Experimental Study on Flexural Behavior of SSC Structures under Pure Bending

D. S. Park [a*], K. W. Ham [a], K. J. Lee [a], Y. P. Suh [a]
[a] *Environment & Structure Lab., KEPRI, 103-16, Munji-Dong, Yuseong-Gu, Daejeon, KOREA*

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 management and less construction cost.

In this study, to verify flexural behavior of SSC wall module under pure bending, several tests were conducted according to the rib and stud reinforcement. As a result, it is found that rib reinforcement ratio is the main factor of securing the bending capacity of SSC structures

2. Test Methods and Procedure

Some of the techniques to perform the bending test of SSC specimens are described in this section.

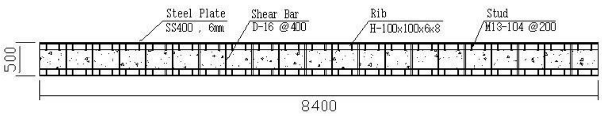
2.1 Specimen Type

SSC specimens are assumed as a 1-way slab. B-4R-2S400-4ST is the standard specimen with 4 ribs, 2 rows of shear bar spacing 400mm and 4 rows of stud spacing 200mm. B-0R-2S400-4ST has no rib reinforcement and B-4R-2S400-0ST has no stud. B-2R-2S400-2ST is half SC specimen with negative bending moment and BP-2R-2S400-2ST is the same specimen with B-2R-2S400-2ST but for positive bending moment.

The properties of specimen are summarized in Table I and Figure 1 shows the schematic view of specimen (B-4R-2S400-4ST(1st and 2nd)).

Table I. Dimension of specimen (Unit : mm)

	B-4R-2S400-4ST(1st)	B-4R-2S400-4ST(2nd)	B-0R-2S400-4ST	B-4R-2S400-0ST	B-2R-2S400-2ST	BP-2R-2S400-2ST
BxHxL (mm)	800 X 500 x 8400					
Rib	4 rows (H-100 x 100 x 6 x 8)		None	4 rows	2 rows	
Plate (SS400)	6mm Upper and bottom side of specimen				Upper side only	Bottom side only
Stud (M13)	4 rows @200			None	2 rows @200	
Shear Bar (D16)	2 rows @400					



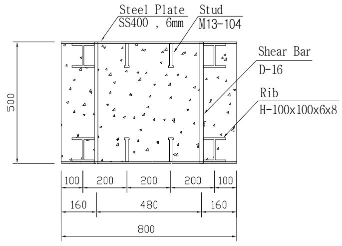


Fig 1. B-4R-2S400-4ST (1st and 2nd)

2.2 Loading Scheme

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

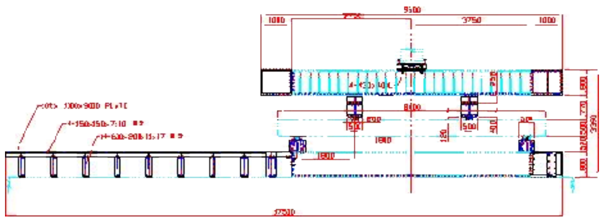


Fig 2. Loading Frame

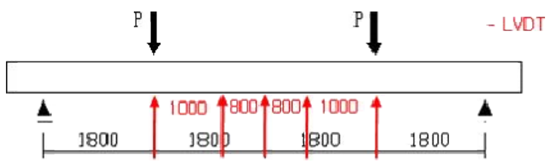


Fig 3. Loading Condition

3. Test Results and discussion

3.1 Failure Crack Pattern

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

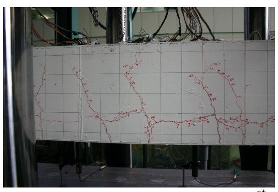


Fig 4. B-4R-2S400-4ST(1st)

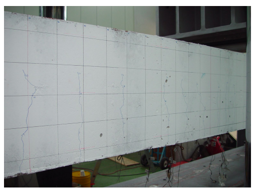


Fig 5. B-0R-2S400-4ST

Some cracks were examined at the welding point among steel plate, stud and shear bar. With high rib reinforcement ratio, the frequency and amount of crack were increased because of increasing loading capacity. However, there is little difference crack distribution with respect to bending loading condition (positive and negative bending). Figure 6 shows crack distribution of specimen.

