(2018) E-Defense Test Plan

Takuya Nagae

2006-2014 E-Defense
2014-2017 Nagoya University

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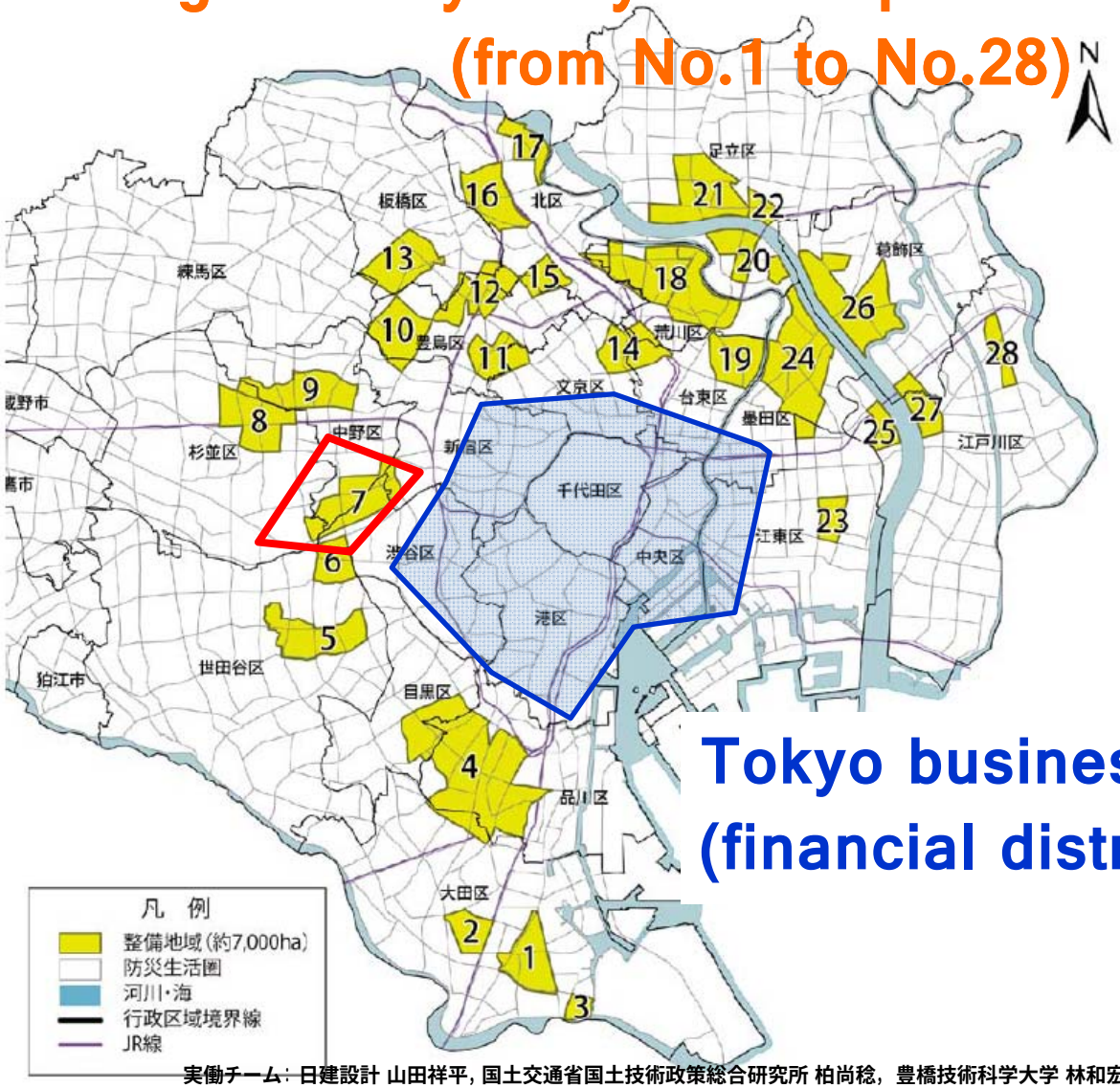
Theme Ⅰ: Comprehensive loss assessment procedure in a pilot metropolitan residential area

Densely populated wooden house areas are designated by Tokyo Metropolitan Government (from No.1 to No.28)



Tokyo business district (financial district)

