THE 2019 E-DEFENSE SHAKE-TABLE TEST OF A LARGE-SCALE 3-STORY DISASTER MANAGEMENT CENTER

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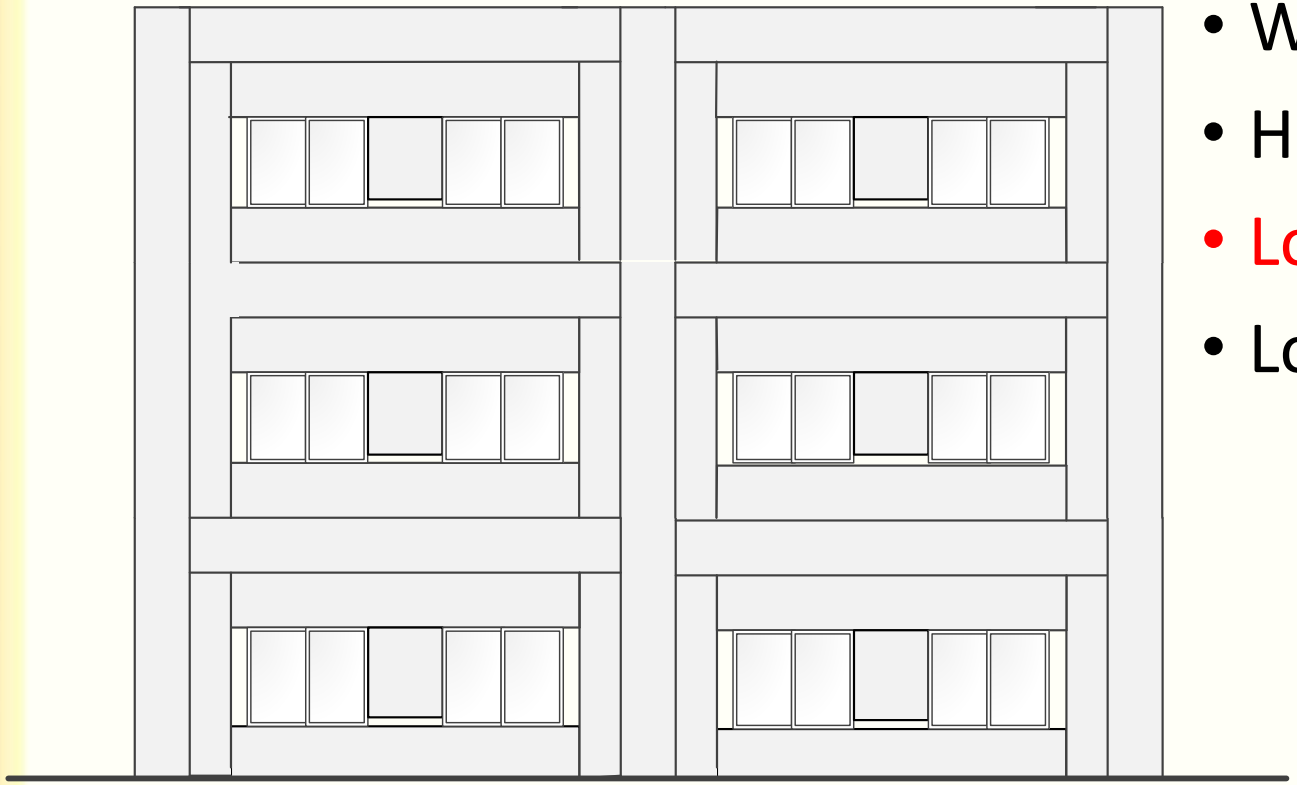
Conventional R/C structure in Japan



