SELF-PROPELLED IMPACT VIBRATION EXPERIMENT AGAINST DETERIORATED BRIDGE SLAB

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1. INTRODUCTION

A lot of fatigue damage of reinforced concrete slabs of bridges have been reported. Therefore, the maintenance of bridges is an important issue [(1)]. After some experiments with SIVE (Self-propelled Impact Vibration Equipment) to evaluate the deterioration degree of slab simply and rationally, using in a real bridge is the next step. SIVE can make small turns by a simple operation using hands. The equipment also can change the mass of a falling weight, height and rubber condition used as cushion system. Comparing to others system such as: FWD light and FWD car system in this study, the results of impact vibration experiment for the real bridge deck were concretely introduced, which is deteriorated due to such as Alkali silica reaction. This bridge is a plate girder bridge built in 1973 at national route 157, Shiramine Hakusan . The bridge length is 36 m and the width of roadway is 7 m. In this study, the characteristics of impact behaviors of bridge deck providing useful information for the maintenance necessity and its measure were also discussed.

2. IMPACT TEST ON HINOKI BRIDGE

Impact test was conducted on the Hinoki Bridge using SIVE (Self- propelled Impact Vibration Equipment) (Fig.1), the U side was done from impact cushion type B, falling height 15, 30 cm, D side was impact cushion type E, falling height Impact test was conducted from 30 cm.

This bridge was a road with one lane on one side, and impact tests were conducted three times at each point. On the U side and the D side in the above figure, the loading points are numbered from 0 to 6 in order from the Kanazawa direction, and the displacement meters are installed at the loading points 2 and 5.

Also, the external acceleration meter was set from 1 to 6 on the U side and D side excluding the load point from the right side in the direction of travel as in the Fig.2.

This time, we focused on each loading point of the bridge and organized the data.

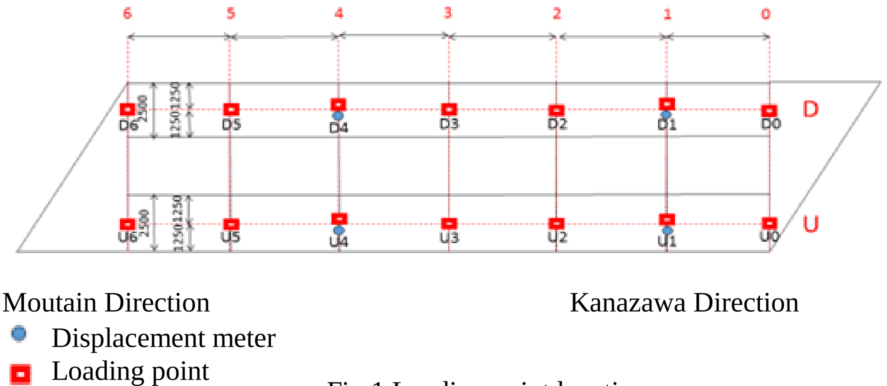

Fig.1 Loading point location

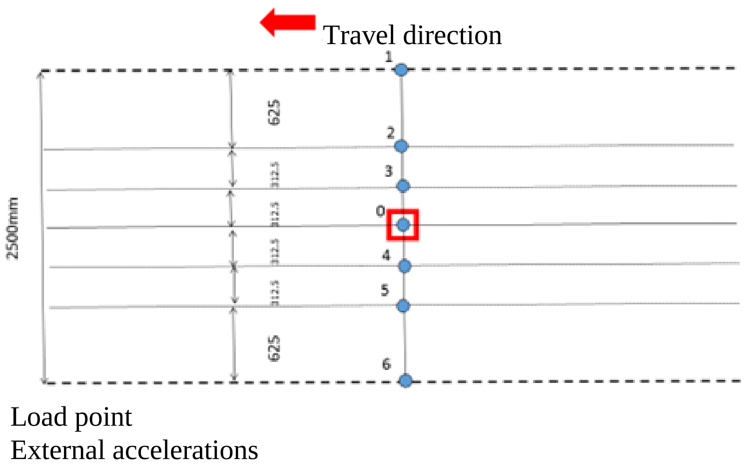

Fig.2 External Accelerations position

3. EXPERIMENT RESULTS

The figures below show the loading point displacement and the calculated displacement from the external accelerometers 1 to 6 at the time when the loading point displacement became the maximum, and the numbers on the horizontal axis

Keywords: Self-propelled impact vibration equipment, Bridge slab , Deterioration ,deflection
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5 → loading point
1 → external accelerometer 1
3 → external accelerometer 2
4 → external accelerometer 3
6 → external accelerometer 4
7 → external accelerometer 5
9 → external accelerometer 6

Fig.3 shows the maximum displacement of each point with the data collected by external accelerations. The falling heights are 15 cm and 30 cm. The maximum displacement is about 0.5 mm. Fig.4 shows the results of displacement on D side, point D0 and D3, D3. It can be seen that the maximum displacement in D3 point is aproximately 0.43 mm. It seems that the maximum displacement was found in the middle of bridge slab. Fig.5 shows the displacements of all point in both D side and U side of Hinoki bridge. As can be seen, the displacement of U side of bridge was higher than one in D side.

Fig.6 shows comparison of absolute displacement results between SIVE, external displacement gauges and Doppler measure equipment. In both side of bridge the results were significant differences between each measure methods.