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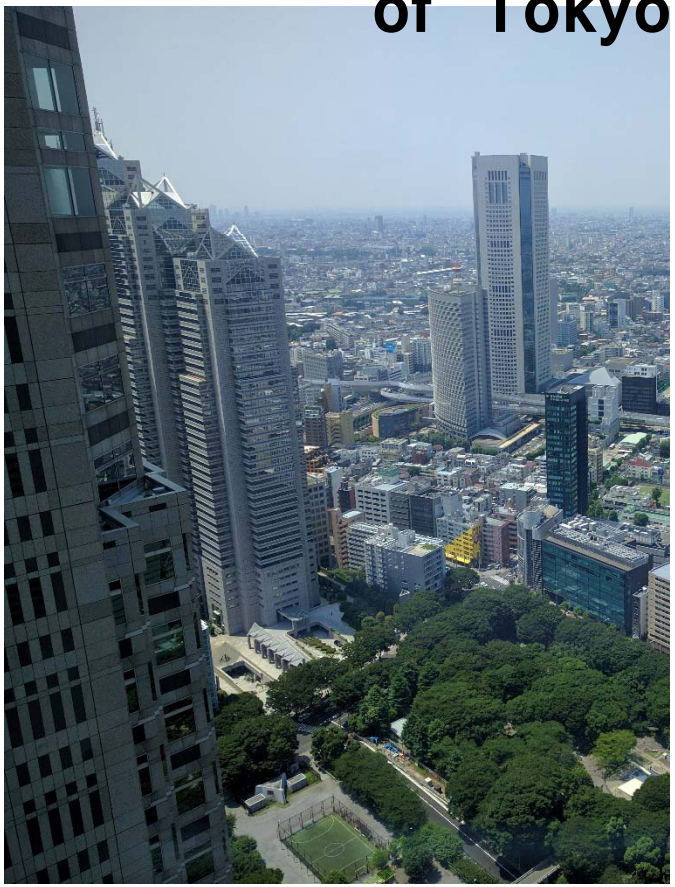
Theme I: Comprehensive loss assessment procedure in a pilot metropolitan residential area

View from the 45th floor of the main office building of Tokyo Metropolitan Government



Wooden houses spread west of the Tokyo Metropolitan Government building

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Theme I: Comprehensive loss assessment procedure in a pilot metropolitan residential area

Wooden houses spread west of Tokyo Metropolitan Government office

The 2018 test is focusing on the damage of this type of areas

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Theme I: Comprehensive loss assessment procedure in a pilot metropolitan residential area

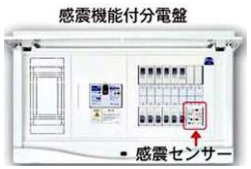
A strong mission from MEXT

- **Identification** of the significantly damaged locations
- **Rapid** assessment for the total seismic damage
- **Efficient control** of the ambulance service and rescue actions **etc.**

To make a test podium on the shaking table of E-Defense

Integrated data

Power distribution board



Motion sensor

Shut off system of gas meter

Affordable devices

Whole wide area assessment

TEST → Development of computational evaluation systems

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Theme I: Comprehensive loss assessment procedure in a pilot metropolitan residential area

E-Defense Test Specimen Selection

Now, the experiences of structural tests are getting accumulated and possible to connect with the new tests.

A previous test for the 3-story house structures can be a good reference.

This type of wood structure can be a representative of the houses newly constructed in the metropolitan residential areas.

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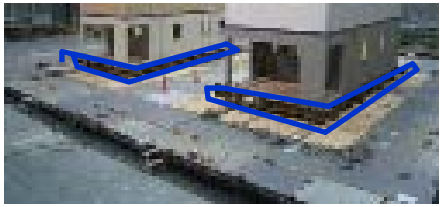
Theme Ⅰ: Comprehensive loss assessment procedure in a pilot metropolitan residential area

The previous tests →Fixed Base Structure
A normal direction…
(Parameter → Amount of wall, connection detail etc.)



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This time, the utility functions related to occurrence of loss as well as fire will be incorporated →Sensor verification

Power distribution board

Motion sensor

Shut off system of gas meter

An extracted house system will be produced as systematically as possible.

