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CHAPTER 1

INTRODUCTION

1.1 General

A bridge is a structure that spans a divide such as stream, river, ravine, valley, railway track, roadway and waterway. The traffic that uses a bridge may include pedestrian or cycle traffic, vehicular or rail traffic, water or gas pipes or a combination of all the above. Bridges can generally be classified according to their function, materials of construction, form of superstructure, span and type of service. A bridge should be designed such that it is safe, aesthetically pleasing, and economical.

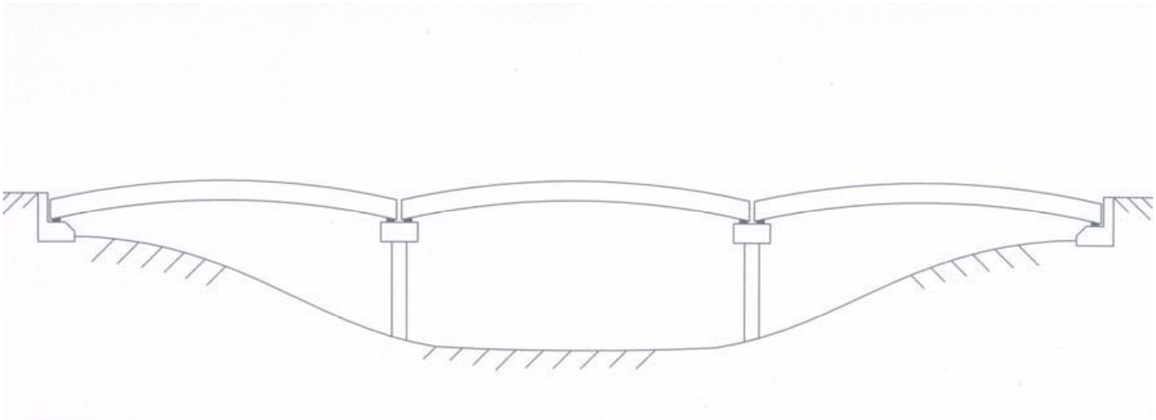
In the construction of pre-tensioned or post-tensioned beam bridges, a very common problem that most contractors faced was to determine and estimate the actual upward deflection or ***camber*** of pre-tensioned or post-tensioned beams due to prestressing. In order to achieve the design bridge finished levels without any unforeseen additional construction cost, camber of beams shall be accurately estimated. If it's under estimated, then the finished design levels will not be able to achieve without reducing the thickness of deck slab or bituminous wearing course.

While in the case of over estimated, the finished design levels can only be attained by increasing the deck slab or wearing course thickness and this is certainly will incurred additional construction cost.

