

6. Aging Characteristics of Natural Rubber Bearings in a Base-Isolated Building after 40 Years of use

- Survey Results of a Monitored Specimen and Validation of Long-Term Trend Forecasts for Natural Rubber Bearings -

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Age-related change in the horizontal stiffness of natural rubber bearings (NRB) is a critical concern in seismic isolation design. Increasing horizontal stiffness over time can generate greater seismic response acceleration in the superstructure, potentially affecting structural safety and performance. However, the rates of change in horizontal stiffness assumed at the design stage are typically based on accelerated thermal aging tests. Limited data is available regarding the aging characteristics of NRB installed in actual buildings.

To address this issue, we conducted investigations of a base-isolated building approximately 30 years after its completion, examining both the overall isolation layer and individual NRB. The consistency of the observed aging characteristics was confirmed by comparing the results obtained at each NRB site. Additionally, we compared the measured changes in horizontal stiffness with the design predictions and with the results obtained by current aging prediction models, followed by an additional survey after 40 years of use.

The results indicate thermal aging tests provide relatively accurate forecasts for NRB. Additionally, we found that the equations for forecasts changes in the horizontal stiffness of bearings currently proposed by the Japan Society of Seismic Isolation (JSSI) provide conservative estimates.

Keywords: natural rubber bearing (NRB), aging, thermal aging test,
equation for forecasting bearing stiffness