Experimental Study on application of coupler at SC(Steel plate Concrete) Structures

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1. Introduction

Comparing with RC(Reinforced Concrete) structures, SC (Steel plate Concrete) structure has an excellent advantage of construction period, cost & quality. In the construction of SC module, tie bar is needed to withstand concrete pressure during concrete pouring. But it has a disadvantage because of difficulty of installment. So usage of coupler with tie bar is suggested in this study. Two tests were conducted to verify efficiency of coupler of tie bar. On the basis of test results, it is found that tie bar with coupler has shown good structural performance compared to tie bar without coupler.

2. Test Procedure

2.1 Specimen Shape

Beam type specimens which were designed as SC walls were assumed as a 1-way structure. Case-02 was the same specimen with case-01, but coupler which interconnects shear bars were used. The properties of specimen are summarized in Table 1 and Figure 1,2 shows the schematic view of specimen (Case-01, Case-02).

Table 1. Specification of specimen (Unit : mm)

	Case-01	Case-02
Length	8400	8400
Depth	500	500
Steel plate thickness	9	9
Stud diameter	16	16
Stud pitch	200	200
Shear bar pitch	400	400
Coupler		O
Shear bar ratio	0.2	0.27
Shear span ratio	1.6	1.6
T/t	55.6	55.6

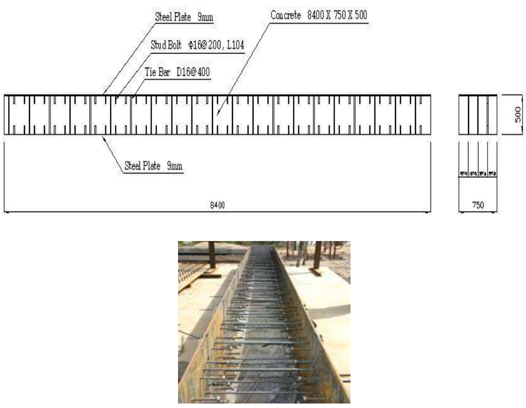


Figure 1. Case-01 specimen

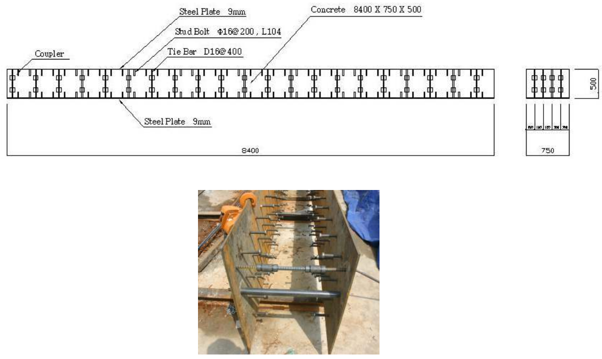


Figure 2. Case-02 specimen (coupler type)

2.2 Loading Frame

Loading frame was designed to apply 4 different load at the middle and edge of specimen. 6 hydraulic jacks subjected to the main frame were used for static loading. 2 pair of hydraulic jacks were installed at the center of the main frame and 1 pair of hydraulic jack was installed at both ends. Then hydraulic jacks were connected with same hydraulic line to level horizontally the entire main frame. Figure 3 shows drawing of test apparatus. Figure 4 shows load distribution at center and edge of specimen.

