Ceiling having "Pair Locking Clip" are seismic resistant

The implementation of the newly developed "Pair Locking Clip" (i.e. joint bracket for the prevention of the ceiling falling off down) in all building projects



Hazard

Earthquake Cyclone Tornado

Solution Purpose

Prevention & Mitigation

Solution Theme

Research & Investigation Disaster Prevention Plan Infrastructure Technology Building Technology Products & Goods

Technology Subject

Technical Research & Development Legislation & Technical Regulations Mitigation Plan Business Continuity Plan Railways Airport Urban Facility for Disaster Prevention Design & Construction of Resilient Building Resilience Improvement on Existing Building Mitigation Measures for Interior & Facility Machinery & Equipment

Advantages

"Pair Locking Clip" is a joint bracket for preventing the ceiling falling down, newly developed to

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withstand earthquakes. The Pair Locking Clip is intended for all building projects that has been ordered after September 1, 2016. to give a sense of security to an owner of a building. The ceiling having "Pair Locking Clip" are 3 times higher in strength as compared to the conventional ceiling and the same has been verified through experiments/testing.

Solution Illustrated

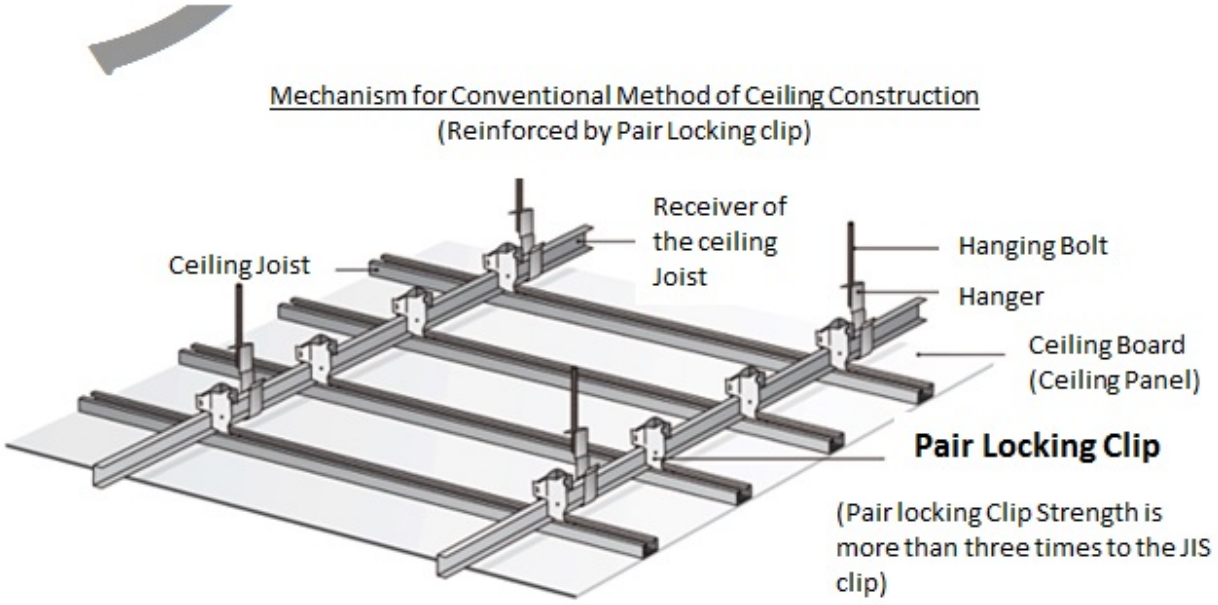

Figure 03: Pair Locking Clip Mounted Condition

Background

In large earthquakes, the ceiling falling off damage are quite often reported. Also in the Kumamoto Earthquake of April 2016, the ceiling falling off damage has been reported in the school and Hospital. When failed false ceiling were observed, it has been pointed out that the vulnerability of the bracket (Clip) (which Join the ceiling joist and joist receiver) is the main cause of the failure of false ceiling falling off. Thus reinforcing the important element (Bracket/Clip) will reduce the risk of false ceiling falling off damage.

We have developed our own "Pair Locking Clip", a bracket to firmly attach the ceiling joist (i.e. ceiling foundation) with the receiver of the ceiling joist. The "Pair Locking Clip" has been verified through experiments to have 3 times more strength as compared to the conventional method of construction that include JIS clip. We have decided to implement the newly developed "Pair Locking Clip" (i.e. joint bracket for preventing the ceiling falling down) in all building project that has been ordered after September 1, 2016.

We are implementing the same technique in the Design Build Projects and are striving hard along with our subsidiary company Chiyoda Kenko (Co. Ltd), material suppliers and trading companies to promote among the different Clients and Engineers the "Pair Locking Clip" for future construction projects. Thus we have our belief that we have significantly contributed to the protective measures taken for ceiling falling off damage prevention.

