

Experimental Study on Temperature Behavior of SC Structures

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1. Introduction

SC(Steel plate Concrete) module method uses steel plate instead of reinforcing bar and mold in existing RC structure. Steel plate modules are fabricated in advance, installed and poured with concrete in construction field, so construction period is remarkably shortened by SC module technique.

In case of existence of temperature gap between internal and external structure surface such as spent fuel storage pool, thermal stress is taken place and as a result of it, structural strength is deteriorated.

In this study, we designed two test specimens and several tests with temperature heating were conducted to evaluate temperature behavior of SC structures and RC structure..

2. Test Procedure

2.1 Outline of Specimen

The shape of specimen is shown in Fig 1 – Fig 2. All the cross section of test specimens are the same. As the major factor which gives influence to bending property of a SC, the steel ratio is chosen as a test parameter. In the tests, SS400 steel plate and 35N/mm² concrete materials are used.

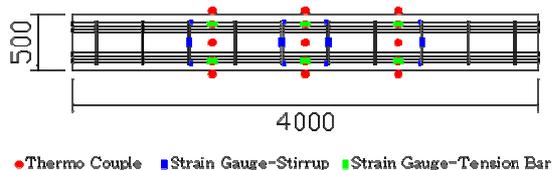


Figure 1. Test specimen and Gauge(RC050T)

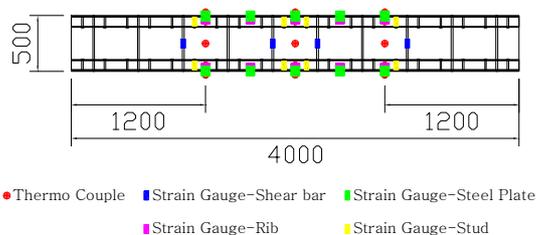


Figure 2. Test specimen and Gauge(SC050T)

2.2 Test Method

Maintaining 183 °C maximum temperature difference between lower and upper steel plate by heating lower

part of SC specimen using thermal heat panel, the flexural deformation due to heat inflation occurs (Fig 2). Fig. 3 shows time vs. temperature curve used experiment.

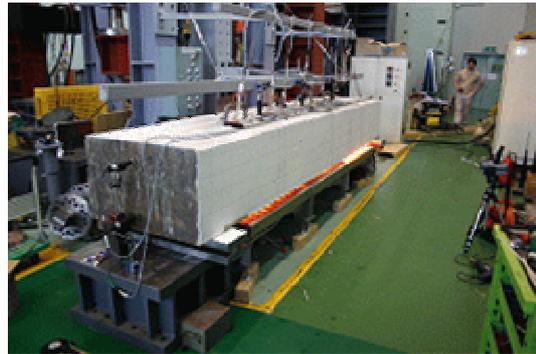


Figure 3. Specimen and Thermal Heat Panel

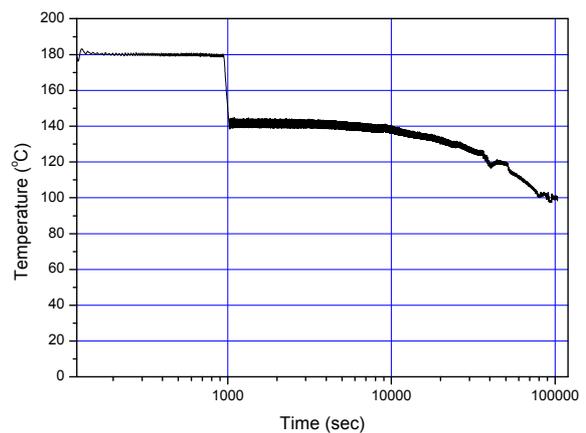


Figure 4. Time vs. Temperature Curve

3. Test Results and Discussion

In test results, displacement and crack distribution of specimen were evaluated under temperature loading condition. Also moment-curvature relationship was analyzed.

3.1 Crack distribution under temperature heating

Fig 4. shows crack distribution of RC specimen during temperature heating. The minute crack occur in the bottom of specimen due to thermal stress.

