Concrete Footbridges
New Project
Background

Concrete footbridges were once common place in the UK but more recently steel is the dominant material.

However, the introduction of ultra high strength concrete, stress ribbon construction and matter of robustness and low maintenance is seen to again offer opportunities for concrete footbridges in the UK.

Also elsewhere in Europe Concrete Footbridges or more correctly Pedestrian Bridges are very much in vogue.

As a result it has been agreed to add a new Footbridges section to the CBDG website, together with a 6-8 page brochure.
Project style

It is intended to adopt a production style used for the earlier C&CA Concrete Footbridges publication.

This consists of a two page spread:
1. Providing lines drawing of elevations and cross sections, with some general text and companies involved
2. A photograph of the footbridge
Chineham Lane Footbridge, Basingstoke
Action

A pdf of the original C&CA publication sent to members asking people to identify and comment on condition

Where possible take new colour photographs

Offer newer footbridges for inclusion into the web based section: providing text, illustrations and photograph

Being web based this will allow a simple means for adding to and updating

To date we have had three responses but we are sure there must be many more projects to feature and urge members to action this matter.
Bridleway Bridge, Stansted Airport, Essex

A prestressed concrete over-bridge, cast in-situ on temporary falsework. This alternative design both modified the cross-section and significantly reduced the number of bearings by making the central ‘V’ shaped piers monolithic with the superstructure.

Owner: British Airports Authority
Client: Fitzpatrick
Value: £200,000
Completion: 1986
Bridge over River Cherwell
Birdwell Bridge over M1 Motorway
Bridge over A2 at Bexley
Cottismore Bridge over Oxford Southern Bypass
Bridge over River Cam
Concrete Footbridges
Newer Examples
Martin Knight Architects - Lochnagar Street Bridge (Portfolio scheme)

© Martin Knight Architects

UHSC

© Bouygues
**Ductal** (Ultra-high performance concrete)

- Proprietary pre-mixed ultra-high performance concrete whose physical characteristics exceed those of common concrete used in the construction of building.

- Manufactured by Lafarge and Bouygues.

- High compressive strength and flexural resistance compared to other concretes.

- High durability, abrasion resistance, and chemical/environmental resistances (e.g., freeze and thaw, salt water, etc.).

- Due to these properties, Ductal can be used in thinner cross-sections and in more varied applications than common concrete.

- Ductal is almost self-placing and is best suited for precast elements or in-situ repair or upgrade works.
- Constituents of Ductal are cement, fine sand, silica fume and silica flour as a filler, additive and water, using a low water cement ratio and may include high-strength steel fibres or non-metallic fibres.

- Ductal is a ductile material that possesses ultra high compressive strength, high tensile strength and high durability together with high fatigue performance.

- Has excellent impact, blast and abrasion resistance.

- The type and quantities of special materials used in Ductal result in a superior material that can provide innovative and valuable solutions for a wide range of applications;

- It is not a replacement for ordinary concrete in applications that do not exploit its unique properties and requires performance engineering.
<table>
<thead>
<tr>
<th>Ductal Properties</th>
<th></th>
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<tbody>
<tr>
<td>Compressive Strength</td>
<td>typically 160-230 MPa... compressive strength in excess of 750 MPa recorded (see: Cyclic loading and Fracture Mechanics of Ductal concrete, Ehab Shaheen and Nigel G. Shrive, Springer Science+Business Media)</td>
</tr>
<tr>
<td></td>
<td>B.V.2008, Published online: 8 April 2008</td>
</tr>
<tr>
<td>Flexural Strength</td>
<td>30-50 MPa</td>
</tr>
<tr>
<td>Young's Modulus (E)</td>
<td>55-60 MPa</td>
</tr>
<tr>
<td>Density</td>
<td>2.45-2.55 kg/m³</td>
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The Glenmore/Legsby pedestrian overpass

The Glenmore/Legsby pedestrian overpass is a single span, 53 m bridge stretching across 8 lanes of traffic, with two cantilevered, high performance concrete abutments and a drop-in, 33.6m T-section Ductal® girder. Installation was completed in just 8 hours.