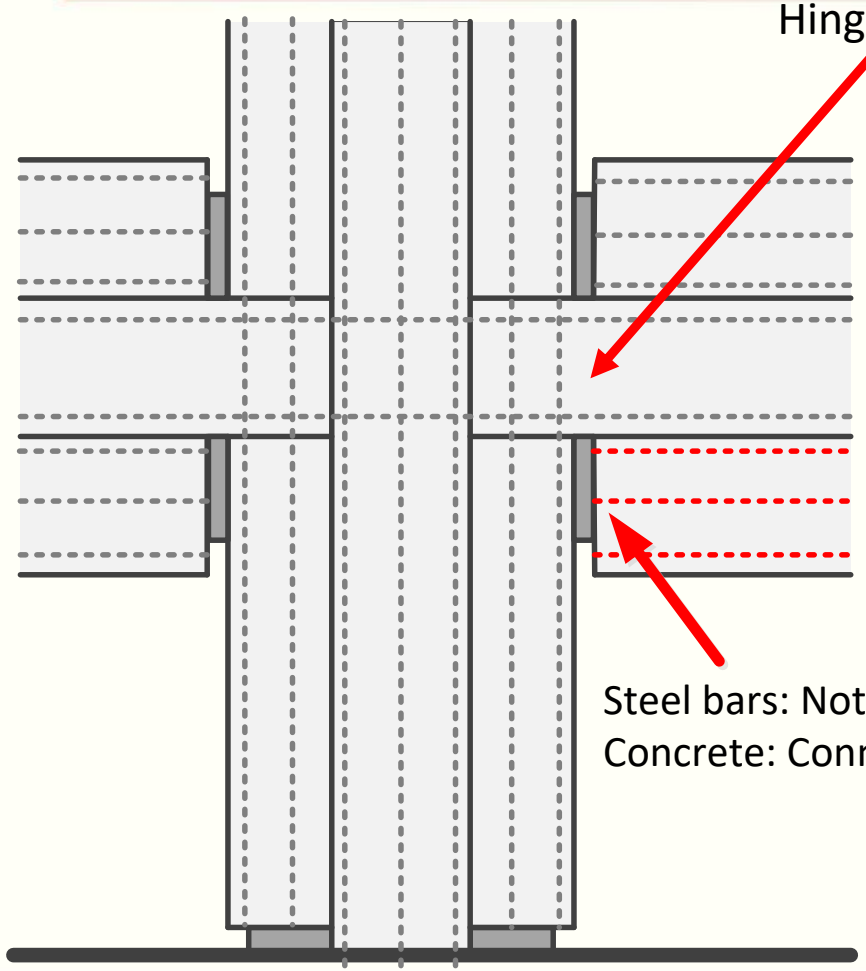
- Wing/Hanging/Standing walls contribute.
- High ultimate strength.
- Low allowable strength.
- Low ductility.

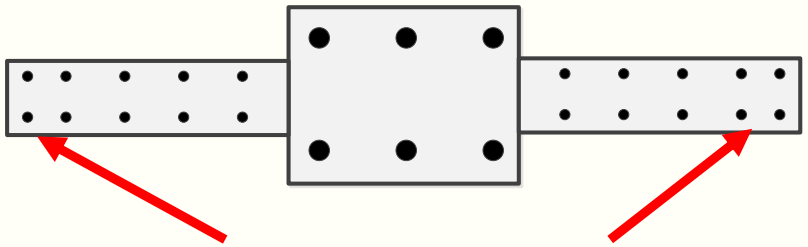
Design guidelines for key disaster buildings

- Reinforce concrete buildings;
  - Category I:
    - Base shear coefficient exceeds 0.55 at the maximum deflection angle of 1/300.
    - Yielding factor of members is less than 1.0
  - Category II:
    - Base shear coefficient exceeds 0.40 at the maximum deflection angle of 1/200.
    - Yielding factor of members is less than 2.0
    - Total yielding mechanism is formed.

The guidelines were developed in Y2018.