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Exposition of the Solution

■Features

The "Pair Locking Clip" has the following features.

① It consists of a simple material, with each pair containing two clips, and have a simple mechanism to fasten the receiver Joist.

② The interlocking is tight as the pair of clips clipped in each other (refer to Figure 4).

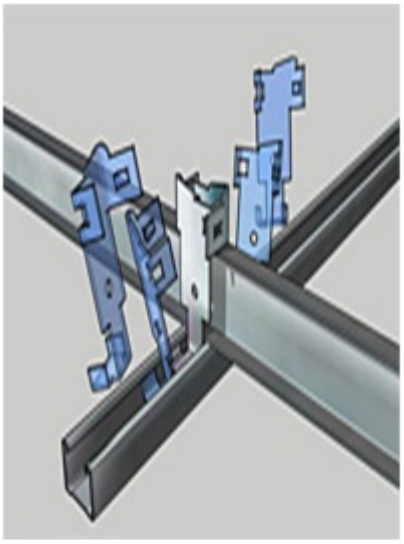

Figure 4: Attaching/Fastening a pair locking clip

③ The Fastening by pushing it with the finger has made it convenient and fast. Screws and bolts are not needed.

④ We have developed two type of "Pair Locking Clip”, one is for existing building and the other for newly constructed buildings.

■ Verification experiment

In order to verify the performance of the "Pair Locking Clip", three types of experiments have been conducted. The material experiments, ceiling unit experiments and dynamic excitation experiments for large scale ceiling. By performing each of these experiments, as well as keeping in view the physical properties of the material we have evaluated and confirmed the overall safety and seismic performance of both the conventional ceiling JIS clip and "Pair Locking Clip" ceiling.

Achievements of Examples

Material Experiment results

In the material experiment, the clip has been pulled in the vertical direction, to verify the strength and rigidity, thus it has been proved that "Pair Locking Clip" has enough strength as compared to JIS clip, we have an anti-wind pressure clips and have equivalent strength and rigidity. The experiment/test results are depicted in Figure 5 and Figure 6.

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Figure 5: Tensile Test Experiment

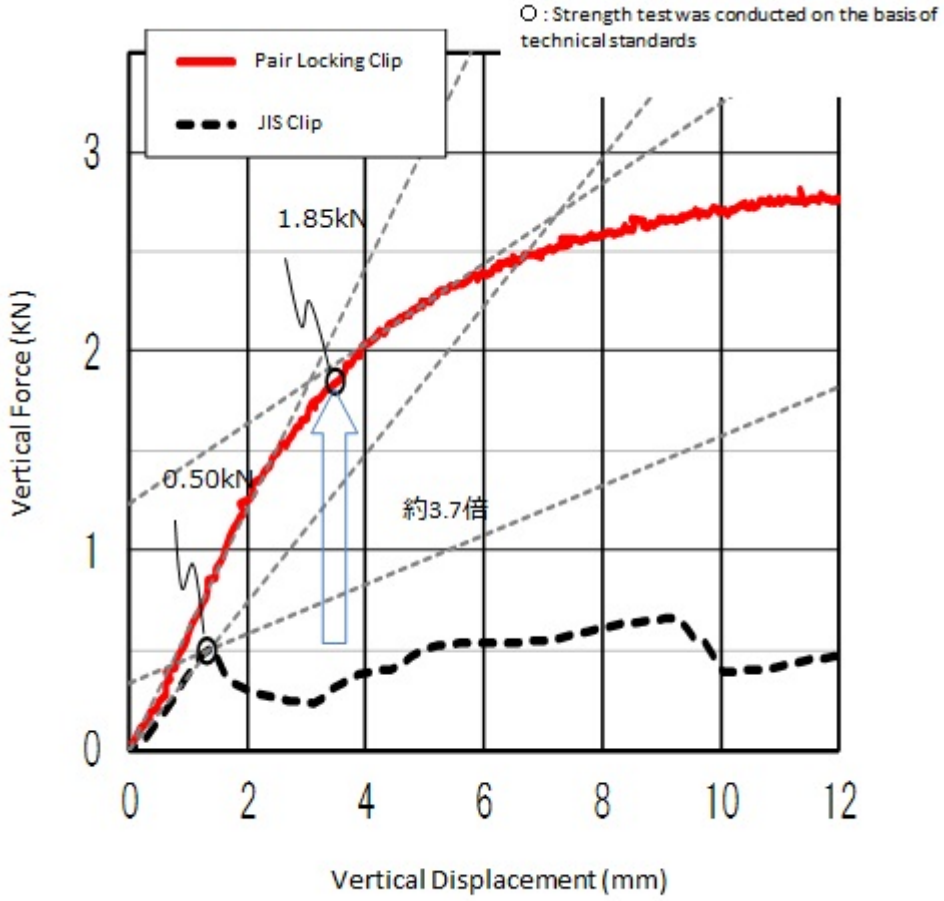

Figure 6: Tensile test Results

■ Ceiling Unit Experimental Results

The Unit Experiment has been conducted with the predetermined Loads with plain compression. During experiment, JIS clip has been damaged as the claws become open but no impairment has been observed in the "Pair Locking Clip". The experiment/test results are depicted in Figure 7 and Figure 8.



