November 2, 2015

For Immediate Release

Sumitomo Forestry Co., Ltd.
Sumitomo Forestry Hometech Co., Ltd.

Passed technical evaluation by the Japan Building Disaster Prevention Association

Development of Seismic Retrofitting Method Using Existing Mortar External Walls

Reducing the burden of retrofitting by allowing renovation without moving out

Sumitomo Forestry Co., Ltd. (President and Representative Director: Akira Ichikawa; Head Office: Chiyoda-ku, Tokyo; hereafter “Sumitomo Forestry”) announced its subsidiary specializing in renovation, Sumitomo Forestry Home Tech Co., Ltd. (President and Representative Director: Toshiro Mitsuyoshi; Head Office: Chiyoda-ku, Tokyo; 100% owned subsidiary of Sumitomo Forestry; hereafter “Sumitomo Forestry Home Tech”) has developed a new and original seismic retrofitting method, the ReFo-Mo-Wall construction method. This construction method makes use of existing residential mortar external walls to enhance aseismic strength without having to dismantle the building’s interior.

This construction method has passed technical evaluation by the Japan Building Disaster Prevention Association (Evaluation Number DPA-Juugi-66). Based on the state of the customer’s residence and renovation request, Sumitomo Forestry Home Tech carries out safe renovation using a variety of seismic retrofitting methods, including this new construction method.

■ Characteristics of the ReFo-Mo-Wall construction method, a seismic retrofitting method making use of existing mortar external walls

This seismic retrofitting method turns existing mortar external walls into load-bearing walls, by (1) attaching base sheets (nonwoven resin fabric) onto the side of external walls and held in place with washer-attached nails to the foundation, posts, and beams; and (2) applying net sheets and polymer cement mortar (to prevent mortar peeling) to the side to be reinforced, and finishing with paint. It can be used on residential buildings two stories and lower, built using the wooden post-and-beam construction method with mortar external walls.

As this construction method turns existing mortar external walls into load-bearing walls, aseismic strength can be improved just by working on the exterior of the building without having to dismantle the building’s interior. Through this technique, seismic retrofitting can be carried out without having to involve the entire building, reducing the burden on the customer by reducing cost and allowing the customer to continue staying in the building. Usually, when renovation is carried out on one part of a building, there is a need to consider the entire building’s balance (eccentricity ratio) and carry out reinforcement. As a result, in order to maintain the superstructure score at 1.0 and above, there may be a need to extend the scope of renovation, including dismantling of interior areas for reinforcement works. By developing this construction method, it is now possible to propose to customers an option for seismic retrofitting which does not include having to dismantle interior areas.

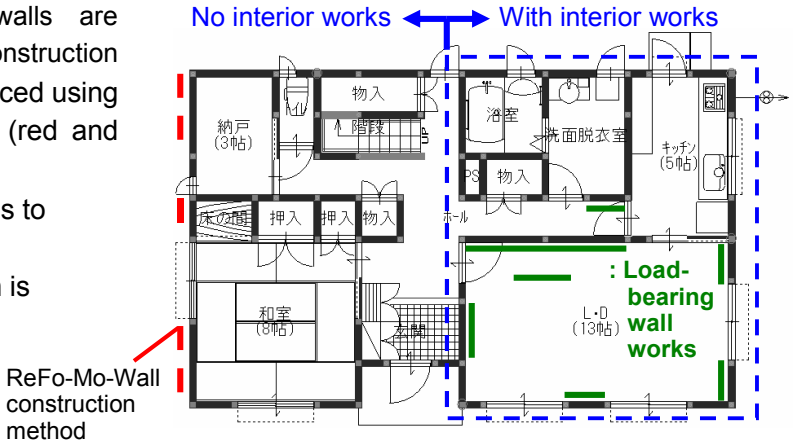
This construction method has passed technical evaluation by the Japan Building Disaster Prevention Association. By using this construction method, it is possible to increase the aseismic strength of existing external walls beyond that of single braces using only external works, without the need for interior works.

* Standard wall strength 4.0 kN/m (including mortar undercoat); equivalent wall magnification of 3.2 times using N-value calculation.