New details at the end of the walls





These flexural reinforcement tend to yield at early stage

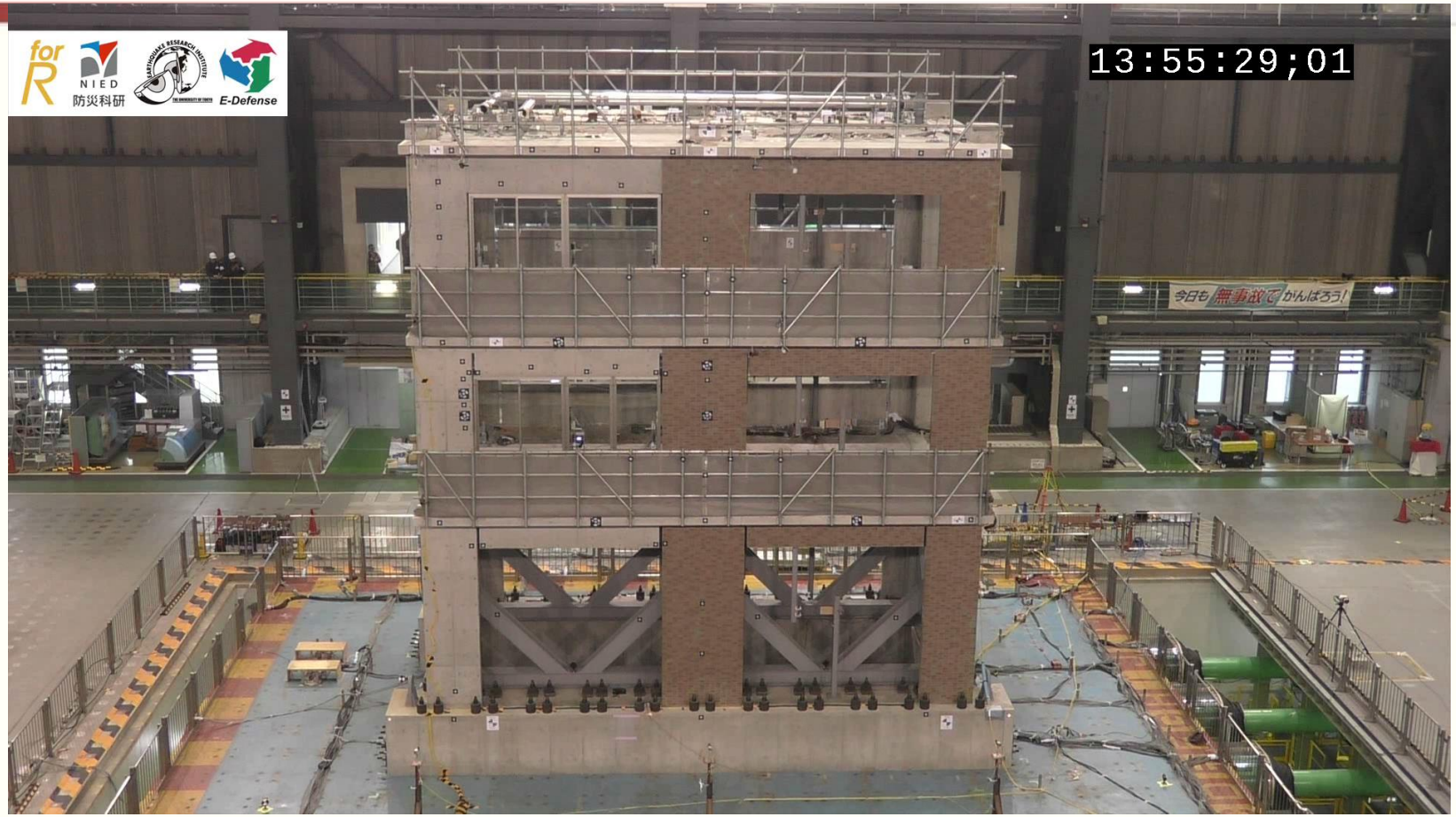
These flexural bars are NOT anchored to prevent yielding

Objectives #1

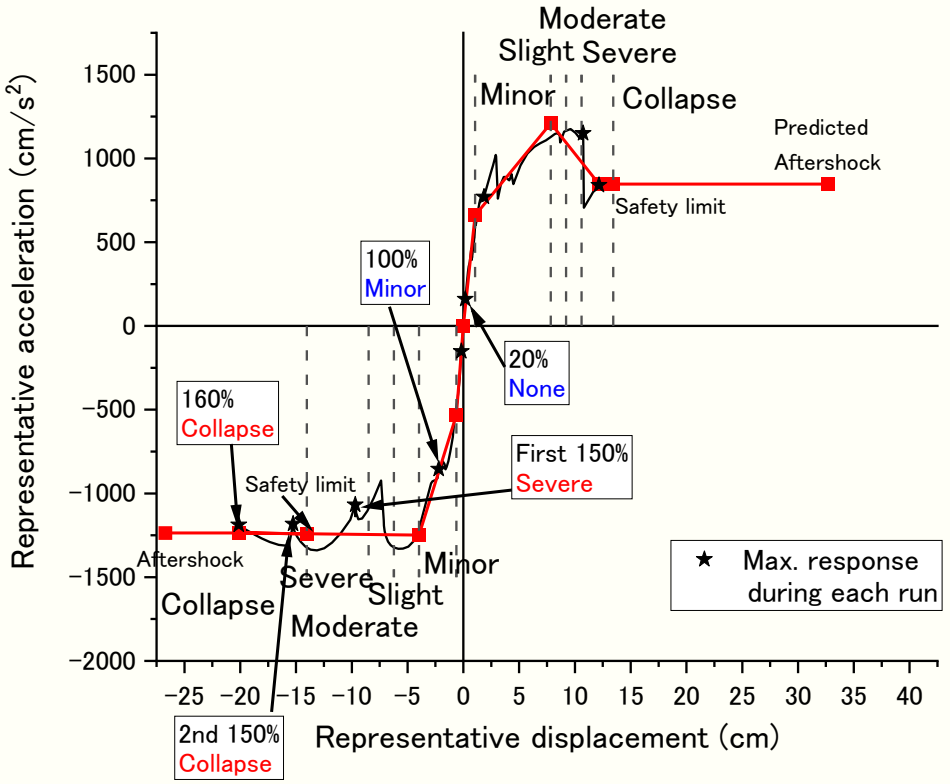
Confirm the following items;

- The validity of the new guidelines.
  - Design earthquake level and 1.5 times the level.
- The performance of the new detailing of the spandrel walls.
- The validity of the structural health monitoring system.
- The performance of the non-structural elements.

