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From past experiences, buildings in Japan built before1980 tend to sufer severe damage by earthquake compared to buildings built aferward. Te structural performance of building structures in Japan are regulated by the Building Standard Law, enacted in 1950 by the national government. Te BSL has gone through many revisions, and the most recent major revision on building structures was operated in 1981. Te results of damage investigation by multiple earthquakes have revealed that buildings built before this revision show severe damage by large earthquakes compared to the buildings built aferward [1]. Te architectural engineering society together with the government have been trying to promote the application of seismic diagnosis and structural reinforcement on buildings for the past several decades.

Te structural systems of buildings in Japan are mainly reinforced concrete, timber and steel constructions. For residential buildings 60% of the existing housing units are of timber construction, mostly detached houses. Also, 90% of the cultural heritage are timber structures. How to secure the safety of these existing private houses and valuable architectural heritage are a major concern and challenge for timber engineers in Japan.

Several evaluation methods for timber structures have been developed, tested and applied. Te methodologies range from simple checklist to highly sophisticated calculation accompanied by partial destructive investigation, material/element/joint experiments. Te main interest and target has been to clarify the maximum restoring force, ductility and maximum response to probable or artifcial input motion. In most cases the discussion is to prevent the structure from collapse. Of course there are examples to minimize the structural damage, preferably within the elastic range, so that the building can be used directly afer a large earthquake. In order to realize this, sophisticated technology and device for vibration control have been developed and applied. But these devices require highly specialized knowledge of the engineer and more ofen larger budget. Te balance between the necessary investmentand the value of the existing building is discussed.

Te above evaluation methodologies are mainly based on calculation, sometimes accompanied by joint or element tests. Tere are other approaches to understand the actual structural performance of existing structures based on non-destructive vibration measurement. Te most classical method is the ambient vibration test (micro tremor measurement), which has been operated on timber structures In Japan since the 1920's [2]. Structural performance evaluation and health monitoring based on earthquake monitoring has also been operated, mainly afer 1995 earthquake in Kobe. Recently due to the development sensors and devices, various studies relating to damage identifcation based on earthquake monitoring is increasing for all types of structures (several examples are shown in references) [3-10]. Te main objective is to determine the change in natural frequency of the structure before, during and afer earthquake, in order to evaluate the stifness degradation of the structure.

Timber structures are strongly non-linear from minor amplitude range. We have proposed a relationship to estimate the natural frequency/stifness

Advanced Materials Research, Trans Tech Publications, Switzerland 778: 823-828.

10. Toyoda T, Fujita K, Takano K (2019) Vibration measurement and structural performance evaluation of a 17th century timber guest house in Japan. Japan Architectural Review 2: 16-25.