Experimental Study on Bending and Shear Behavior of SC Structures under Out of Plane Load

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1. Introduction

Comparing with RC structures, SC (Steel Plate Concrete) module can shorten construction period.

This is an experimental study on the out of plane load behavior of SC (Steel Plate Concrete) wall module under bending and shear loading. 4 tests were conducted to verify structural performance according to rib reinforcement ratio, stud reinforcement ratio and shear reinforcement ratio. On the basis of test results, it is found that rib reinforcement ratio is a main factor of flexural strength of SC structures.

2. Test Procedure

2.1 Specimen Shape

Beam type specimens were designed as SC walls were assumed as a 1-way structure. B-4R-2S400-4ST is composed of bending type, 4rib, 2shear Bars, 4stud. S-4R-2S400-4ST was the same specimen with B-4R-2S400-4ST, S-4R-0S-4ST has no shear bar and S-4R-2S400-0ST has no stud. The properties of specimen are summarized in Table 1 and Figure 1 shows the schematic view of specimen (B-4R-2S400-4ST).

Table 1. Specification of specimen (Unit : mm)

Specimen	B-4R-2S400-4ST	S-4R-0S-4ST	S-4R-2S400-4ST	S-4R-2S400-0ST
B X H X L (mm)	800 X 500 x 8400			
Rib	4 rows (H-100 x 100 x 6 x 8)			
Plate (SS400)	6mm			
Stud (M13)	4 rows @200	4 rows @200	4 rows @200	4 rows @200
Shear Bar (D16)	2 rows @400	None	2 rows @400	2 rows @400
Shear Ratio	1.8 Flexural	3.6 Shear		

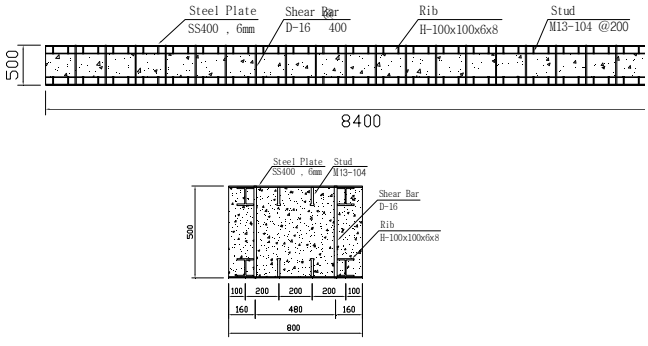


Figure 1. B-4R-2S400-4ST

2.2 Loading Frame

Loading frame was designed to apply shear and flexural load by strong beam. Figure 2 shows drawing of test apparatus.

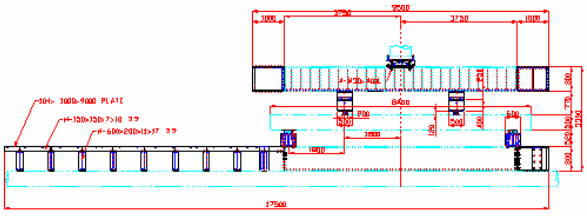


Figure 2. Loading Frame(Flexural Test)

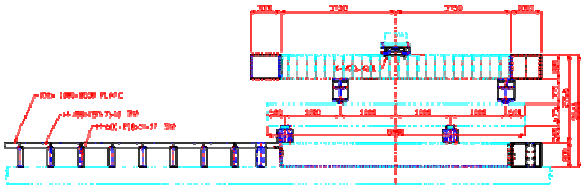


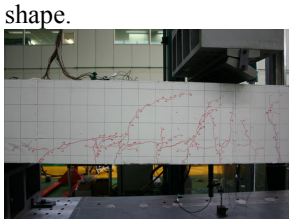
Figure 3. Loading Frame(Shear Test)

Figure 3 shows Loading Frame for Shear Test.

