

10 Preliminary Consideration of Anticipated Departures From Standard

10.1 Use of Eurocodes

The UK is in the process of adopting Eurocode as the basis of structural design. The two year transition phase to the full use of Eurocode for the Highways Agency runs from April 2008 to April 2010 during which time Approval in Principle (AIP) documents for bridges may be submitted either in accordance with the old bridge code, BS 5400, or in accordance with Eurocode as modified by the UK National Annexes (NAs). Some National Annex documents remain unpublished.

For Transport Scotland, the use of Eurocodes is currently a Departure from Standard. However, the design of the Forth Replacement Crossing will be in accordance with Eurocode, and a project specific Design Memorandum will document the design rules adopted and include supplementary rules which will complement Eurocode.

10.2 Post-tensioned grouted ducts

Internal post-tensioned grouted ducts are under consideration in two locations:

- transverse prestressing in the concrete slab of the composite box girder option for the cable stayed bridge deck
- longitudinal cantilever prestress in the deck of the concrete box girder option for the approach viaduct

A moratorium on the use of post-tensioned grouted ducts was lifted in 1996 but certain restrictions remain in place which are described in the Highways Agency Interim Advice Note 47/02 – ‘Post-tensioned grouted duct concrete bridges’ - which makes reference to the Concrete Society Technical Report TR 47 (2002). IAN 47/02 notes that the design of the post-tensioning system will be classed as an aspect not covered by standards, and subject to departure procedures.

A moratorium for precast concrete segmental construction using internal grouted tendon systems still remains in force. Although precast slabs are under consideration for the Composite Deck this moratorium is not relevant since the in-situ stitches allow effective splicing and continuity of the duct.

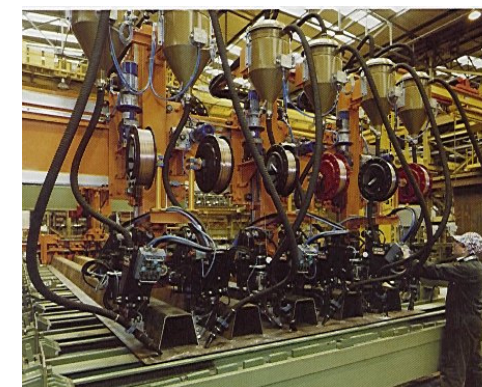
However, the moratorium is relevant to the longitudinal cantilever prestress in the concrete approaches. Preliminary discussions with Transport Scotland indicate that a Departure From Standard to allow construction of the approach using internal tendons in precast segmental construction would not be approved. Therefore the design has been progressed assuming in-situ construction.

10.3 Orthotropic deck stiffness

For the orthotropic box girder deck it is preferable to maximise the diaphragm spacing, within practical limits, in order to reduce the manual fabrication associated with the diaphragms. A large part of deck panel fabrication is associated with adding the transverse plating (combs) and this work tends to involve non-automated methods as illustrated below:

Typically in UK and Europe, the spacing of diaphragms that provide transverse support to orthotropic steel decks is in the range of 3.5 to 4.5 m. In the US, the practice is to extend

the span of the orthotropic deck to about 6.1 m, which results in a heavier trough and deck plate but significant reduction in workmanship. The reduction in work content can compensate the cost of marginally more material.

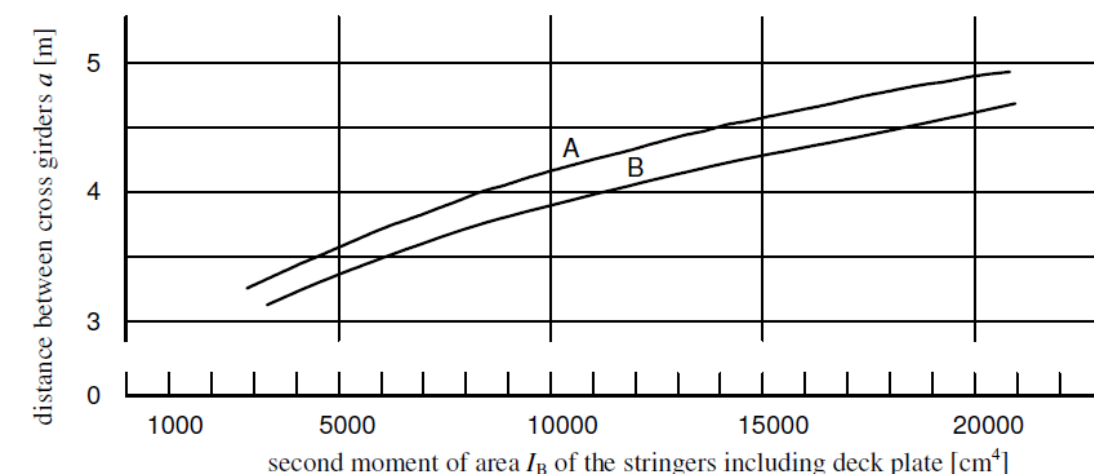


Automated Panel Fabrication



Manual Fitting of Transverse ‘Combs’

Eurocode EN 1993-2:2006 C.1.2.2 (2) introduces recommended empirical limitations to the stiffeners of longitudinal deck stiffeners in order to prevent cracking of the surfacing due to differential deflections.



Two situations are considered:

- Curve B – Stiffeners under heavily loaded traffic lanes within 1.2 m of a longitudinal web
- Curve A – All other situations

The recommended limitations appear to unreasonably penalise the use of an increased diaphragm spacing with the allowable strains in the surfacing (under both sustained loading and fatigue loading) being lower when the spacing is increased.

A Departure from Standard is anticipated to modify Curve A so as to base the relationship between diaphragm spacing and stiffener stiffness on the allowable strain in the surfacing being constant over all ranges of diaphragm spacing.

The behaviour of the deck under the situation covered by Curve B is more complex but since this situation is not applicable to the current design solutions being developed for the Forth Replacement Crossing it is envisaged that Curve B will not be modified by the proposed Departure.

10.4 Ship Impact

As noted in Section 3.4, the Eurocode does not provide a prescriptive methodology for a statistical ship impact analysis. A project specific statistical methodology is currently being developed which is compliant with Eurocode but includes some of the statistical components of the AASHTO methodology where they are believed to be relevant.

Approval of this methodology will be subject to departure procedures.