Experimental Study on Shear Behavior of SSC Structures under Out of Plane Loading

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1. Introduction

In comparison with the RC(Reinforced Concrete) structure, SSC(Stiffened Steel plate Concrete) module has the advantage of short construction period, good quality control and less cost.

In this study, to verify shear behavior of SSC wall module under out of plane loading, several tests were conducted according to the rib reinforcement ratio, stud reinforcement ratio and shear reinforcement ratio. On the basis of test results, it is found that rib reinforcement ratio is the main factor of securing the loading capacity of SSC structures.

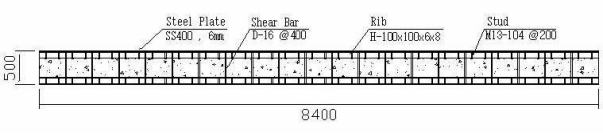
2. Test Procedure

2.1 Specimen Shape

SSC specimens are assumed as a 1-way slab. S-4R-2S400-4ST is the standard specimen with 4 ribs, 2 rows of shear bar spacing 400mm and 4 rows of stud. S-4R-0S-4ST has no shear bar and S-4R-2S400-0ST has no stud. The properties of specimen are summarized in Table I and Figure 1 shows the schematic view of specimen (S-4R-2S400-4ST).

Table I. Specification of specimen (Unit : mm)

Specimen	S-4R-0S-4ST	S-4R-2S400-4ST	S-4R-2S600-4ST	S-4R-2S800-4ST	S-4R-2S400-0ST	**S-0R-2S400-4ST**
BXHXL (mm)	**800 X 500 x 8400**					
Rib	4 rows (H-100 x 100 x 6 x 8)					**None**
Plate (SS400)	**6mm**					
Stud (M13)	4 rows @200				None	4 rows @200
Shear Bar (D16)	**None**	**2 rows @400**	**2 rows @600**	**2 rows @800**	**2 rows @400**	**2 rows @400**



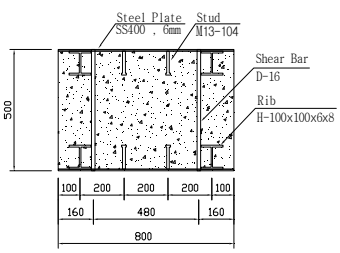


Fig 1. S-4R-2S400-4ST

2.2 Loading Frame

Loading frame was designed to apply shear loading condition by strong beam and 700tonf UTM (Universal Testing Machine). Figure 2, 3 shows drawing of test apparatus and loading condition.

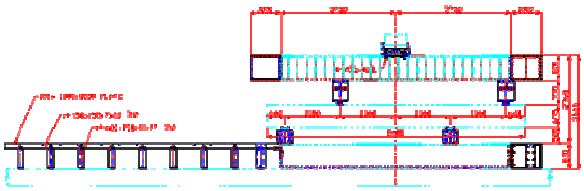


Fig 2. Loading Frame

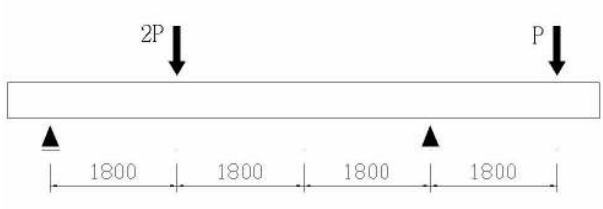


Fig 3. Loading Condition

3. Test Results and discussion

3.1 Failure Shape

On the basis of failure shapes, shear and flexural failure were mixed. As rib ratio becomes low, it has a tendency to have a flexural failure shape.

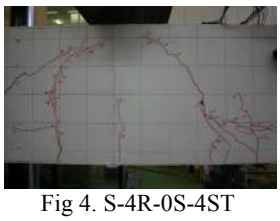


Fig 4. S-4R-0S-4ST

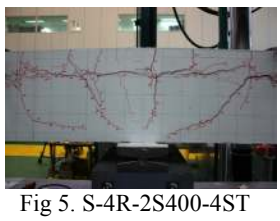


Fig 5. S-4R-2S400-4ST

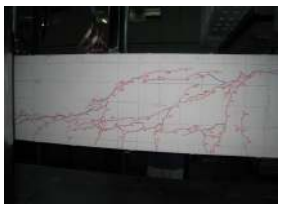


Fig 6. S-4R-2S400-0ST

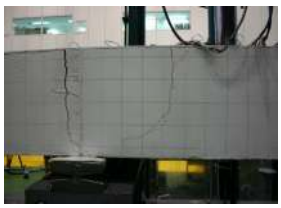


Fig 7. S-0R-2S400-4ST

Some cracks were examined at the welding point among steel plate and stud, shear bar. With high stud and shear bar ratio, the frequency and amount of crack were increased because of increasing loading capacity. Figure 8 shows crack distribution.