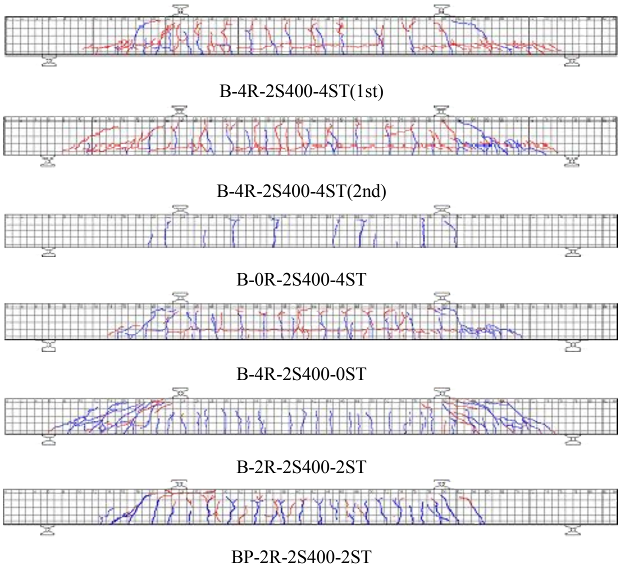


Fig 6. Crack Distribution

3.2 Load-Displacement Relationship at the Centre

Figure 7 shows a load-displacement relation at the center of specimen with respect to stud reinforcement. There is no stud reinforcement effect under pure bending.

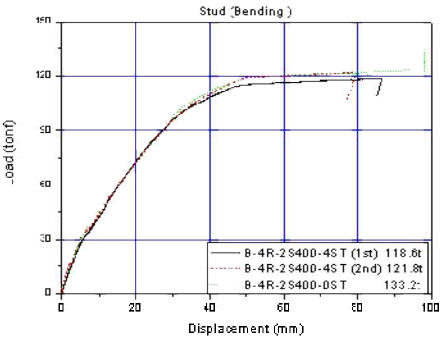


Fig 7. Load-Displacement curve w.r.t. stud

Figure 8 shows a load-displacement relation at the center with respect to loading condition of bending moment. There is little difference between positive and negative bending moment.

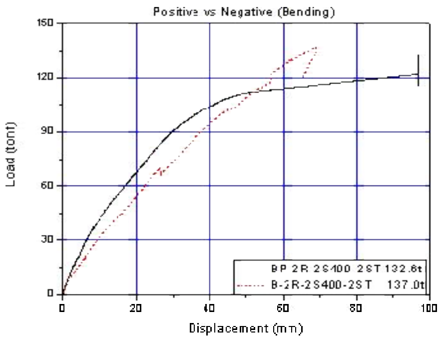


Fig 8. Load-Displacement curve w.r.t. loading type

Figure 9 shows a load-displacement relation at the center with respect to the rib reinforcement. Rib has a great strength enhancement effect comparing with stud reinforcement.

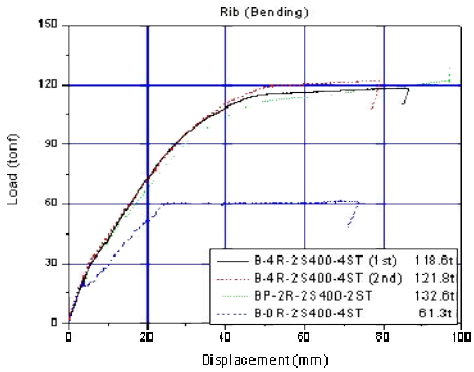


Fig 9. Load-Displacement curve w.r.t. rib

4. Conclusion

Several structural tests were conducted to verify the behavior of SSC structure under pure bending.

In case of rib reinforcement, maximum bending capacity is increased about 193%. However, In case of stud reinforcement and moment loading type, there is no significant difference of loading capacity. Therefore, it is found that increase of rib ratio is the main factor of securing flexural loading capacity of SSC structure.

ACKNOWLEDGEMENT

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

REFERENCES

[1] B.Mckinley, L.F.Boswell, "Behavior of double skin composite construction," Journal of Constructional Steel Research 58, 2002.

[2] 日本電氣協會 鋼板ユソクリ-ト構造 耐震設計技術指針 JEAG 4618-2005