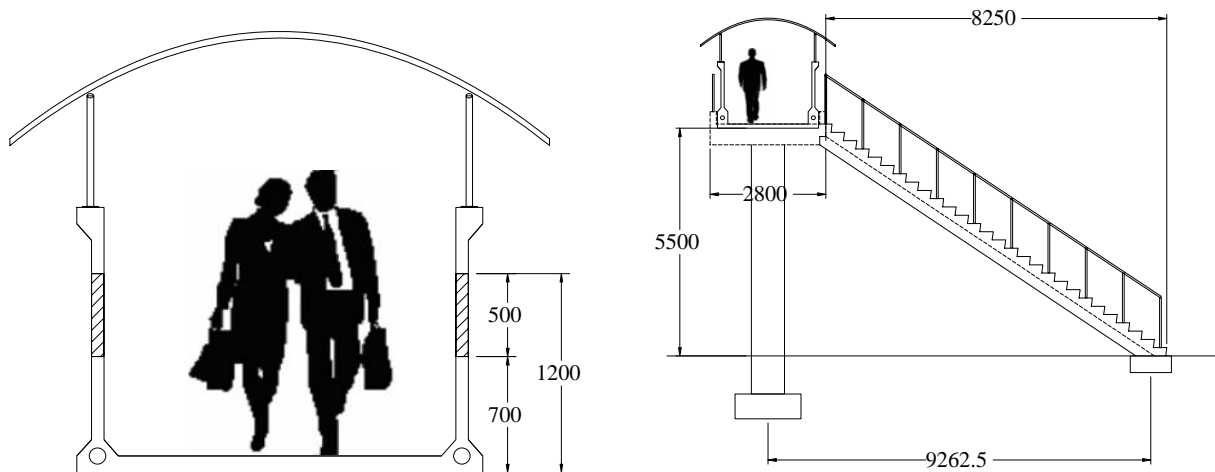
- **DURA[®] PBG** consists of three slender plates, i.e. two 75 mm thin webs and 100 mm thin deck slab.
- **DURA[®] PBG** is typically prestress to 70~80% of the characteristic tensile strength of the strands. Strands used are 15.2 mm diameter 7-wire super strands (low relaxation) complying with BS 5896; with a characteristic breaking load of 260 kN.
- The UHPdC used for the **DURA[®] PBG** has a cylinder compressive strength range between 120 to 140 MPa (equivalent to cube compressive strength of 130 to 160 MPa).
- The UHPdC used for the **DURA[®] PBG** has a characteristic flexural strength of 20 MPa or characteristic cracking strength of 7.5 MPa.
- All steel fibers used are made from high carbon steel wires with tensile strength of 2300 MPa.
- **DURA[®] PBG** eliminates the used of conventional steel reinforcing bars and stirrups. The girders consist of large circular opening at the web regions that serve as natural air ventilator and architectural feature.

Advantages of DURA[®] PBG

- **DURA[®] PBG** is significantly thinner in section and at least 50% lighter than conventional bridge system. Ease of handling / transportation and installation - This weight efficiency also leads to further saving of the foundation and substructures; at the same time contributing to a sustainable development regime.
- **DURA[®] PBG** is highly durable and impermeable. Research results show the UHPdC used is at least 20 times more impermeable than conventional concrete. It is therefore suitable for use even in harsh environments.
- **DURA[®] PBG** is unique as the bottom flange of the girders serve both as the structural component for the beam and also as the deck slab for the pedestrian.
- No site casting of the deck slab is needed (except stitching of the girder to the landing slab), thus lead to elimination of scaffolding, props or formwork, which will greatly reduce construction site activities and improving safety margins. Together with carefully planned detailing, the construction process can be shortened considerably, resulting in overall cost and time savings.
- **DURA[®] PBG** can span up to 50 m without the need of a central column that occasionally subjected to unwanted collision (thus further improved public safety)
- Due to its high durability, high ductility and high fatigue strength, it provides excellent resistance against impact and abrasion loads.
- The natural finishing of **DURA[®] PBG** is aesthetically pleasing, therefore there is no need for coating and painting work.