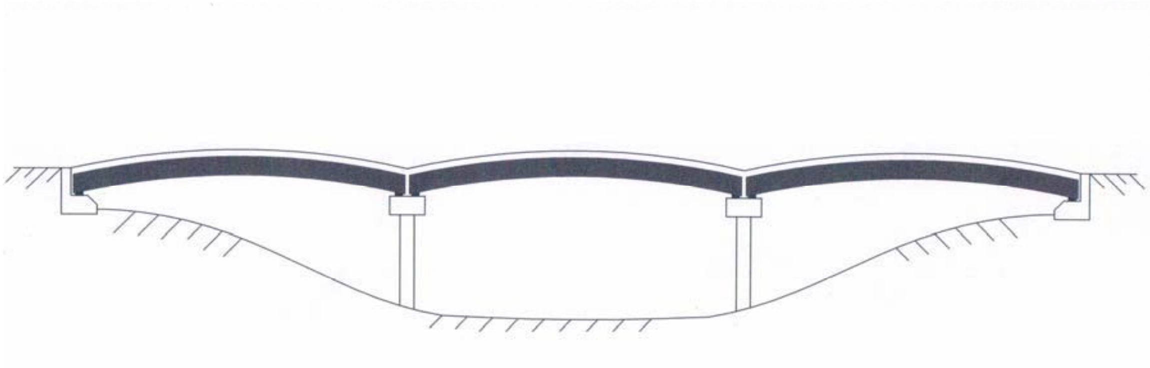
1.2 Problem Statement

One of the important criteria in bridge design and construction is to produce a smooth driving surface for a comfortable driving experience by the road user. In order to achieve the design bridge surface finished levels without compromising on the deck slab or bituminous wearing course thickness, camber on bridge surface needs to be estimated and accounted for when the riding surface is established. If camber of beam is not accounted for by designer and ignored by the contractor in a multi span bridge construction, it may leads to an undulating or “roller coaster” riding surface and potential hazard to travelling public especially on a superelevated bridge deck.

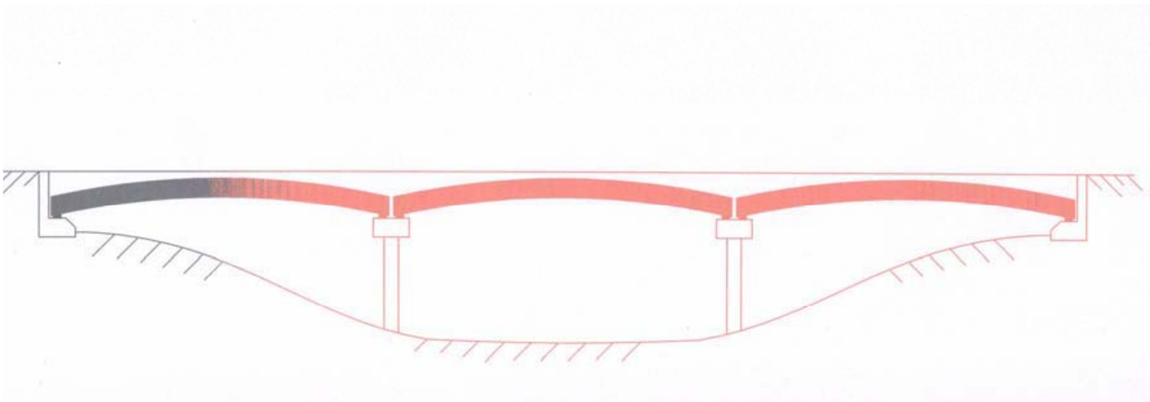
To overcome this problem, camber of pre-tensioned or post-tensioned beams shall be identified, and adjustment has to be made on the finished levels of beam seats, abutment walls and piers based on the estimated beam cambers accordingly and subsequently increase the thickness of deck slab at both ends of each span of bridge to compensate the adjusted levels in order to produce a smooth bridge deck surface. (Figure 1.1)



Beam camber for a 3 spans bridge



An undulating bridge surface due to fixed deck thickness



Thickening deck slab to overcome beam camber's problem

Figure 1.1 : Schematic illustration of beam camber for a 3 spans bridge

1.3 Objective of Study

The purpose of this study is to determine the actual camber of post-tensioned "I" beam. Among the objectives are :-

- To determine the actual beam camber on site for post-tensioned " I " beam.
- Compare beam camber between design estimation based on BS 8110 and actual site data.
- And, to identify various factors that can possibly influence the deflection of post-tensioned beam.

1.4 Scope of Study

The scope of this study will be focused on full scale 36m long post-tensioned "I" beam with overall height of 1.98m.(Figure 1.2) Field data for actual beam camber will be measured base on differences of survey levels before and after prestressing of post-tensioned cables, while design estimation is based on BS 8110.

The possible criteria that may affect deflection of post-tensioned beam such as strength of concrete, modulus of elasticity, creep and shrinkage of concrete will be monitored. Insitu concrete specimens such as concrete cubes and concrete cylinders will be collected and laboratory testing will also be carried out.