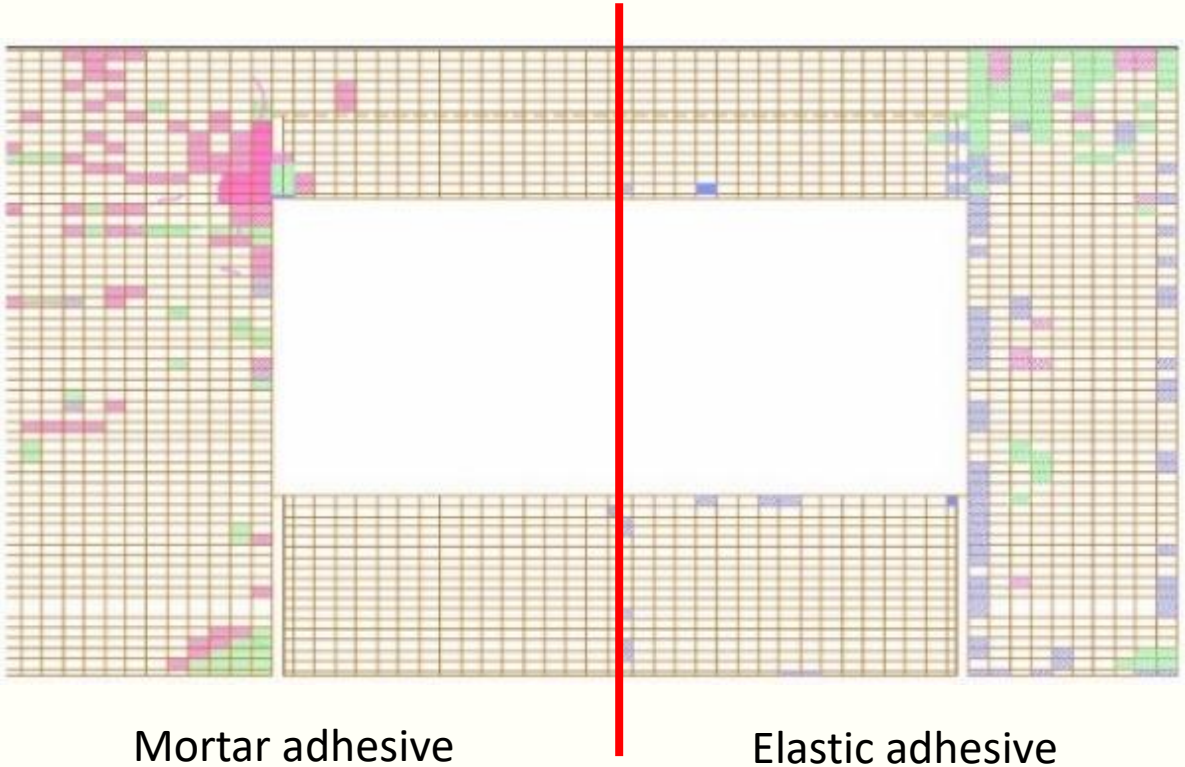
150%-2



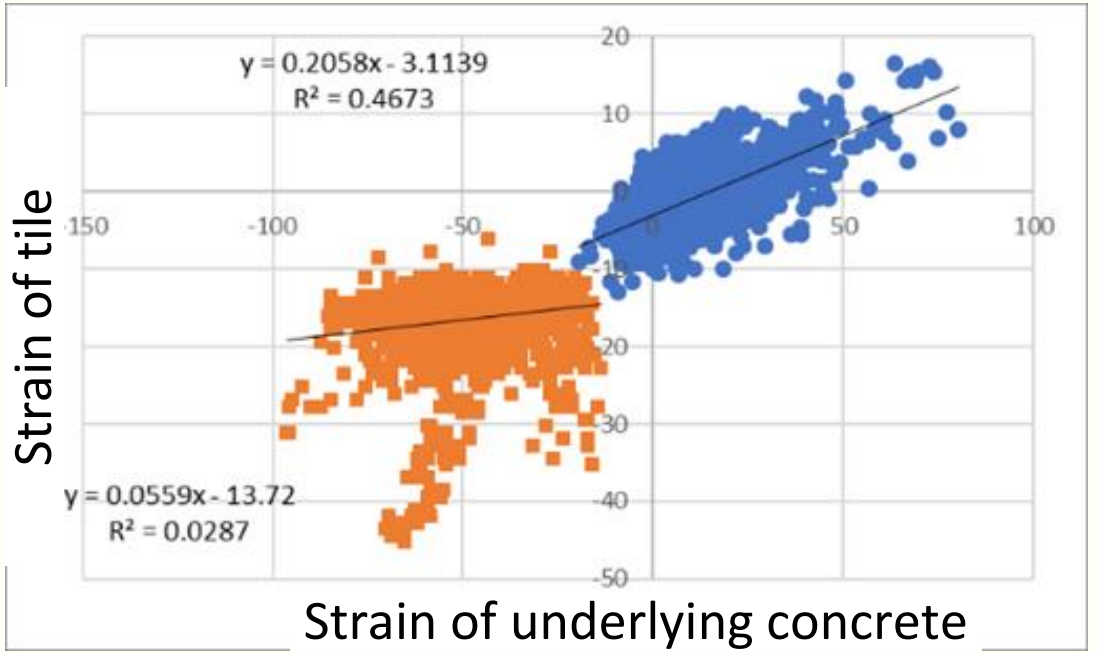
Structural health monitoring



Tiles



Mortar adhesive　　Elastic adhesive