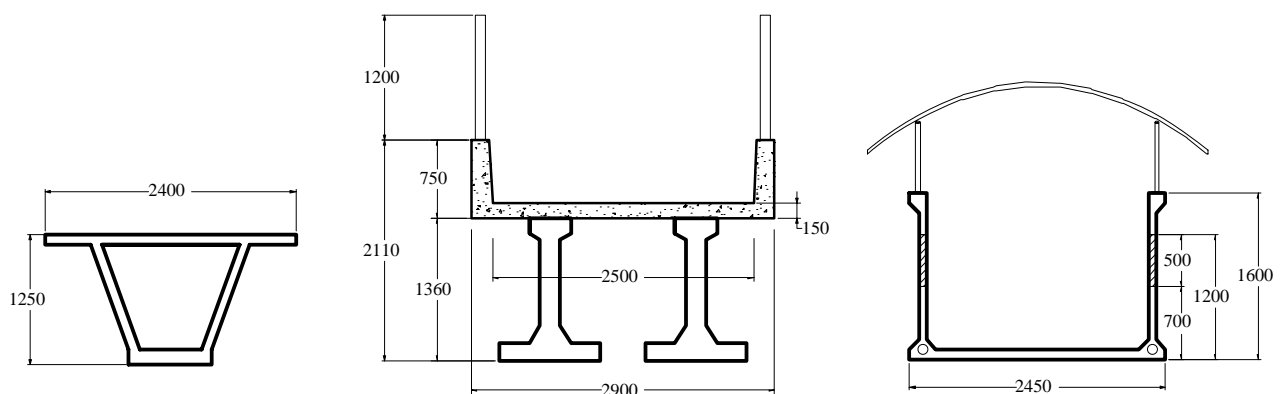


General Plan View



Cross-Section View

Figure 1: Example of DURA[®] long span pedestrian bridge system.



Conventional Box Beam
(1500 kg/m)
Up to 29 meters

Conventional M10 Beams
(3780 kg/m)
Up to 35 meters

UHPdC U Beam
(1200kg/m)
Up to 40 meters

Figure 2: Comparison of DURA[®] PBG to conventional systems.

DURA[®] PBG

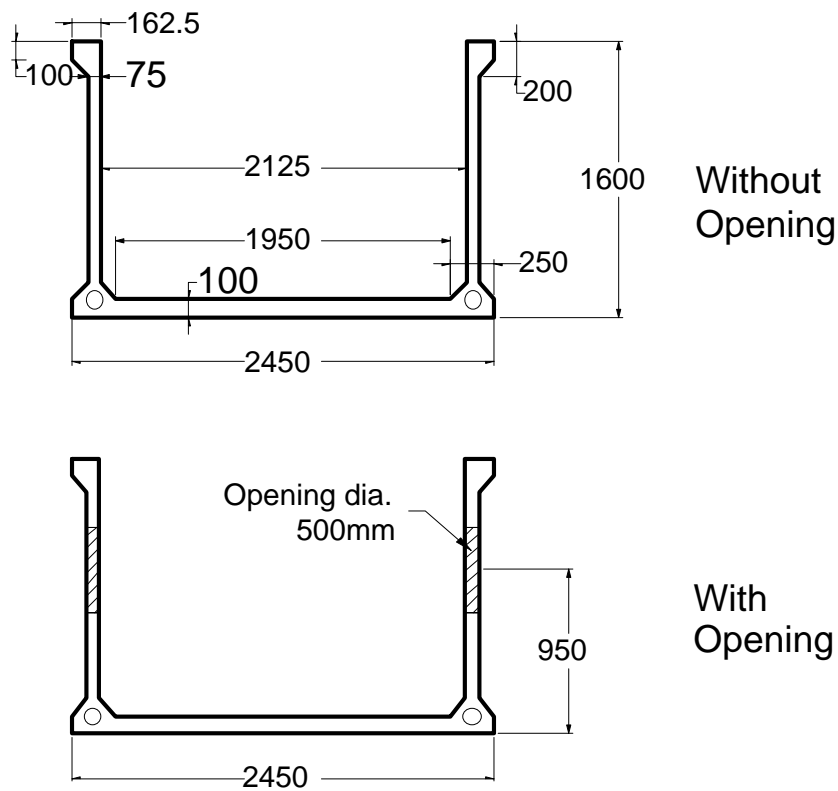
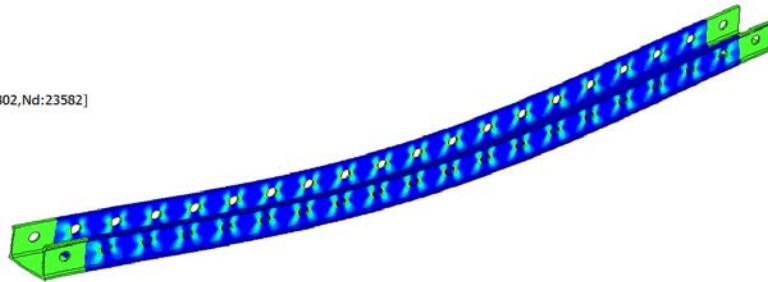
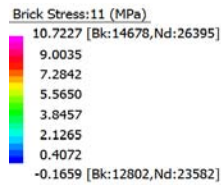