3. Test Results and discussion

3.1 Failure Shape

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



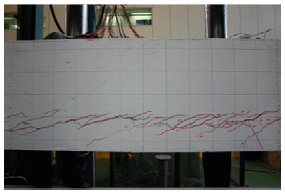
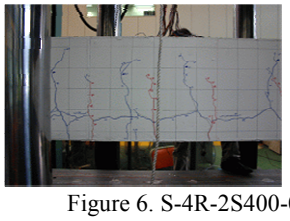


Figure 4. B-4R-2S400-4ST Figure 5. S-4R-0S-4ST



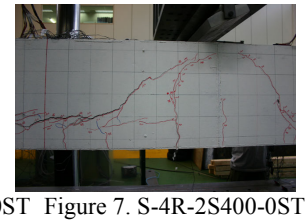


Figure 6. S-4R-2S400-0ST Figure 7. S-4R-2S400-0ST

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

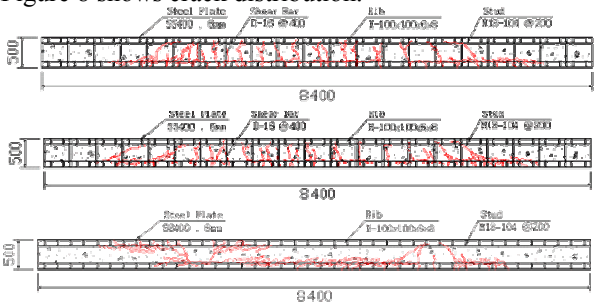


Figure 8. Crack Distribution

3.2 Load-Displacement Relationship

In the Figure 9~11, 10 and 11 were shear failure and 9 was mixed failure with shear and flexural. Figure 9 show a load-displacement relation at the center of specimen.

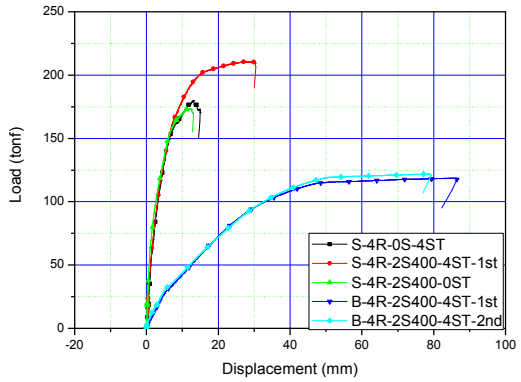


Figure 9. Load-Displacement relation(center)

Figure 10 shows a load-displacement relation at the center from stud .

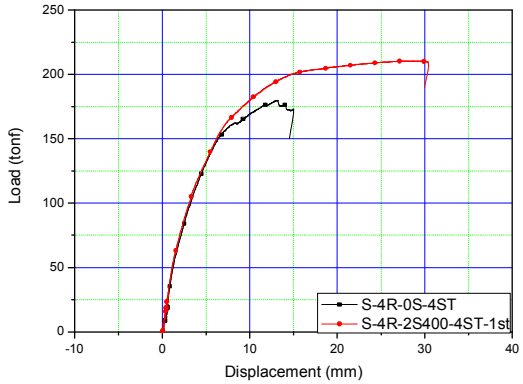


Figure 10. Load-Displacement relation(shear bar)

Figure 11 shows a load-displacement relation at the center from shear bar .

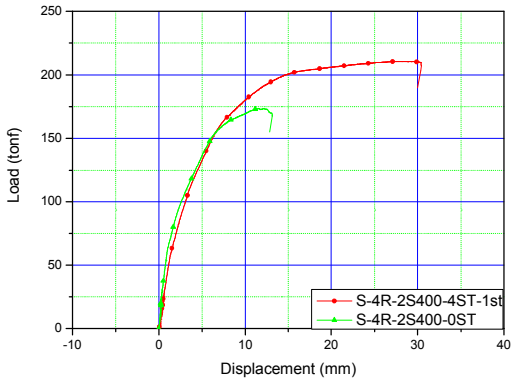


Figure 11. Load-Displacement relation(stud)

4. Conclusion

Several tests were conducted to verify behavior of SC module walls under bending and shear loading.

As a result of experiments, Concrete yield before load buckling of steel plate at SC structure specimen wth rib. In case of including shear bar maximum capacity is increased to 19%. In case of including stud maximum capacity is increased to 21%. Also it is found that increase of rib ratio is a main factor of securing Flexural capacity.

ACKNOWLEDGEMENT

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