# Discussion on the paper of M.J.N. Priestley "Model study of a prestressed concrete box girder bridge under thermal loading"

Autor(en): **Nelson, Hugh M.**

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**Discussion on the Paper of M.J.N. Priestley:**
**Model Study of a Prestressed Concrete Box Girder under Thermal Loading**

Discussion sur l'article par M.J.N. Priestley:
Etude sur modèle d'un pont en béton précontraint à section en caisson soumis à des variations de température

Diskussion zum Beitrag von M.J.N. Priestley:
Modellversuch einer vorgespannten Hohlkastenbetonbrücke unter Temperaturbelastung

HUGH M. NELSON
University of Glasgow
Great Britain

Dr. Priestley's work on controlled tests of a bridge structure is a useful attempt to get some sense into the rapidly accumulating practical data.

The University of Glasgow, in collaboration with W.A. Fairhurst & Partners, is at present trying to rationalise data collected from the Tay Road Bridge.

The bridge has 42 spans, mainly of 55 m span steel boxes with a reinforced deck as shown in Fig. 1.

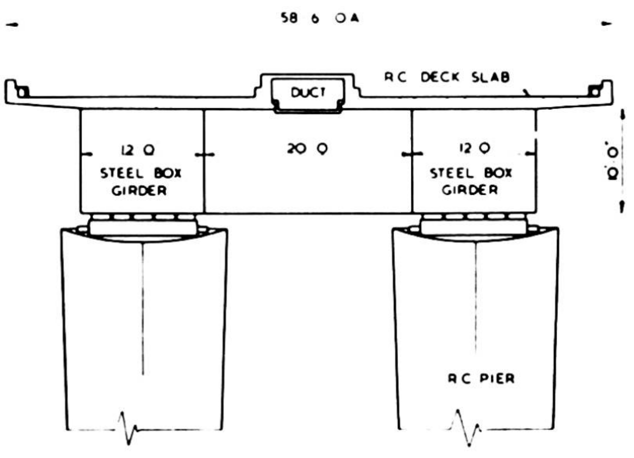



FIG 1 TYPICAL CROSS SECTION

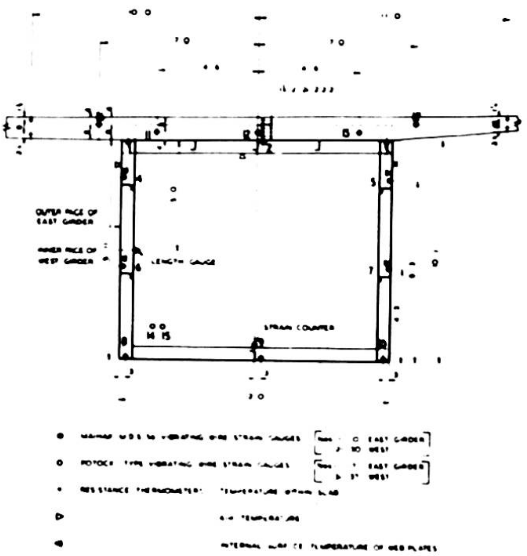
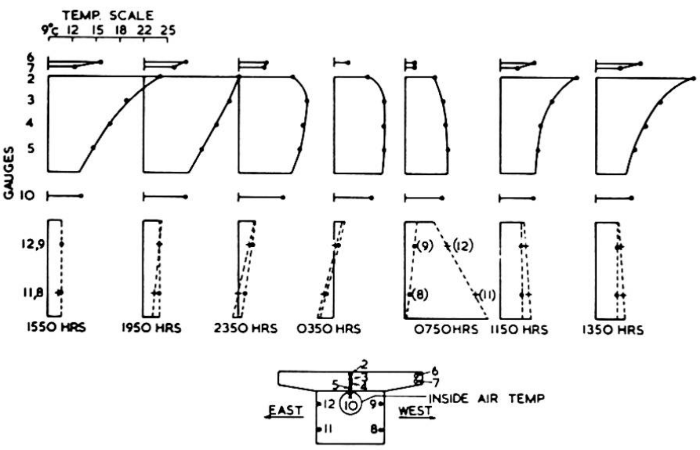


FIG 2 LOCATION OF GAUGES

As well as strain measuring equipment, resistance thermometers were installed during erection as in Fig. 2. Rubber encapsulated thermometers were embedded in the deck slab, and the temperature of the steel surface inside the boxes was measured by surface mounted thermometers. Data logging equipment was mounted in a box built into the walkway handrail.

It is difficult to select data of interest and of quantitative practical value, the difficulties being shown by a study of a single day's temperature cycle, Fig. 3.




TAY BRIDGE TEMPERATURES
6-7th AUG 1968

Fig 3

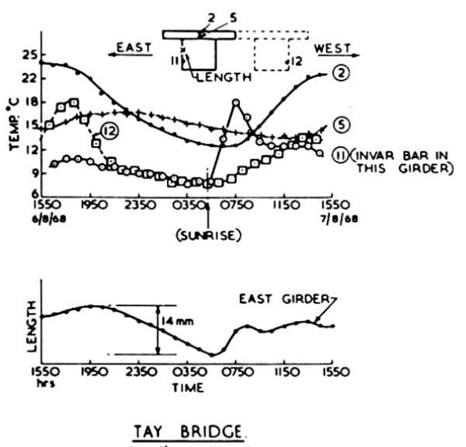
Starting at 1550 hrs, just before the deck surface reaches its maximum temperature, the temperature profile through the deck is as expected and the steelwork is at a much lower but fairly uniform temperature. That is, protected from direct sunlight and cooled by a light wind. The temperature in the cantilevered slab follows the same form of cycle as the central part but is always cooler due to cooling by the wind.

The base of the deck slab lags behind the upper surface in its heating and cooling cycles and the steel box is always at a relatively low temperature, only showing marked heating when at sunrise the sun's rays strike the steel directly. Internal air temperature is always close to that of the underside of the deck slabs and above the skin temperature of the steel box.

These effects are shown up,in Fig.4, when plotting against a time scale. The lag of the slab base behind the slab surface is clearly shown.

The steel temperature does not vary much until the easterly face takes a jump at sunrise. This jump is also evident on the west side as the sun gets lower in the sky.

Length measurements were made in the east girder so that only the morning "jump" shows.




TAY BRIDGE
(6-7th AUG. 1968)

Fig 4

The point of this presentation is to emphasise the usefulness of an approach such as that of Dr. Priestley. The mass of data which one accumulates is all interesting and useful in a general way but almost impossible to codify and present The extraction of quantitative data for use in subsequent design work is a major problem and only likely to be possible when controlled experimental data is available as a guide to what is actually of importance.