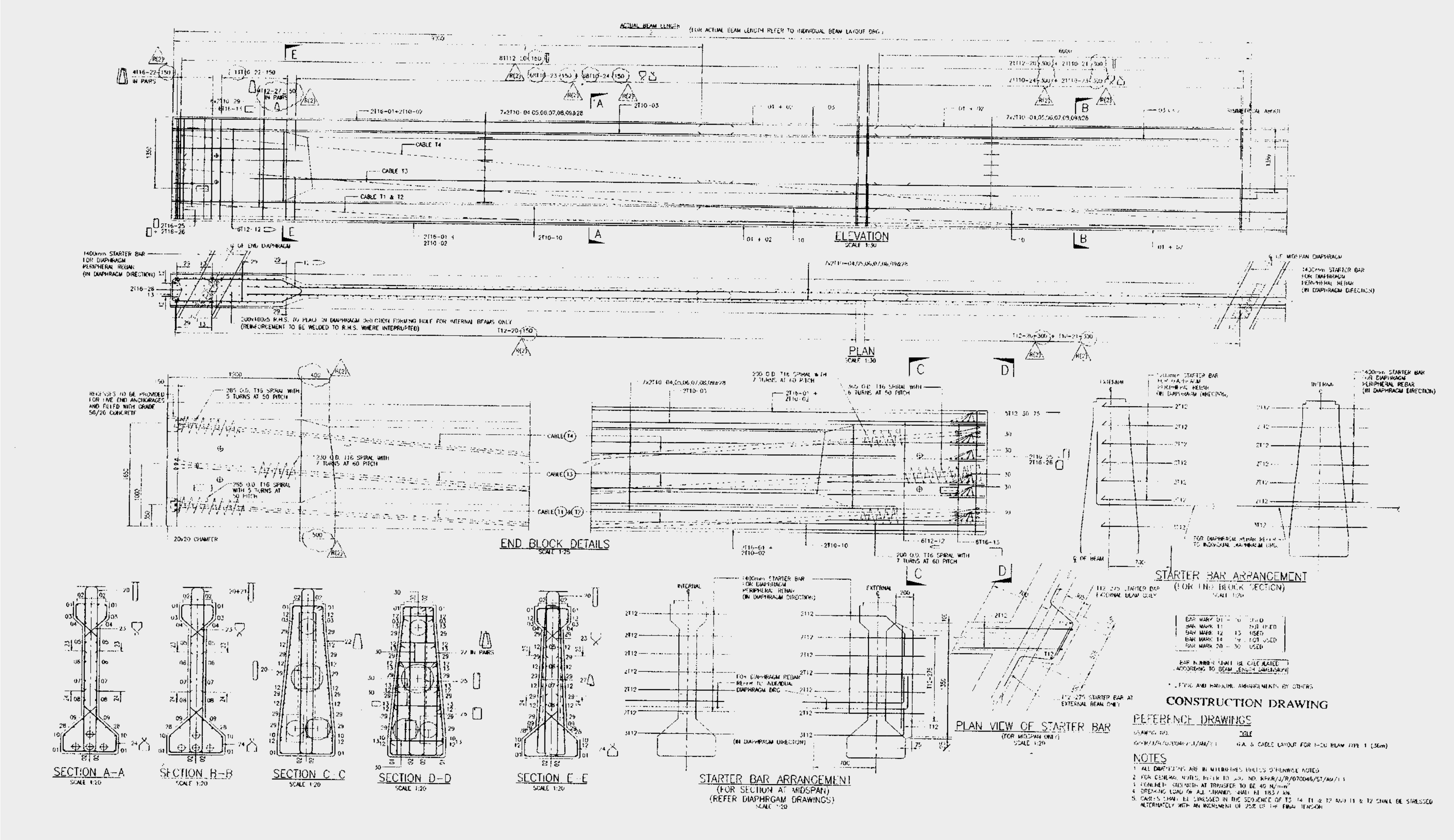


Figure 1.2 : Typical detail for 36m post-tensioned beam