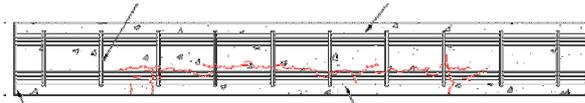


Figure 5. Crack Pattern of Specimen(RC050T)

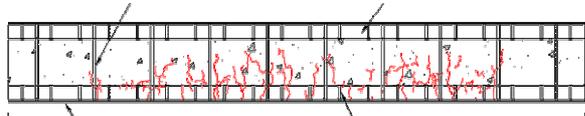


Figure 6. Crack Pattern of Specimen(SC050T)

Fig 7 – 8 show temperature distribution of specimens during heating.

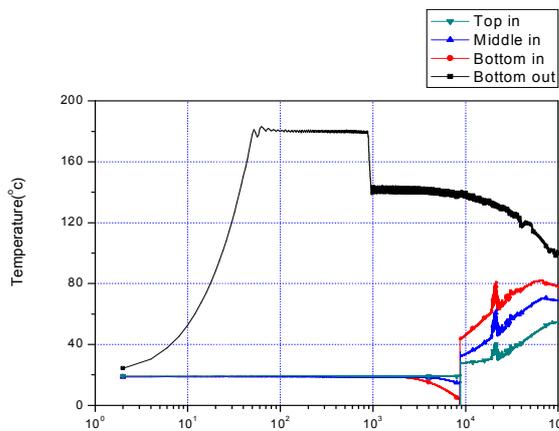


Figure 7. Temperature Distribution of Specimen (RC050T)

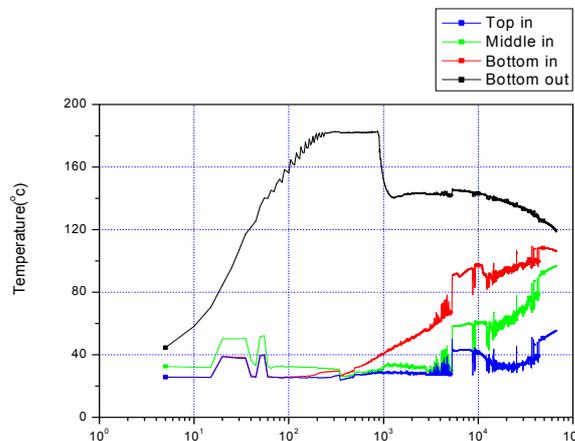


Figure 8. Temperature Distribution of Specimen (SC050T)

3.2 Deflection distribution under Heating

The relation of Deflection-Temperature of specimen are shown in Fig 9-10. Comparison with RC050T, SC050T showed large deflection due to temperature.

The maximum center vertical deflection of SC050T is 3.37mm at 131 °C.

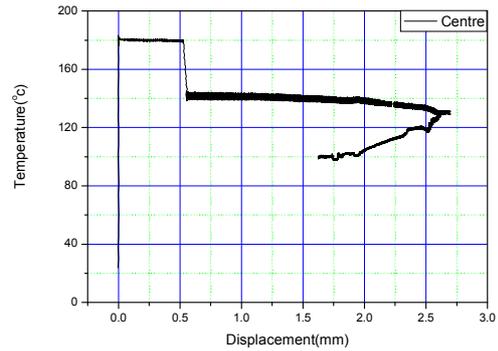


Figure 9. Relation of Temperature-Displacement (RC050T)

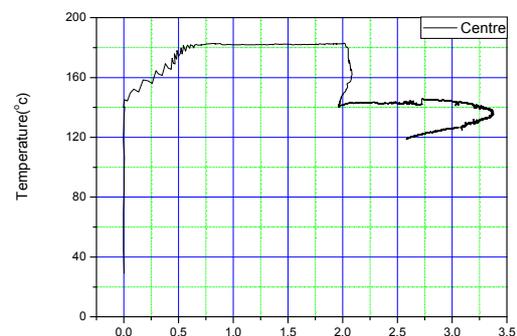


Figure 10. Relation of Temperature-Displacement (SC050T)

4. Conclusion

To evaluate the behavior of SC structures when exposed to heat sources such as spent fuel storage pool, several thermal loading tests were conducted with thermal heat panel. Test results are as follows ;

- ① The minute crack occur in the bottom of specimen due to thermal stress.
- ② The maximum vertical deflection occur at 131 °C.
- ③ The maximum vertical deflection of SC structure is 23% larger than that of RC structure.

ACKNOWLEDGEMENT

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