

Taney Cross

By Brian Ó Murchú

Cable-Stayed Suspension Bridge

Once a sleepy village, served by the old tramline which ran from Harcourt st. station, the village of Dundrum on the outskirts of Dublin, is currently undergoing major developments, including roads, shopping centre and bridge construction projects. The most recent development is a new asymmetric cable-stayed suspension bridge, which towers over the entrance to the village like a giant modern sculpture.

Bold and uncompromising in its design, the bridge deck is assembled using precast concrete segments, held in place by prestressing bars, tendons and cable-stays which are anchored back to a single inverted Y-framed pylon. The bridge, which has a cable-stayed span of 109 metres, will carry Dublin's long promised 'Luas' tram system and with it the hopes of many a hapless Dublin commuter.

The chosen design is a solution to a complex range of requirements, one of which was to limit the disturbance to traffic flow during construction. The use of a single pylon, located some distance back from the junction achieved this, while the careful positioning of the foundations for the approach spans and its

effect on the design of the superstructure, avoided the relocation of a range of services including water, gas and electricity, currently located under the road intersection. The design solution required only the removal of a small Bord Gáis regulator station leaving all other services undisturbed.

The positioning, number and forces of the cable-stays is one of the fundamental items in the design of such a bridge, influencing the structural performance as well as the method of erection and the economics. The Dundrum bridge stays are located 7 metres apart horizontally to cater for the maximum deflection requirement of 1:500. This cable-stay layout also facilitates the installation of precast concrete deck segments each of which is post-tensioned back to the previous completed section. Although the deck is supported by the cable-stays, the design allows for the removal and replacement of an individual stay should there be a requirement to do so in the future. The bridge is also designed for the dynamic rupturing of any two stays should a tram collide with them. The back-stays, which are used to balance the



Precast Kerbs

Anchor Cable-Stays



Service Duct

large overturning moments on the pylon due to the for-stays, are anchored to the vertical face of the inverted Y-frame tower and tied back to an anchorage abutment on the north side. With a larger numbers of cable-stays, individual cables can be replaced with relative ease if necessary. More critically however, the larger number of elastic supports leads to moderate longitudinal bending moments in the deck, both during construction and in operation while also facilitating segmental construction and installation of precast units.

Prefabricated segments are pre-stressed during erection so that the sections can be keyed together. The cable-stayed system is a multi-strand configuration where each stay consists of several strands, prefabricated in full length and installed and stressed individually on site. The cables support the dead and superimposed dead loads of the deck with sufficient capacity to accommodate live loads. The cable supports and the pylon tower accommodate all other transient loads, including live loads, temperature, wind etc. As a result the deformation of the deck is minimal, resulting only from moderate variations of the stresses in the cables and the deformation in the pylon tower. Although more complicated to erect, the use of the inverted Y-frame pylon rather than vertical pylons, stiffens the structure.

Taney Cross Cable-Stayed Suspension Bridge - *continued*

Post-Tensioned Cables



The specification includes two 1435 wide tram rails located on track plinths which are raised slightly above the deck level. Two sets of service ducts are located under two 1450mm wide footpaths which are incorporated on either side of the rails outside the plane of the cable-stays. A

specially designed stainless steel parapet railing is located at the deck edges.

The Dundrum Bridge is one of two cable-stayed bridges, which are currently being completed by leading bridge design engineers Roughan and O'Donovan Consulting Engineers. The Dundrum

project differs from the Boyne Bridge located west of Drogheda, in that it is set firmly in an urban / village context. Indeed, this aspect may prove to be the greatest challenge. The imposing scale of the bridge with its enormous tentacles may challenge the sensitivities of local residents in the short term. In the longer term however, there is little doubt that this imposing structure will be appreciated by Dubliners as a landmark structure which greatly enhances the surrounding environment.



Stainless Steel Railing

Project Team

Client:
Railway Procurement Agency:
Pat O'Donoghue

Consulting Engineers:
Roughan & O'Donovan: Joe
O'Donovan, Keith Wilson
and Tony Dempsey

Contractor:
Graham: P J Mc Caffrey and
Philip Brown