STRUCTURAL HEALTH MONITORING OF WOODEN STRUCTURES BY USING SUBSPACE SYSTEM IDENTIFICATION BASED ON SHAKING TABLE TESTS

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To evaluate the earthquake resistance of wooden structures, a structural health monitoring method based on subspace system identification was applied to acceleration data obtained from full-scaled shaking table tests of wooden post and beam structures made with plywood and brace. The ordinary Multi-variable Output-Error State sPace (MOESP) was used to evaluate the temporal variation of the natural frequency of the structure.

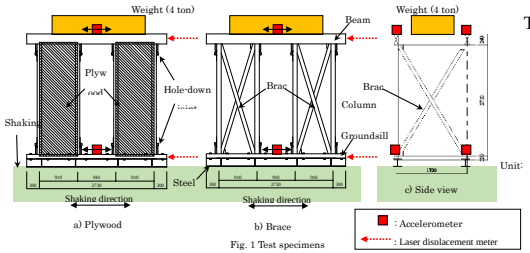

Fig. 1 Test specimens

Table 1 Shaking schedule

Case 1	BCJ-Lv.1 (50%)
Case 2	BCJ-Lv.1 (100%)
Case 3	BCJ-Lv.2
Case 4	JMA Kobe

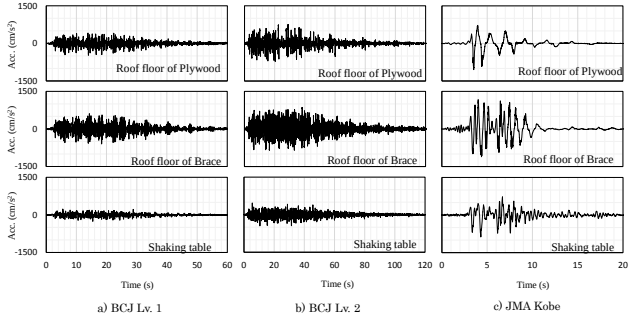

Fig. 3 Acceleration time history

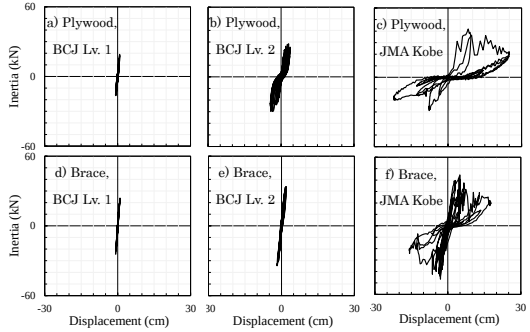

Fig. 4 Hysteresis loop

a) Plywood b) Brace

Fig. 5 Damages on the specimens in the JMA Kobe

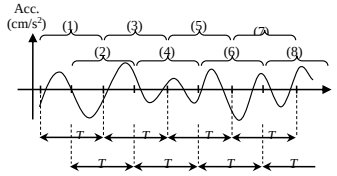

Fig. 6 Input and output data used in system identification

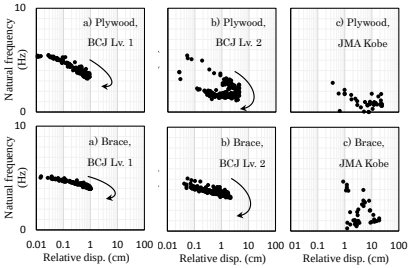

Fig. 7 Relationship between story drift and natural frequency

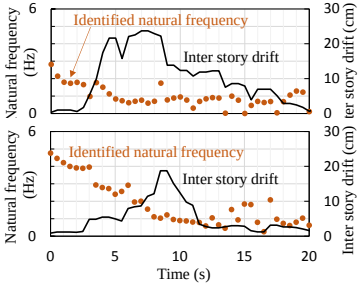

Figure 8 Temporal variation of natural frequency and inter-story drift (JMA Kobe)

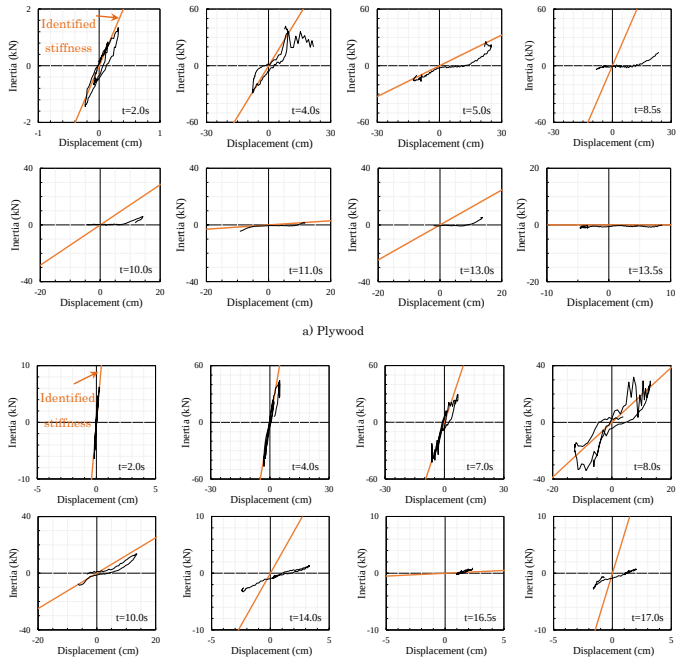

Fig. 9 Comparison of the hysteresis loop and the identified equivalent story stiffness (JMA Kobe)

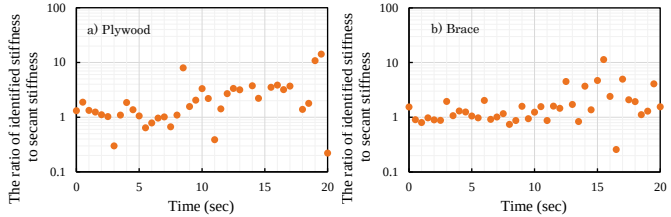

Fig. 10 Temporal variation of the ratio of identified story stiffness to secant stiffness evaluated from the hysteresis loop (JMA Kobe)

The identified equivalent story stiffness was higher than the secant stiffness evaluated by the hysteresis loop of the specimen. This suggests that the subspace method might underestimate the structural damage.