Figure 3: Detail of DURA[®] PMB girders.

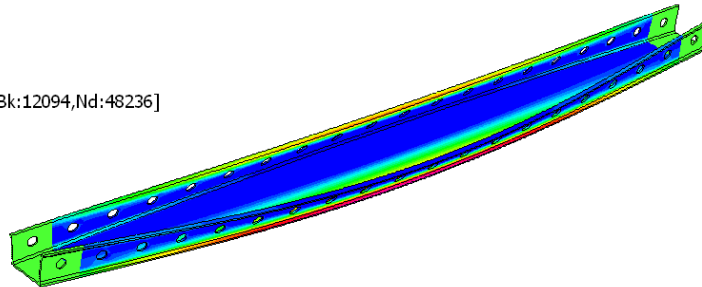
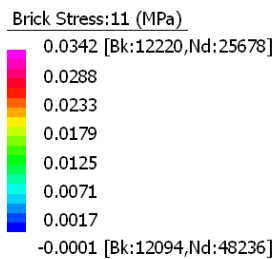
Table 1: Technical Data for DURA[®] PMB Girders

		Unit	DURA [®] PBG		
Prestressing Method			Pre-Tension	Post-Tension	Post-Tension
Length	L	m	16 ~ 30	31 ~ 40	41 ~ 50
Weight	W	kN/m	12	12	13.8
Sectional Area	A _g	x 10 ³ mm ²	513.8	513.8	573.8
Neutral Axis	y _{top}	mm	1122	1122	1365
	y _{bot}	mm	478	478	635
Moment of Inertia	I _{xx}	x 10 ⁹ mm ⁴	149.18	149.18	266.84
Section Modulus	Z _{top}	x 10 ⁶ mm ³	133.0	133.0	195.148
	Z _{bot}	x 10 ⁶ mm ³	311.8	311.8	420.27
Depth	D	mm	1600	1600	2000
1 st Natural Frequency *	Horizontal	Hz	0.0116L ² -0.9325L+21.241		
	Vertical	Hz	0.0141L ² -1.1278L+24.873		

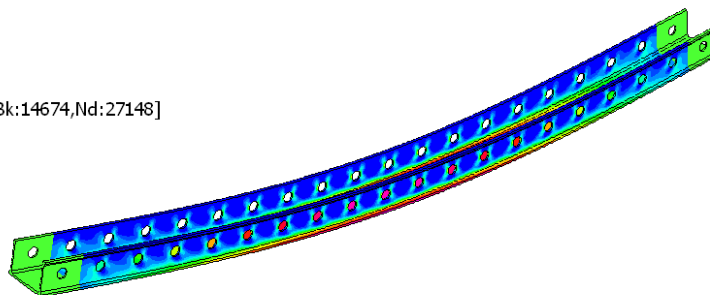
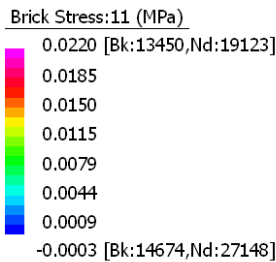
* with R² > 0.996 and L = span length



40m Span FEM Result: At SLS Load Combination 1 (BS5400) & 5 kPa Live Load.



40 m Span FEM Result: 1st Horizontal Natural Frequency of 2.51 Hz.



40 m Span FEM Result: 1st Vertical Natural Frequency of 2.32 Hz.

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