- Optical fiber sensor can detect the damage of tiles.

Windows

＜Outlines＞

・Windows are placed on 2nd and 3rd floors.

・Inter-story drift：2nd floor＞3rd floor

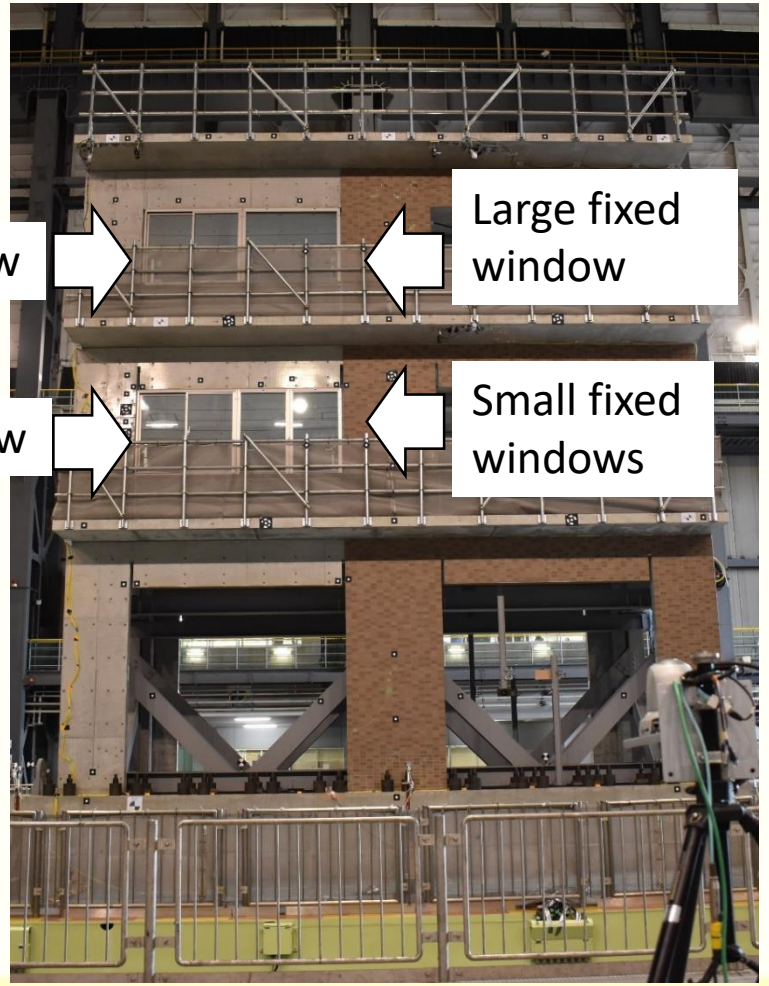
・Windows;