With its superior surface finish, excellent resistance to harsh weather and low maintenance requirements, this bridge is considered a technical, aesthetic feat and a model for structures that have to withstand tough climates.
Great architectural freedom for the pedestrian walkways at Papatoetoe in New Zealand

The first pedestrian walkway in the public transport station redeployment programme in Auckland province measures 175 metres long with a 20-metre span for an impressive display of lightness and fluidity. Built to service the Papatoetoe station platforms, this walkway is a prime example of all the innovative qualities of Ductal®.

The lightness combined with the solidity of this new concrete provides greater architectural freedom as exemplified by very wide spans resting on only two prefabricated segments that also support the walkway roof. A fluidity that is reinforced by large perforations that lighten the overall structure while providing it with a very original identity and aesthetic.
The Sakata Mirai Footbridge in Japan

The Sakata Mirai footbridge was built to replace the former concrete bridge which has spanned the Niita River, in the Town of Sakata, for 40 years. Ductal®, used for the first time in Japan to build the new footbridge, enabled creation of one single span; 50 meters long and 2.4 meters wide. The deck is built of perforated precast elements to give the bridge better deformation resistance and less exposure to the wind.
Pedestrian bridge in Sherbrooke, Canada

The pedestrian/bicycle bridge in Sherbrooke, Quebec (Canada), which crosses the Magog River, provided opportunity for early experimental use of Ductal® in 1997; and showcased the material’s true technical prowess. The use of Ductal® enabled construction of a single 60-meter long span only 3 cm thick, paving the way for the later use of Ductal® in long-span roofing.

Three major technological innovations were realized with this project – the total absence of steel bar reinforcement, enabling the creation of thin, elegant structures (and enhancing urban landscape), use of small prestressed elements, and confinement of web member diagonals in stainless steel tubes.
Yamagata footbridge

The Yokemuri footbridge, completed in January 2004, is located in the Yamagata region of Japan.

The footbridge is built using the principle of a square box girder frame of 35.3 meters length, 3.5 meters width, and 0.95 meters height.

The construction was conducted by Taisei with Ductal® premix, produced and supplied by Taiheiyo Cement Corporation. Ductal®’s durability properties are used to withstand the severe climatic environments in that region (high differences of temperatures).
Bridge of the future

The US Federal Highway Administration (FHWA) has launched a comprehensive study to design solutions based on high performance materials with a goal to significantly reduce the number of obsolete bridges over a couple of decades.

From the initial results of several material testings, Ductal® has proven to be the best solution, providing reduced maintenance costs and improved durability.

Consequently, a decision was made to erect an experimental bridge at FHWA’s testing facilities in McLean, Virginia (near Washington, DC).

This optimized bridge is made of two pi shaped girders; 21.3 meters long by 2.44 meters wide, with pretention strands. The design of these girders was optimized through an in-depth study conducted by M.I.T. (Massachusetts Institute of Technology).
Shepherds bridge

The first road bridge made of Ductal®, “Shepherds Bridge”, has been erected 150 km north of Sydney (Australia), to replace an old, obsolete timber bridge.

It measures 15 meters long by 21 meters wide. In terms of structures, 16 girders made of Ductal®, support a reinforced concrete slab, cast in-place over thin plates of Ductal® used as formwork and set over the girders.

This bridge was designed and built by VSL-Australia, for the Australian RTA (Roads and Traffic Authority), to provide durability, strength and a reduced maintenance cost.
The Seonyu Footbridge in Seoul

The pedestrian bridge in Seonyu, also called the Bridge of Peace, was inaugurated in April 2002. It crosses the Han River, linking Sunyudo Island (a natural park) to the heart of the South Korean capital.

This footbridge, designed by French architect Rudy Ricciotti, features an elegant, ultra-high performance concrete central arch 120 meters long and 4.3 meters wide.

It is extremely thin, like a sail billowing between the two banks of land. This challenging artistic feat and technical prowess was made possible with Ductal®, which provided extreme fluidity to the lines of the deck where thickness does not exceed 3 cm. Ductal® enables such technical daring due to its superior compressive and flexural strengths and outstanding ductility.