A complex system

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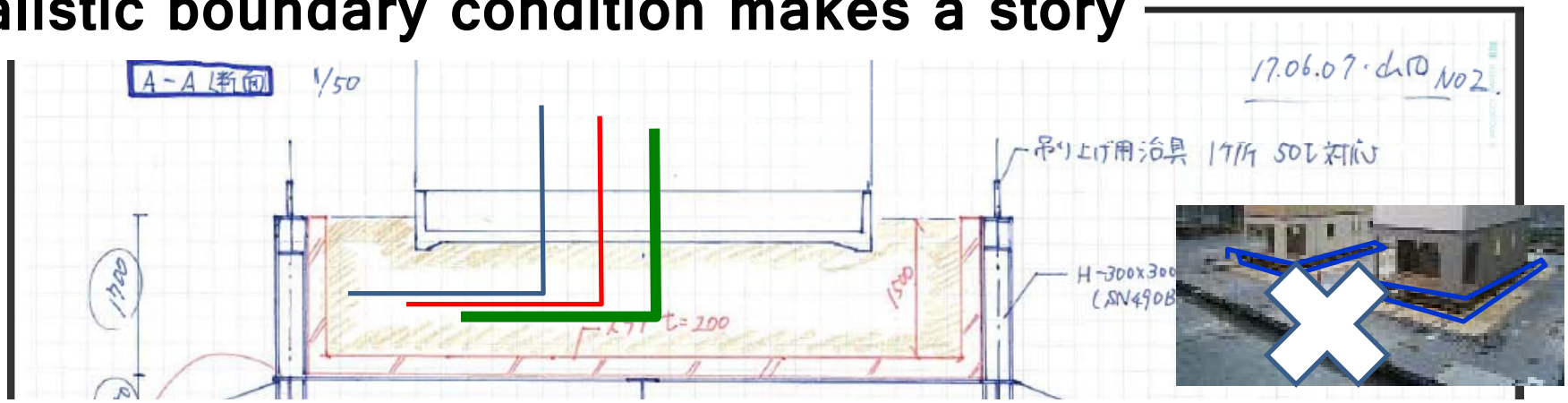
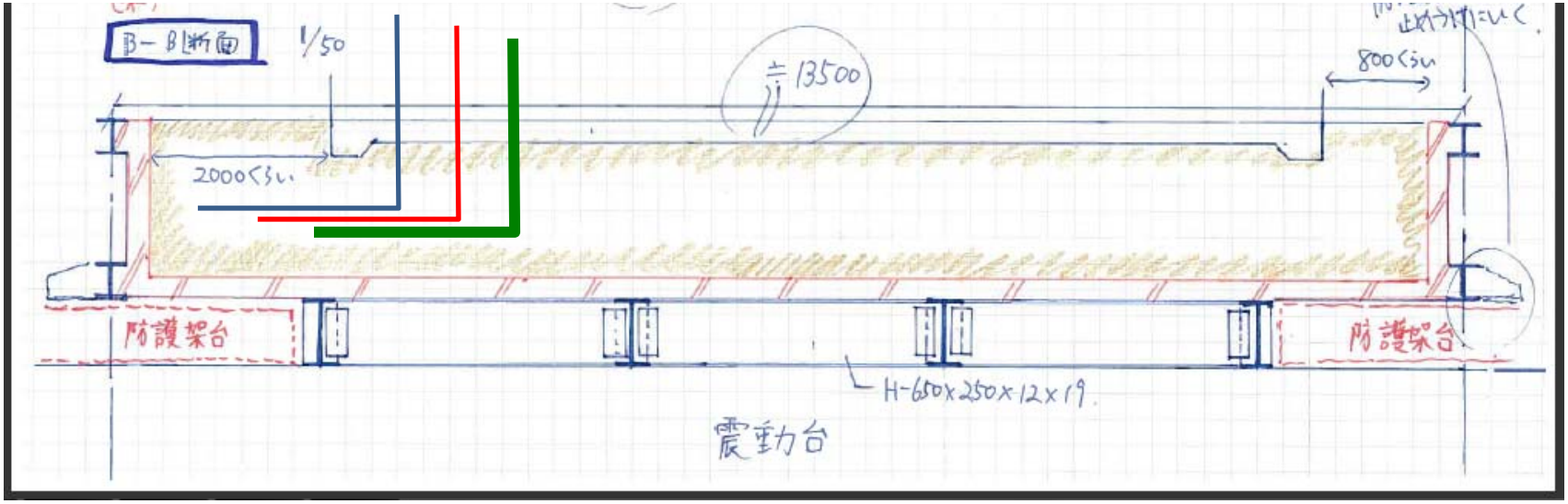
Theme I: Comprehensive loss assessment procedure in a pilot metropolitan residential area

Realistic boundary condition makes a story



Soil structure combined actions may cause failures of electricity, gas and water systems.