3rd floor：Double sliding window

＋Large fixed window

2nd floor：Double sliding window

＋Small fixed windows

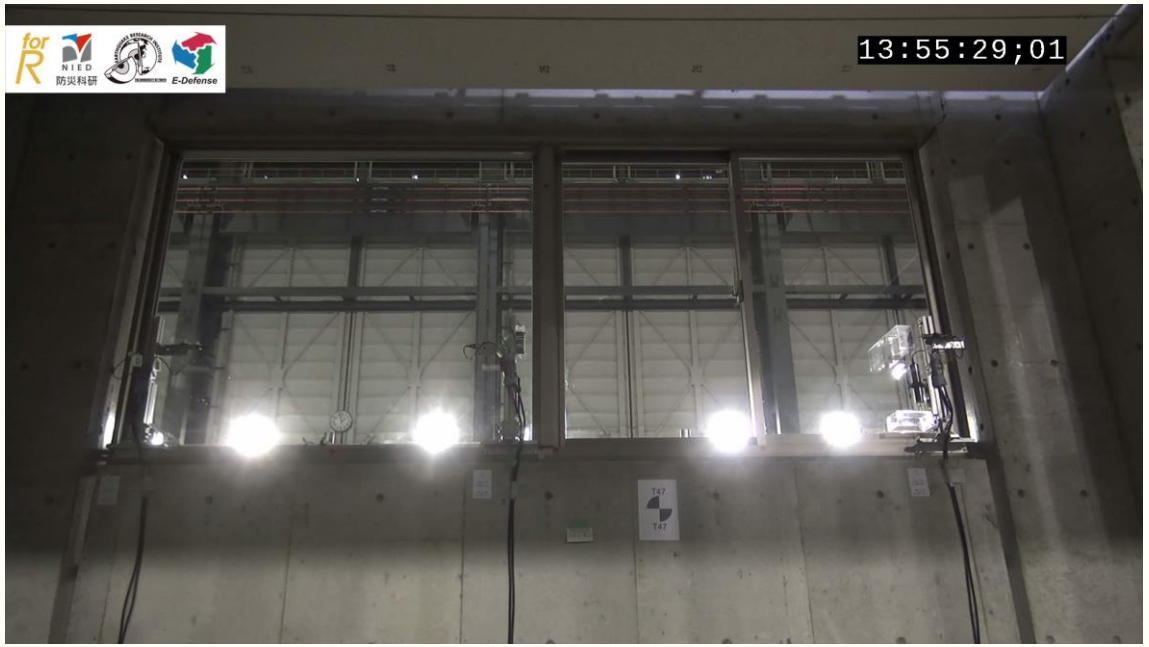


→The double sliding wall has high deformability.

→The seismic performance of the large fixed window is less than the smaller fixed windows.

