

The Effects of Holes in the Web on the Multi-stage Prestressed Concrete Girder

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Summary

Bulb-T girders are mainly using under 50m span bridges in Korea even though these are more economical than the other girder types. To solve demerits and limits of the current bulb-T girders, Holed Incrementally Pre-stressed Concrete (H-IPC) is recently developed at Ajou Univ. in the Republic of Korea.

H-IPC girder is applied in several revolutionary design concepts compared with the current bulb-T girder. At first, a large number of holes are introduced in the web of the girder and the arrangement of tendons is optimized because some anchorages at the girder end are moved into holes in the web. Prestressing force is introduced in multiple stages by each loading stage to minimize the section of the girder.

This study shows the deflection behavior analysis of full scale H-IPC girder, which was 2m in height and 50m in length, with holes of differing diameters in the web.

Keywords: H-IPC Girder; Holes in the Web; Multistage Prestressing; Spliced Girder; PSC Girder.

1. Introduction

Existing PSC I type girders have not been well applied to the design for long-span bridges above 50m (in length) in spite of the structural effectiveness and economics. This is because the long span increases the girder height and required cross sectional area to introduce prestress, and this abnormally increases the bending moment by dead load.

A new design concept for Holed Incrementally Prestressed Concrete (H-IPC) girder complemented with existing PSC girders, in which holes are applied in the web through a multistage prestressing method by distributing anchoring devices into hollow part of the web. Hollow reduces the total dead load of girders and makes the effective multistage prestressing possible by rearranging the anchoring parts from the end of the girder to the holes, which reduces the great compressive force concentrated at the end of the girder. Besides, as the H-IPC girder can be spliced, quality control for girders is good and the site works can be minimized by the field assembling construction after manufacturing the precast in the factory.

In this study, the deflection measurements based on the diameter were analyzed and the difference of moment of inertia was compared. As an empirical research to investigate the design concept of H-IPC girder and to grasp the structural behavior, intended to verify the usability of H-IPC spliced girders through static load test with a specimen of a full-scaled H-IPC spliced girder, height with 2m, 50m in length by analyzing the test results and by comparing with the test results of different hole diameter effect (central standard, 800mm, 1000mm).