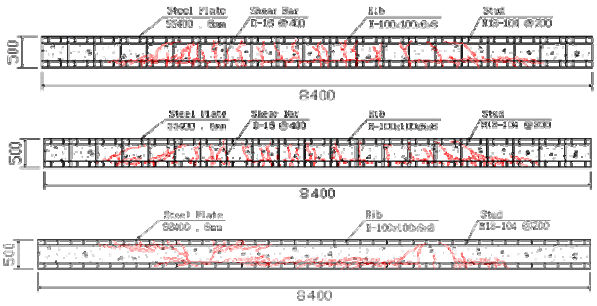


Fig 8. Crack Distribution

3.2 Load-Displacement Relationship at the Centre

Figure 9 shows a load-displacement relation at the center of specimen with respect to the stud ratio. As the stud ratio rises, the loading capacity of the SSC structure is increased.

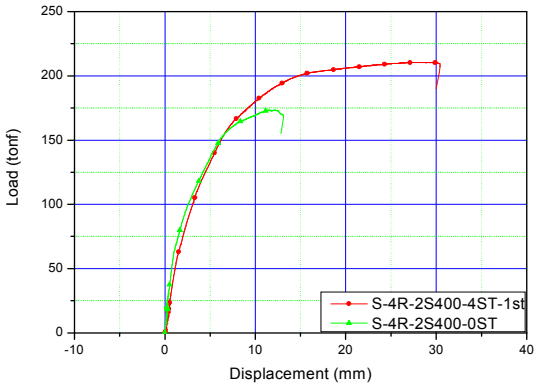


Fig 9. Load-Displacement curve w.r.t. stud

Figure 10 shows a load-displacement relation at the center with respect to the shear bar ratio. As the shear bar ratio increase, the loading capacity of the SSC structure is increased.

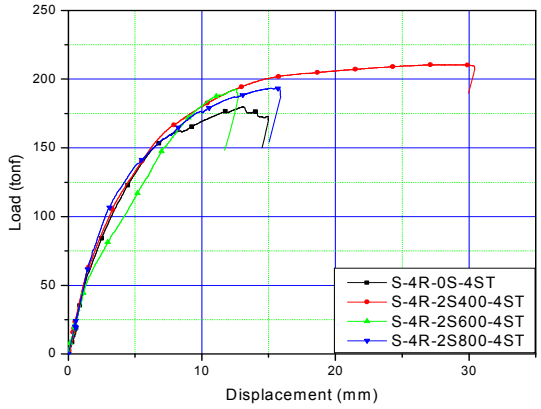


Fig 10. Load-Displacement curve w.r.t. shear bar

Figure 11 shows a load-displacement relation at the center with respect to the rib reinforcement. Rib has a great strength enhancement effect comparing with the stud, shear bar ratio.

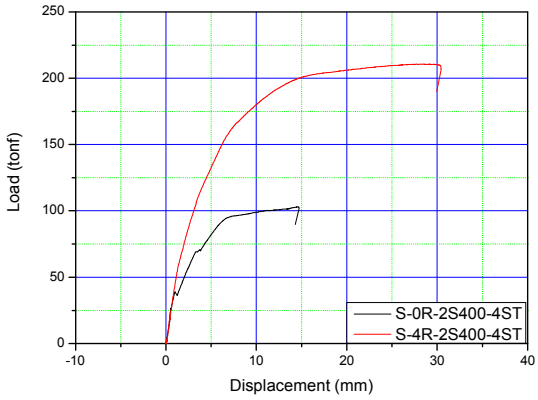


Fig 11. Load-Displacement curve w.r.t. rib

4. Conclusion

Several structural tests were conducted to verify the behavior of SSC structure under shear loading condition.

As a result of experiments, concrete yield before the buckling of steel plate at SSC structure specimen with rib. In case of shear bar reinforcement, maximum capacity is increased about 19%. In case of stud, maximum capacity is increased about 21%. However, in case of rib, maximum capacity is increased more than two times. As a result of test results, it is found that increase of rib ratio is the main factor of securing capacity of SSC structure.

ACKNOWLEDGEMENT

This research was financially supported by Ministry of Knowledge and Economy and the authors are grateful to the authorities for their support.

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