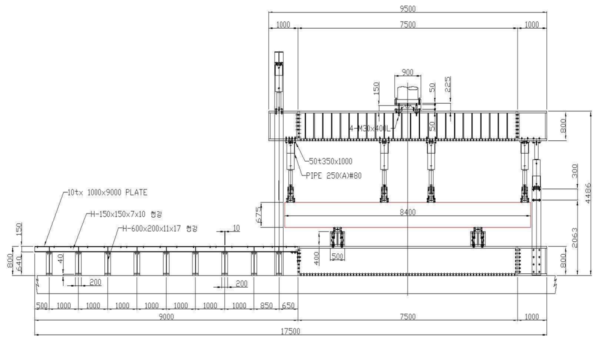


Figure 3. Loading Frame

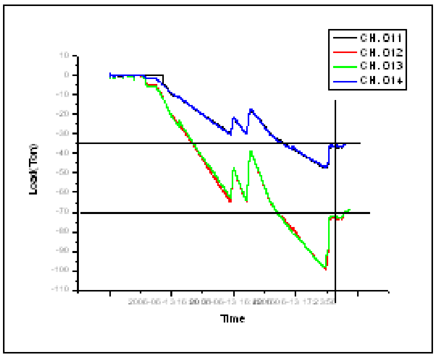
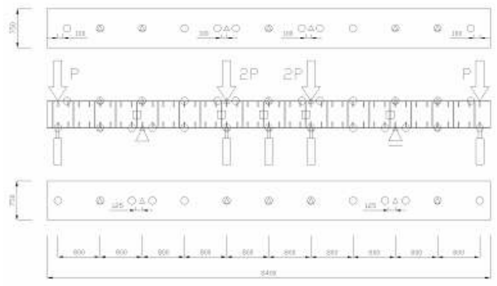


Figure 4. Load Distribution

2.3 Sensor and Data Acquisition

Several LVDTs were installed at the maximum displacement position (centre and each ends of the specimen) and a number of strain gauges were attached internal and external steel plate to analyze structural behavior of SC structures.



3. Test Results and discussion

3.1 Failure Shape

On the basis of failure shapes, shear failure crack patterns were observed.

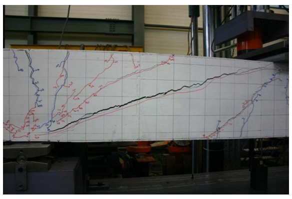


Figure 6. Case-01

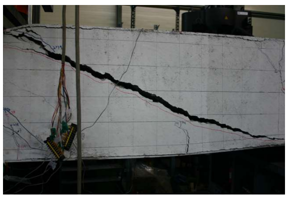


Figure 7. Case-02

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

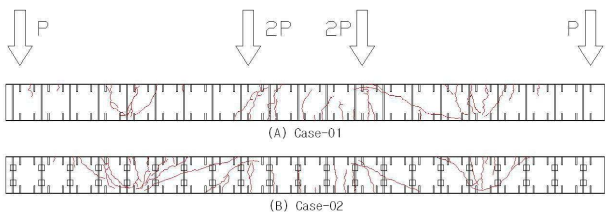


Figure 8. Crack Distribution

3.2 Load-Displacement Relationship

Figure 9 shows a load-displacement relation at the center of specimen. Tie bar with coupler(case 2) shows a larger flexural strength compared to tie bar w/o coupler. It is considered to the effect of increase of shear bar ratio due to a coupler.

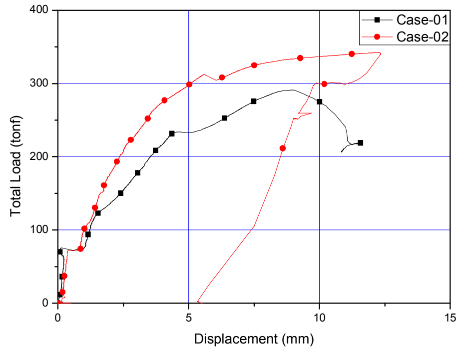


Figure 9. Load-Displacement relation

Figure 10 shows a load-strain relation at the bottom of center steel plate. Case-01, case-02 show an elastic behavior. Case 02 shows an ductile behavior compared to case 01.

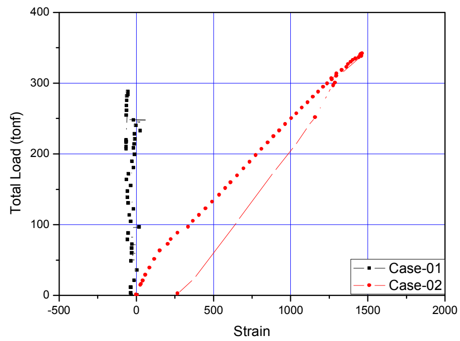


Figure 10. Load-Strain relation

4. Conclusion

Two different type of interconnection of a SC structure tests were conducted to verify efficiency of coupler of SC module walls under bending and shear loading combination.

As a result of experiments, case-02 showed larger shear capacity compared to case-01, therefore usage of coupler is desirable for construction and strength purpose. Also it is found that increase of shear bar ratio is a main factor of securing shear capacity.

ACKNOWLEDGEMENT

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