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Theme I: Comprehensive loss assessment procedure in a pilot metropolitan residential area

EXAMPLE (Kumamoto Mashiki observations, 2016)

This type of Residential buildings showed failures of pipes due to soil structure combined actions

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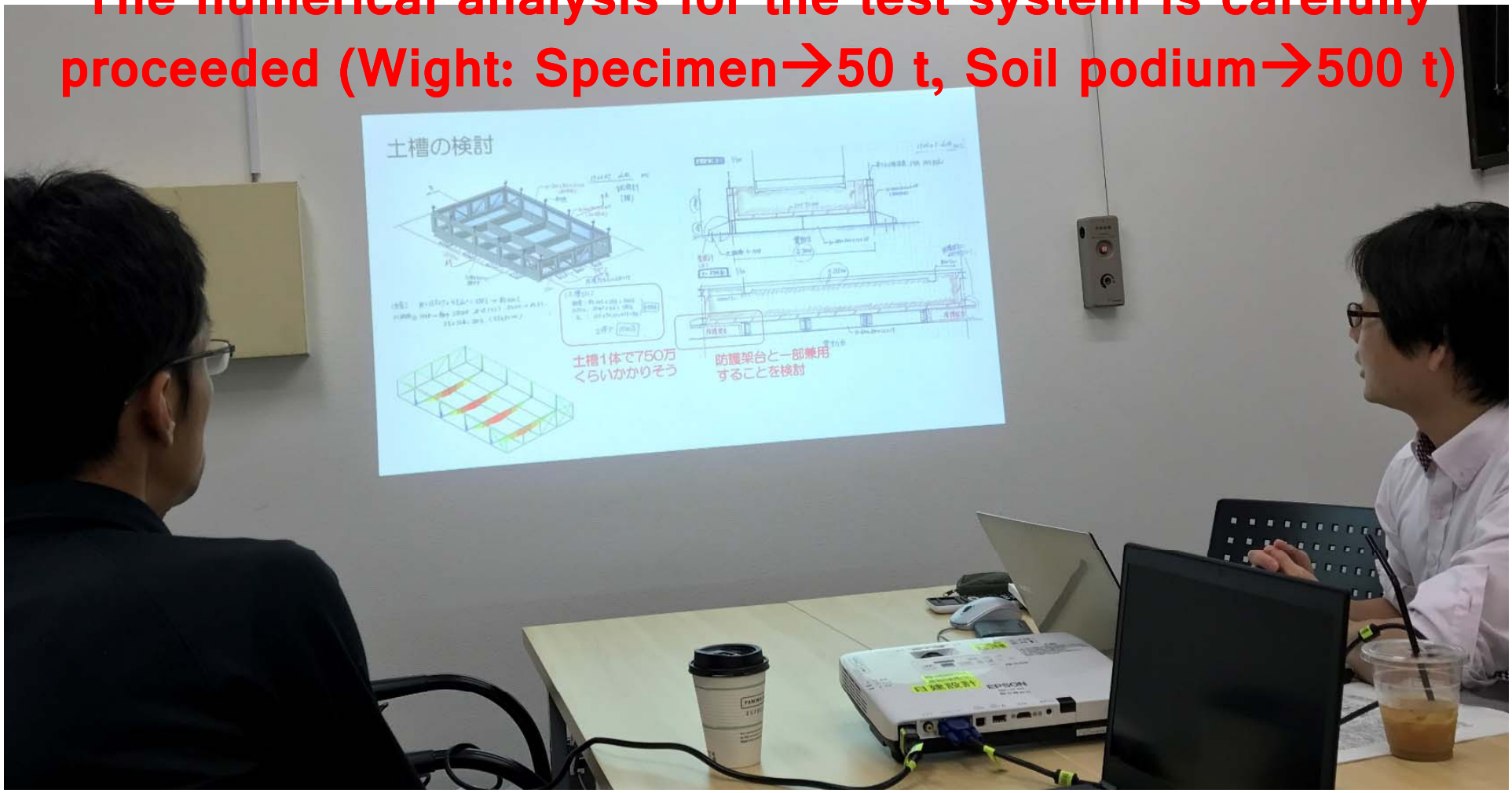
Theme Ⅰ: Comprehensive loss assessment procedure in a pilot metropolitan residential area

