V-386 THE EFFECT OF THICKNESS AND HEIGHT OF PLATE SHEAR CONNECTOR ON LOCAL SHEAR FORCE-LONGITUDINAL DISPLACEMENT RELATIONSHIP

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1. INTRODUCTION

In order to provide basic knowledge for design of composite structure, it is important to know the capacity of shear connectors. It was found in the authors' earlier investigation [1] that local shear force-longitudinal displacement relationship of shear connectors along plate anchorage is essential to be understood in order to estimate the capacity of plural shear connectors. This research is aimed to study the effect of thickness and height of shear connector on local shear force-longitudinal displacement relationship of shear connectors.

2. EXPERIMENT

The experiment was conducted by direct pull-out test. Three specimens, namely Specimen SN-5, ST-10 and SH-10 were tested. The details of specimens are given in Fig.1 and Table 1. The shear connectors for all the specimens were plate shape and the length of shear connectors were equal to the width of bed plate (W) which was 150 mm, but the thickness and height of shear connectors were different for each specimen. Specimen SN-5 was provided with shear connectors of 2.3 mm x 20 mm [Thickness(Tsc) x height(Hsc)], Specimen ST-10 was 1.2 mm x 20 mm and Specimen SH-10 was 1.2 mm x 40 mm. Shear connectors were welded perpendicularly to the bed plate and theirs spacing (S) were kept constant at 100 mm.

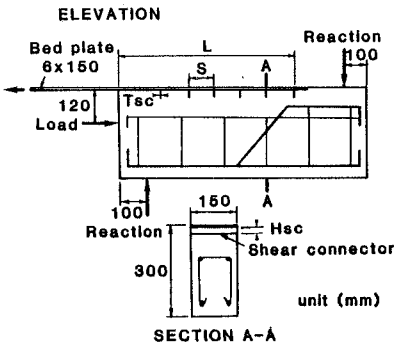

Fig.1 Details of specimens

Table 1 Details of specimens

Specimen	n	T_{sc} mm	H_{sc} mm	L mm
SN-5	5	2.3	20	500
ST-10	10	1.2	20	1000
SH-10	10	1.2	40	1000

Note : n = Number of shear connector
T_{sc} = Thickness of shear connector
H_{sc} = Height of shear connector
L = Anchorage length

3. TEST RESULTS AND DISCUSSION

3.1 Effect of thickness and height of shear connector on local shear force-longitudinal displacement relationship

In the authors' earlier study [1] local shear force-longitudinal displacement relationship of shear connectors between the shear connectors at loaded end and free end were found to be unique. The shear connectors at loaded end and free end exhibit different local shear force-longitudinal displacement relationship due to different boundary conditions. In the present study which involved shear connectors with different thickness and height, similar results were obtained, as shown in Fig.2. However, local shear force-longitudinal displacement relationship is affected by thickness and height of shear connector. Fig.2 shows that thinner shear connector diplaces more easily under the same shear force as compared to thicker shear connector with same height which is stiffer up to the capacity or cracking force of shear connector. Beyond this point, sudden decrease of shear force occurs, accompanying by increase of longitudinal displacement. On the other hand, higher shear connector displaces more than lower shear connector with equal thickness until cracking force is reached. Nevertheless, the cracking force of shear connector was found to be unaffected by thickness and height. This is because failure of shear connector is due to cracking failure in concrete and that failure of shear connector is controlled by concrete strength rather than

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the thickness and height of shear connector.

3.2 Capacity of plural shear connector

The unique local shear force (P)-longitudinal displacement (δ_H) relationship of shear connectors in Specimen SN-5, ST-10 and SH-10 can be represented by a simple model as shown in Fig.2 with two simple expressions as follows :

$$P/(fc'.W) = K.\delta_H \qquad \delta_H \leqq \delta_{HU}$$
$$P/(fc'.W) = P_{max}(\delta_{HU}/\delta_H)^c \qquad \delta_H > \delta_{HU} \quad (1)$$

where,
P_{max} : cracking force,
δ_{HU} : longitudinal displacement corresponding cracking force,
K, c : constants,

Table 2 Parameters of Equation (1)

Specimen	Geometry of S.C.		Equation's Parameter		
	T_{SC} mm	H_{SC} mm	δ_{HU} mm	K	c
SN-5	2.3	20	.09	081	.9
ST-10	1.2	20	.12	061	2.0
SH-10	1.2	40	.14	052	3.0

Base on this model, effect of thickness and height on the capacity of plural shear connector for plate anchorage can be simulated and the results are shown in Fig.3. The capacity of plate anchorage for thicker shear connector is larger than that of thinner shear connector. However, the capacity of plate anchorage seems to be unaffected by height of shear connector provided that the thickness is the same.

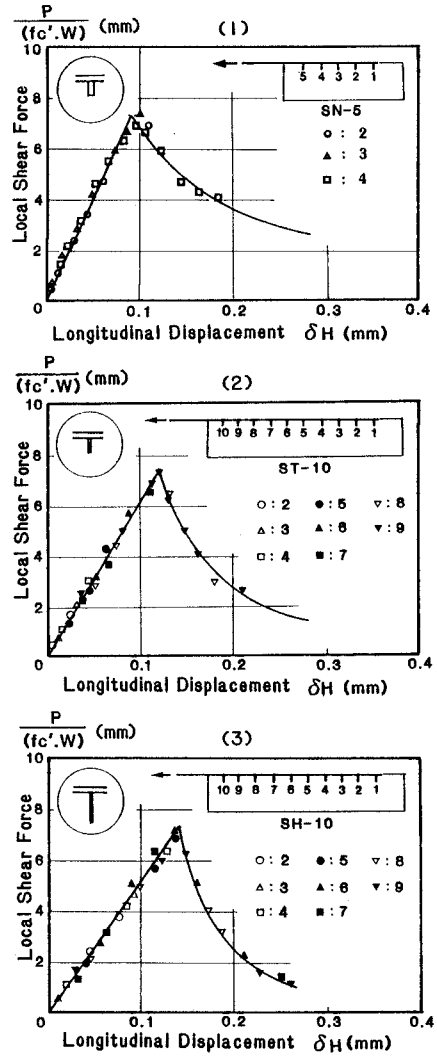

Fig.2 Effect of thickness and height of shear connector on local shear force-longitudinal displacement relationship

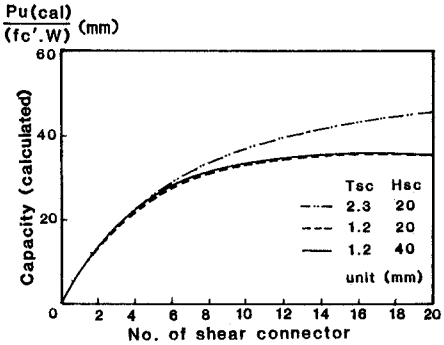

Fig.3 Effect of thickness and height of shear connector on the capacity of plate anchorage

4. CONCLUSIONS

(1) Thinner shear connector displaces more as compared to thicker shear connector when equal local shear force is carried.
(2) Shear connector with greater height displaces more than shear connector with smaller height under the same force.
(3) Capacity or cracking force of shear connector is unaffected by thickness and height of shear connector.

REFERENCE

[1] Chuah,C.L, Rungrojsaratis,V & Shima,H, "Load-displacement Relationship of Shear Connector Along Plate Anchorage", Proceedings of Japan Concrete Institute, 1990 (to be published).