150%-2

2nd floor



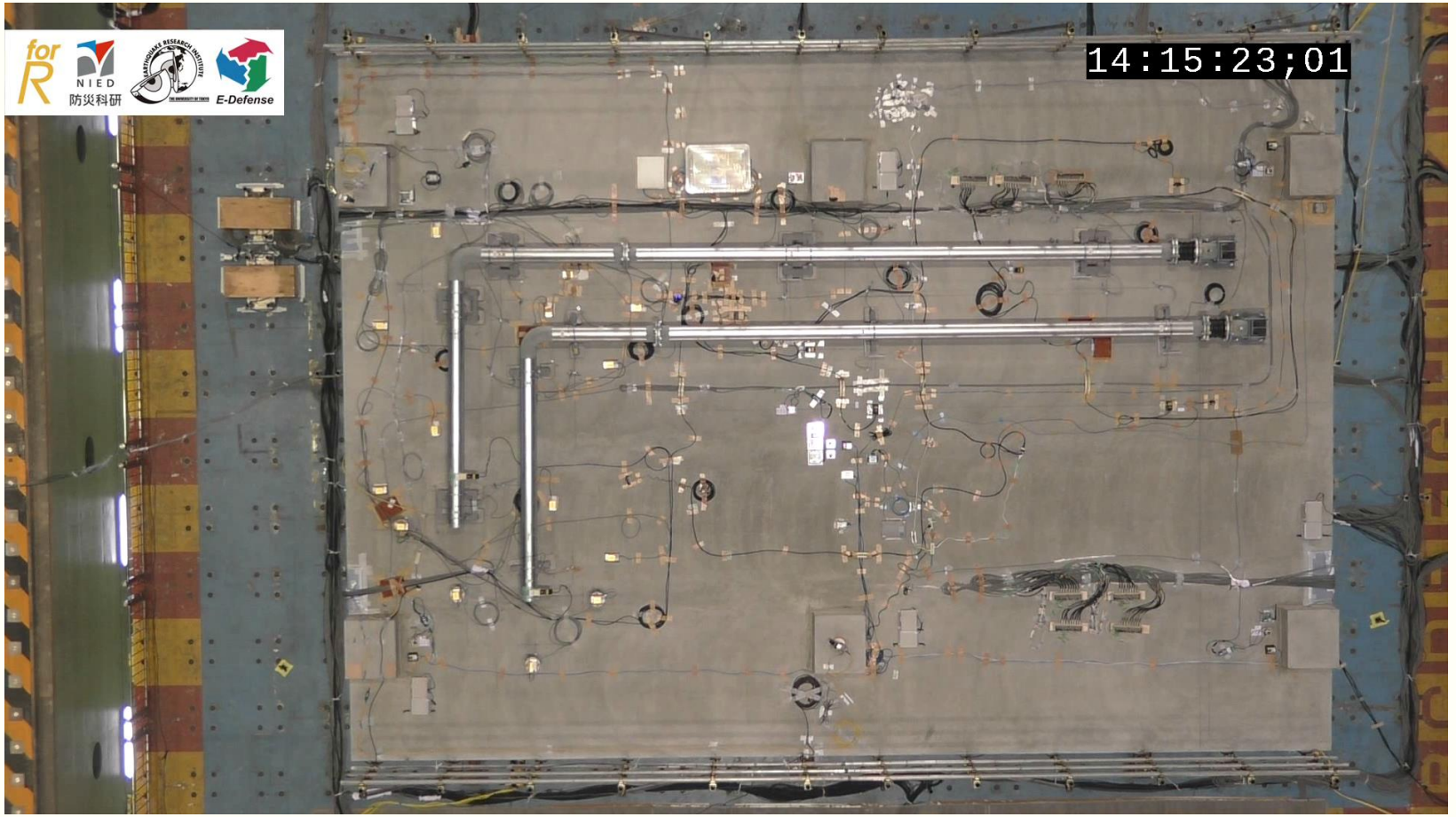
3rd floor

150%-2 Ceiling system

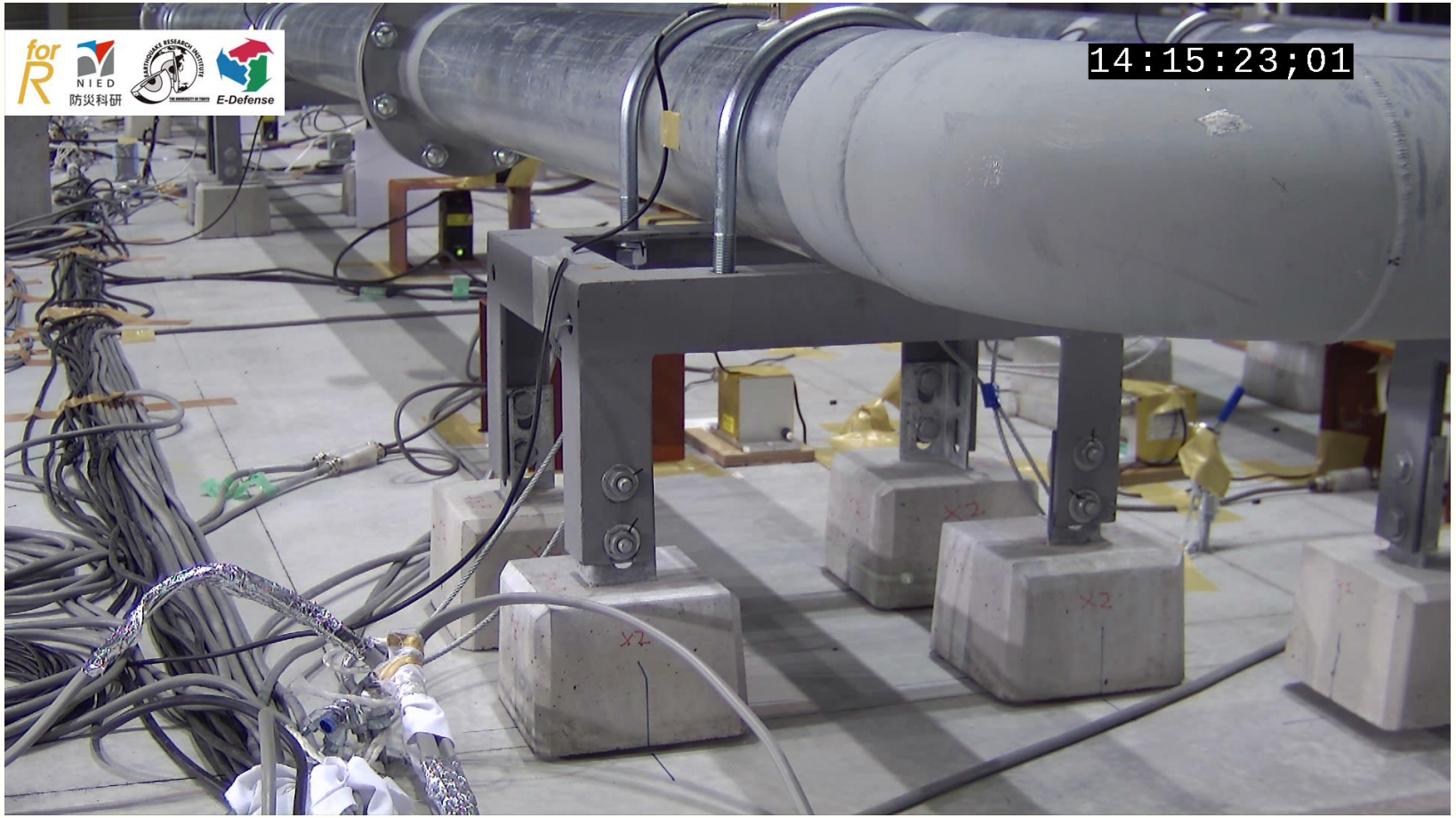
Conventional ceiling

Seismic ceiling

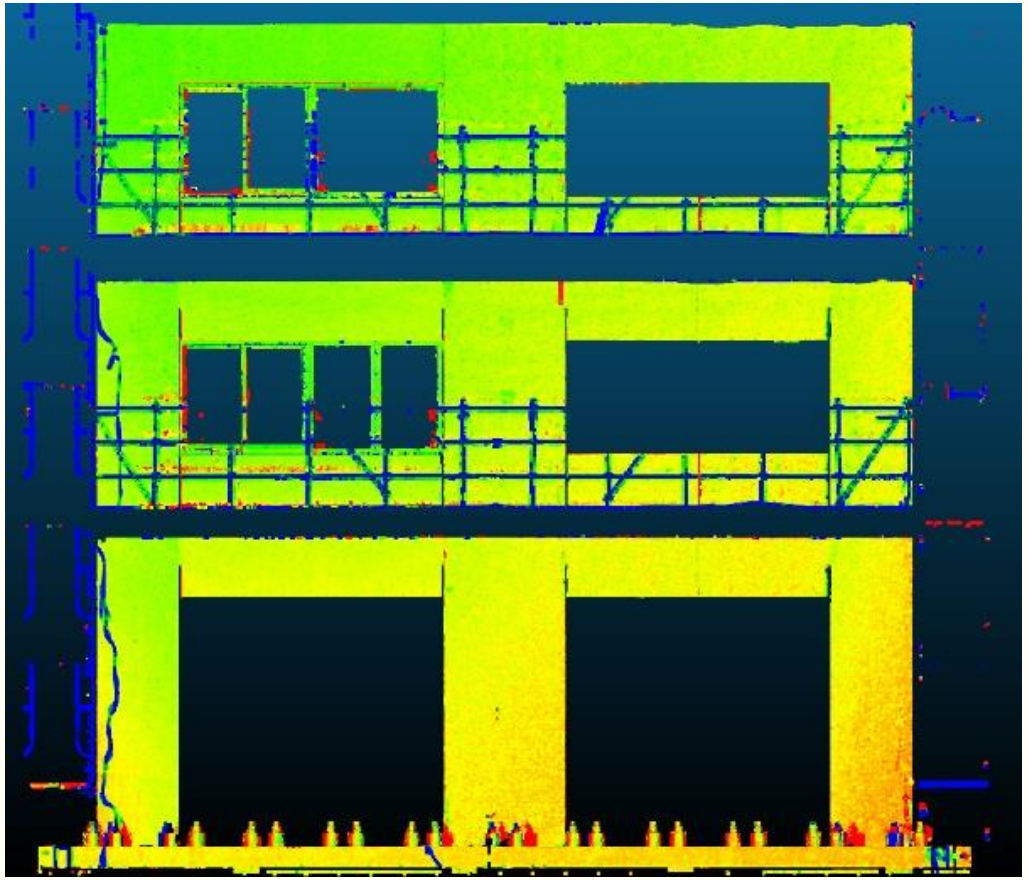
150% Piping system



150%



3D laser scanning



Detected tile damage

Concluding remarks

- A 3-story full-scale reinforced concrete disaster management center was tested on E-Defense.
- Damage to the non-structural elements was also tested to assess the continuous functionality of the building.
  - finishing tiles, window frames, ceiling systems, ceiling systems, and piping equipment
- Especially for non-structural elements, the scaling effect is not negligible, and the specimen needs to be full-scale.
- A full-scale shaking table test is costly and takes time to prepare. Researchers of many research fields should be involved in the large-scale shaking table test to utilize the test most efficiently.

Thank you for your kind attention…