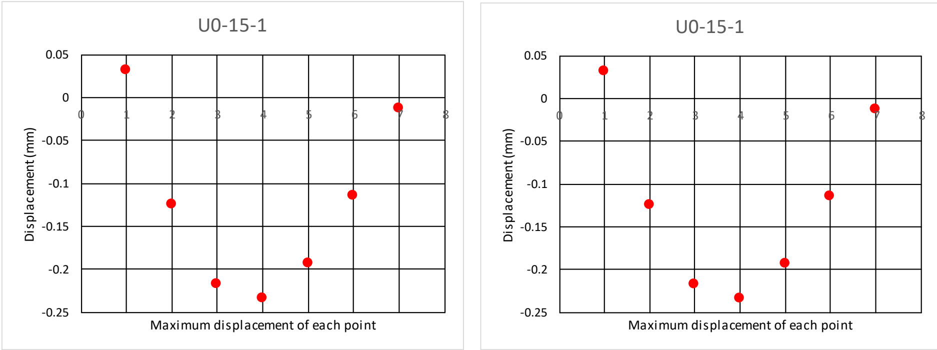

Fig.3 Displacement of point U0

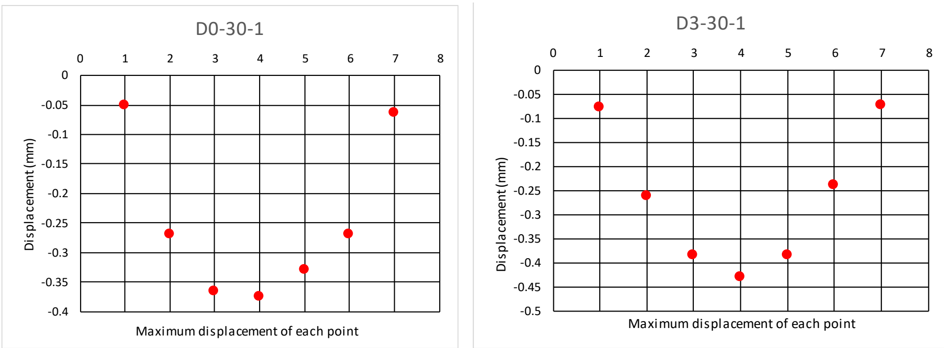

Fig.4 Maximum displacments of each point on D side

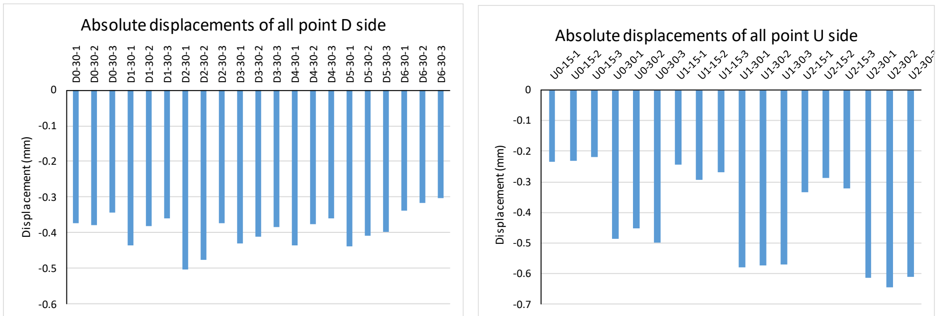

Fig.5 Absolute displacements in all points

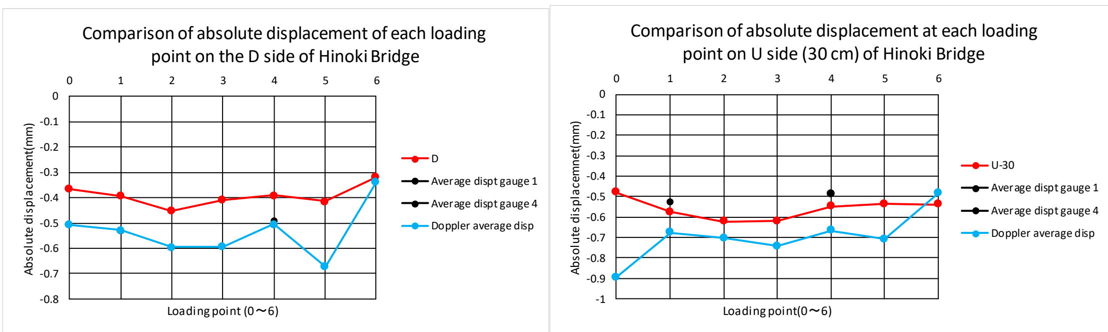

Fig.6 Comparison of absolute displacement with other methods results

4. CONCLUSIONS

The resulting conclusions are summarized. By using SIVE for diagnosis bridge slabs, it is very easy to control the equipment to any point on the bridge and get the valuable data. In this experiment the maximum displacement on the U side is about 0.62 mm. Some differences were found in the results, further experiments are now scheduled to get more accurate results.

REFERENCES.

1) Japan road association: Design specifications for steel highway bridges/Production specifications for steel highway bridge, Gihoudo Co. Ltd., 1956.

ACKNOWLEDGMENTS

Authors express sincere thanks to Mr. Tatsuya Oba, Mr. Tomonobu Kawada, Mr. Takafumi. Yamaguchi who were students of Kanazawa University contributed to pursuit experiment. This study had been done by the support of Cross-ministerial Strategic Innovation Promotion Program (SIP). Here, Authors represent the gratitude.