AN EXPERIMENTAL STUDY ON LOAD-CARRYING CAPACITY OF OUTSTANDING STEEL PLATES MADE OF SBHS400

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1. INTRODUCTION

Steel for Bridge High-Performance Structure, "SBHS" is high-performance steel plate that has been standardized in Japanese Industrial Standard (JIS) for use in steel bridge structure[1]. The high yield strength, high toughness, and high workability are the major features of SBHS. SBHS is available in three types, SHBS400, SBHS500, SHBS700, in which each number represents the number of yield strength grades. Each type of SBHS has different capabilities that are effective for economical design, depending on the purpose of construction.

The studies on SBHS[2), 3)] are not sufficient compared with that of conventional steel like SM490. Especially, the studies on SBHS400 are few. On the other hands, it is necessary to obtain more information in order to investigate it and to develop the design methods for steel structures made of SBHS400. Material properties of SBHS400 had been investigated in the previous study[2)].

This study focuses on features of load-carrying capacity of outstanding steel plates made of SBHS400. The compression tests were conducted with three types of specimens that are different in size and width-thickness ratio parameters respectively. From the test results, the feature of load-carrying capacity of outstanding steel plates made of SBHS400 is examined.

2. TEST SPECIMENS AND LOADING CONDITION

In order to obtain information on load-carrying capacity of outstanding steel plates made of SBHS400, three test specimens were employed. More details of the specimens are shown in Fig.1, Fig 2. and Table 1. Fig.1 shows the shape and dimensions of test specimens and Fig. 2 shows the cross sectional area of the test specimen and the shape of the test specimens is cruciform.

Each type of B04, B07 and B09 consists of webs and flanges made of SBHS400. The mechanical properties of SBHS400, dimensions and major parameters of test specimens are shown in Table 1. The compressive axial force was applied to each specimen by using large-scale test machine at

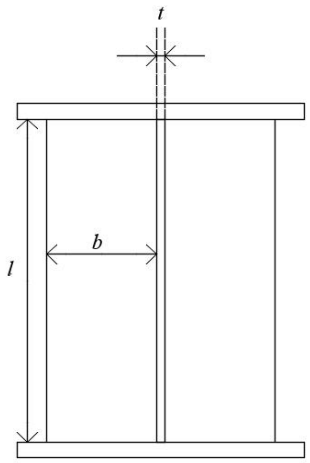

Fig. 1 Test specimen of SBHS400

Fig. 1 Test specimen of outstanding steel plate made of SBHS400

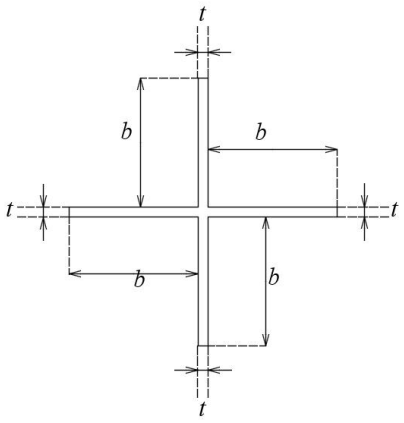

Fig. 2 Cross section of outstanding steel plate made SBHS400

Table 1. Mechanical properties and parameters of SBHS400

		B04	B07	B09
Steel Grade		SBHS400	SBHS400	SBHS400
σ_y	(MPa)	461		
b	(mm)	50	87	112
t	(mm)	9		
l	(mm)	200	262	337
R_R		0.43	0.75	0.97

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0.005 mm/s of loading rate. Fig. 3 shows the condition while experiment was conducted.

3. TEST RESULTS

The results of the experiment are shown in Fig. 4 and Fig. 5. As shown in Fig. 4, the results of B07 and B09 are slightly different when each test specimen reached maximum axial force "P_{max}". On the other hands, B04 shows larger value of P_{max} with relatively larger displacement compared to B07 and B09.

The load carrying capacity of the specimens was also examined by comparing the test results with the strength curve specified in design specifications for highway bridges in Japan[4]. The value of buckling strength σ_{cr} is calculated by dividing maximum axial force by the sectional area of each test specimen. As shown in Fig.5, σ_{cr}/σ_y decreases as R_R increases. The experimental data of σ_{cr}/σ_y are located above the strength curve in Japanese design specifications. These tendencies are the same as those of conventional structural steel like SM490. This indicates the possibility that the load-carrying capacity of outstanding steel plates made of SBHS400 is similar to that of conventional steel and the load-carrying capacity can be evaluated by the strength curve in the current design specifications.

4. CONCLUSIONS

The compression tests of the outstanding steel plates made of SBHS400 were conducted to investigate the load-carrying capacity. According to the experimental results, it is found that the feature of the load-carrying capacity of outstanding steel plates made of SBHS400 is similar to that of conventional steel and the load-carrying capacity can be evaluated by the strength curve in the current design specifications. However, it is necessary to obtain more information on the load-carrying capacity of the steel structures made of SBSH400 by not only experimental studies but also analytical studies.

ACKNOWLEDGMENTS

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Fig. 3 Condition of compressive test

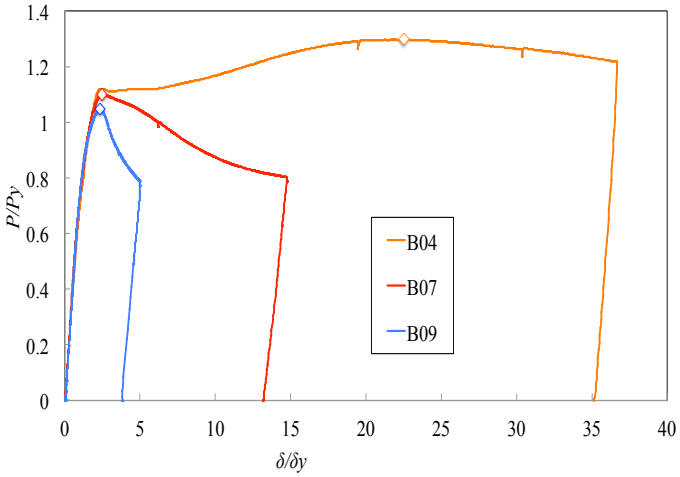

Fig. 4 $P/P_y - \delta/\delta_y$ relationship

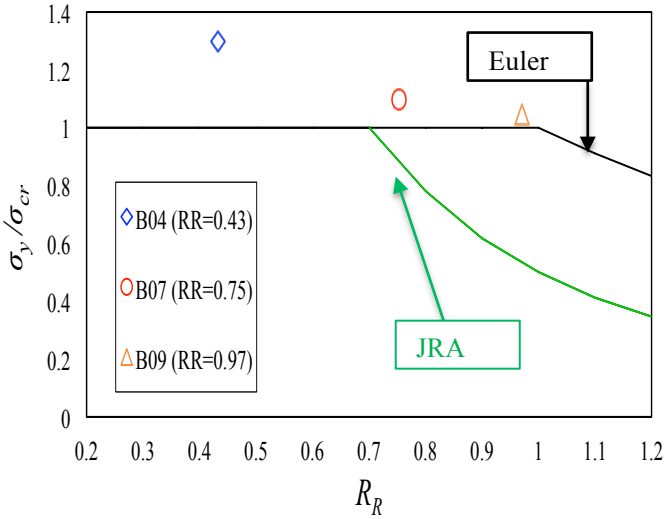

Fig. 5 Comparison between experimental results and ultimate strength curves