Figure 7 Experimental results (JIS clip)

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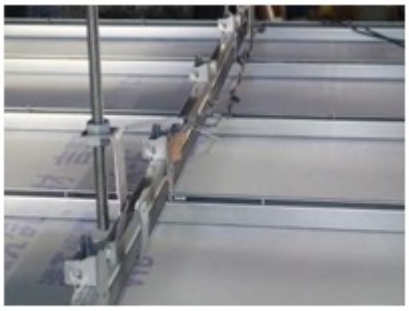

Figure 8 Experimental results
(Pair Locking Clip)

■ dynamic vibration test results

We conducted a vibration experiment by reproducing the 2011off the Pacific coast of Tohoku Earthquake wave (JMA Sendai wave), to strike against the real large-scale ceiling (of size 7.5 m× 4.8m ×1.5m (Height x width x depth)) and wall.

Pair Locking Clips were observed under vibration of 2.2G (i.e. Equivalent to the seismic intensity of 7) and the results have confirmed that there no damage or loss to the "Pair Locking Clip" ceiling.

In addition to this, the amount of strain observed in the engagement portion and in the vertical portion of the "Pair Locking Clip" was also very small which justifies its good quality. Figure 9 reference

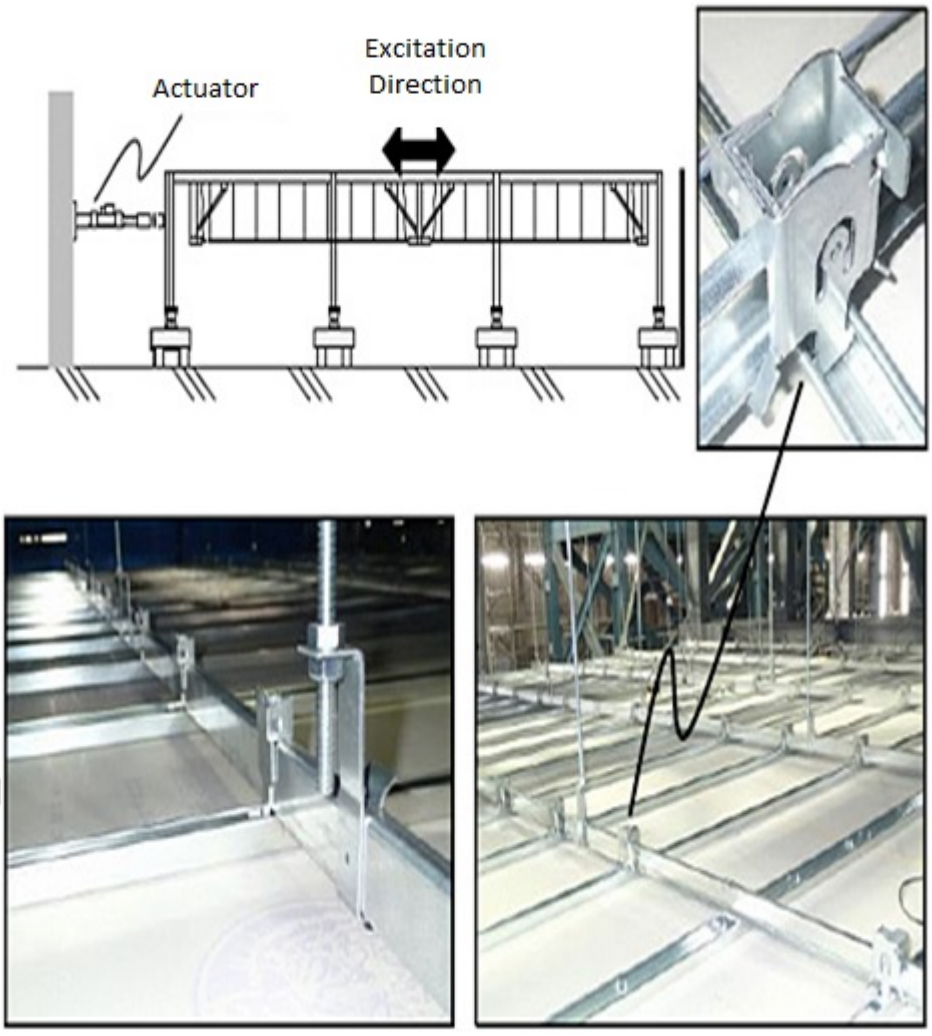

Figure 9 Experimental result shows no damage

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Other References



Figure 02: Pair Locking Clip

Corporate Profile

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