■ Example of reinforcement renovation

<Example of renovating an existing residence with superstructure score* of 0.77>

- When interior walls are reinforced using load-bearing wall works (within dotted blue line)
  ⇒ Superstructure score increases to 0.95
  (slightly below score of 1.0 which is required for not collapsing)
- When existing mortar external walls are reinforced (using ReFo-Mo-Wall construction method) and interior walls are reinforced using load-bearing wall works as above (red and blue dotted lines)
  ⇒ Superstructure score increases to 1.18
  (well above score of 1.0 which is required for not collapsing)



* The superstructure score is based on the aseismic assessment index from the “Seismic Evaluation and Retrofit of Wooden Houses” by the Japan Building Disaster Prevention Association. (A superstructure score of 1.0 is required by the Building Standards Acts in order to be able to withstand major earthquakes.)

- Simulated building: 2-story wooden building built using wooden post-and-beam construction method; floor area 154.52 ㎡; building age above 10 years (below 34 years).

■ Development background

Although making buildings earthquake-resistant is said to be a requirement for earthquake-prone Japan, statistics* show that seismic retrofitting is carried out in only 2.1% of Japan’s privately-owned houses. Seismic retrofitting requires other works, including dismantling parts of the house, in order to reinforce the structure, at no small cost to the owner. To provide a solution under these circumstances, a seismic retrofitting method that does not require the dismantling of interior areas within the existing residence was developed.

* 2013 Housing and Land Survey (Ministry of Land, Infrastructure, Transport and Tourism).

■ Reinforcement process

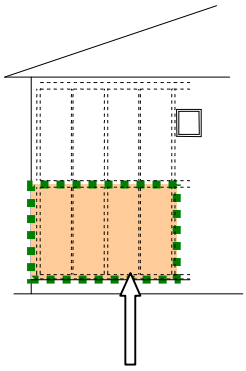


Photo left: Attaching of base sheets and hammering in of washer-attached nails.
Photo right: Applying net sheet to side to be reinforced.

(1) Base sheets (nonwoven resin fabric) are attached from the side of the external walls, and held in place to the foundation, posts and beams with washer-attached nails.

(2) Net sheets and polymer cement mortar (to prevent mortar peeling) are applied to the side to be reinforced, and finished with paint.

<Related information>

■ **Sumirin REP construction method—Sumitomo Forestry Home Tech's diverse range of seismic retrofitting techniques**

The seismic retrofitting techniques carried out by Sumitomo Forestry Home Tech are collectively known as the "Sumirin REP construction method." The most appropriate seismic retrofitting method is proposed based on the condition of the customer's residence. Using the various techniques, building structures can be made earthquake-resistant by reinforcing walls, maintaining spacious interiors and natural lighting without having to dismantle existing ceilings and floors. This newly-developed construction method further expands the range of seismic retrofitting construction methods.

Overview of Sumirin REP construction method <REP is stands for Reinforced Earthquake-Proof>

- Construction method to turn existing mortar external walls into load-bearing walls (ReFo-Mo-Wall construction method)
  - Seismic retrofitting is achieved using existing mortar external walls. Aseismic strength is increased without dismantling the building's interior space.
- Short extremely-tough panel
  - Walls are reinforced without having to tear down ceilings and floors.
- Portal frame shear wall
  - Reinforcement is carried out by placing reinforcing posts on the sides and a reinforcing beam at the top of an opening, using aramid fiber sheets, etc. Space and strength can be achieved at the same time.
- Glass block shear wall
  - Brightness and strength are achieved at the same time by using an aluminum frame fitted with glass block units developed as a load-bearing wall.
- Composite reinforced beam
  - Laminated engineered wood is attached below an existing beam to form a single entity so as to achieve efficient reinforcing of the beam.
- Rigid-joint beam load-bearing wall
  - The *shinkabe* (column-exposed wall) of Japanese-style rooms can be made into a load-bearing wall without having to tear down the *nageshi* (beam running between columns in traditional Japanese architecture) and ceiling, striking a good balance when reinforcing the building.
- Sumirin ARC construction method (ARC=Aramid-fiber Reinforced Concrete)
  - The strength of unreinforced concrete is increased by using steel bands (thin and long belt-like steel pieces) and aramid fiber sheets.
- Sumirin JEM construction method (JEM=Joint Enhanced by Metals)
  - Posts, beams, and the foundation are firmly held in place using hold-down metal joints and epoxy resin adhesives.