The numerical analysis for the test system is carefully proceeded (Wight: Specimen→50 t, Soil podium→500 t)



The test method for Soil Structure Combined Action Test

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Theme I: Comprehensive loss assessment procedure in a pilot metropolitan residential area

Aspect ratio

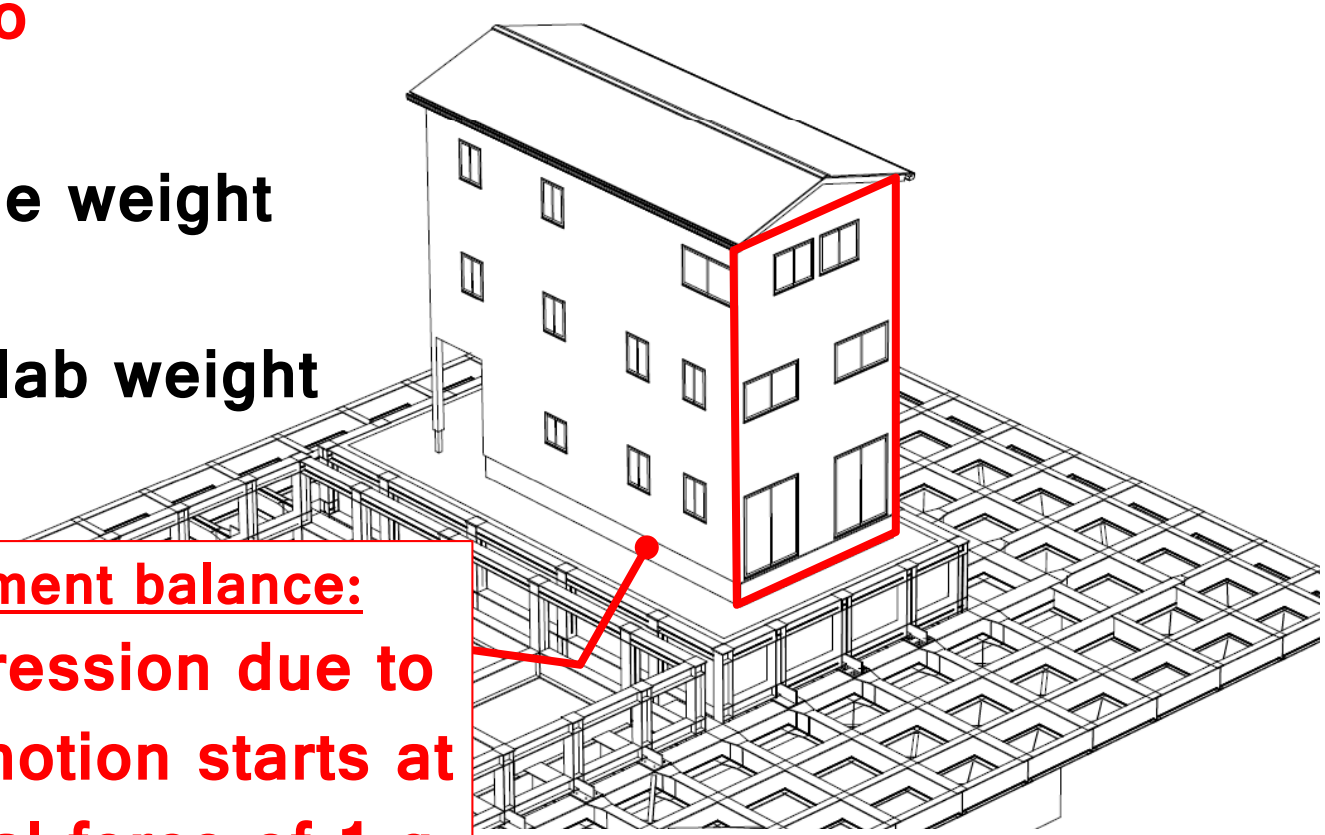
→ 2

Upper frame weight

→ 27 t

Concrete slab weight

→ 28 t



Simple moment balance:

Decompression due to rocking motion starts at the lateral force of 1 g

EXAMPLE

Soil structure combined action

v.s.

Damage assessment issue of utilities

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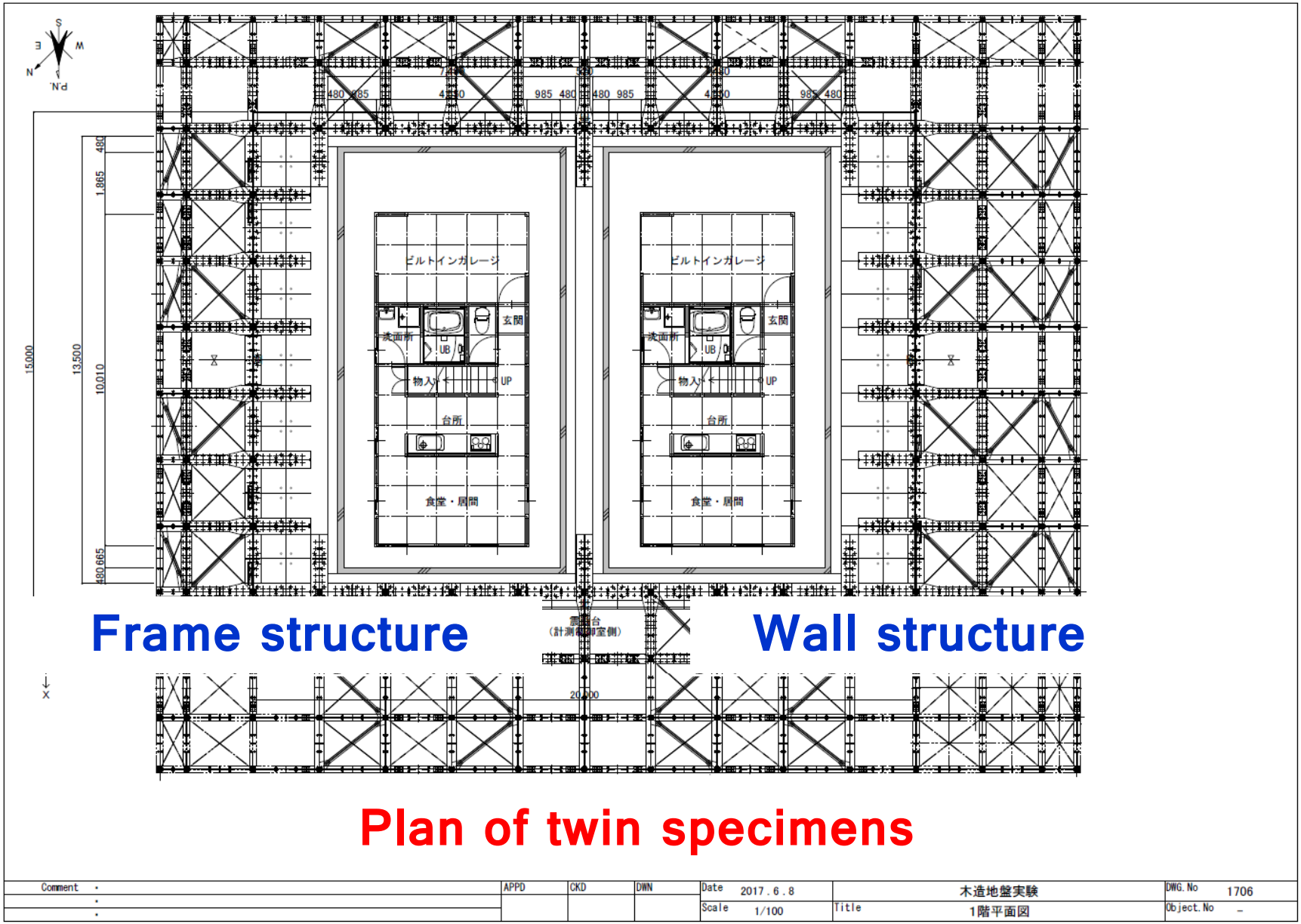

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Theme I: Comprehensive loss assessment procedure in a pilot metropolitan residential area

Summary (The 2018 December test for densely populated urban area)

Typical 3-story wooden houses (current design base) will be set on their soil podiums.

The system includes underground pipes of gas, water and sewer. Electricity is planned, too.

One is frame structure, the other is wall structure.

The loss assessment and structural performance assessment will be the target.

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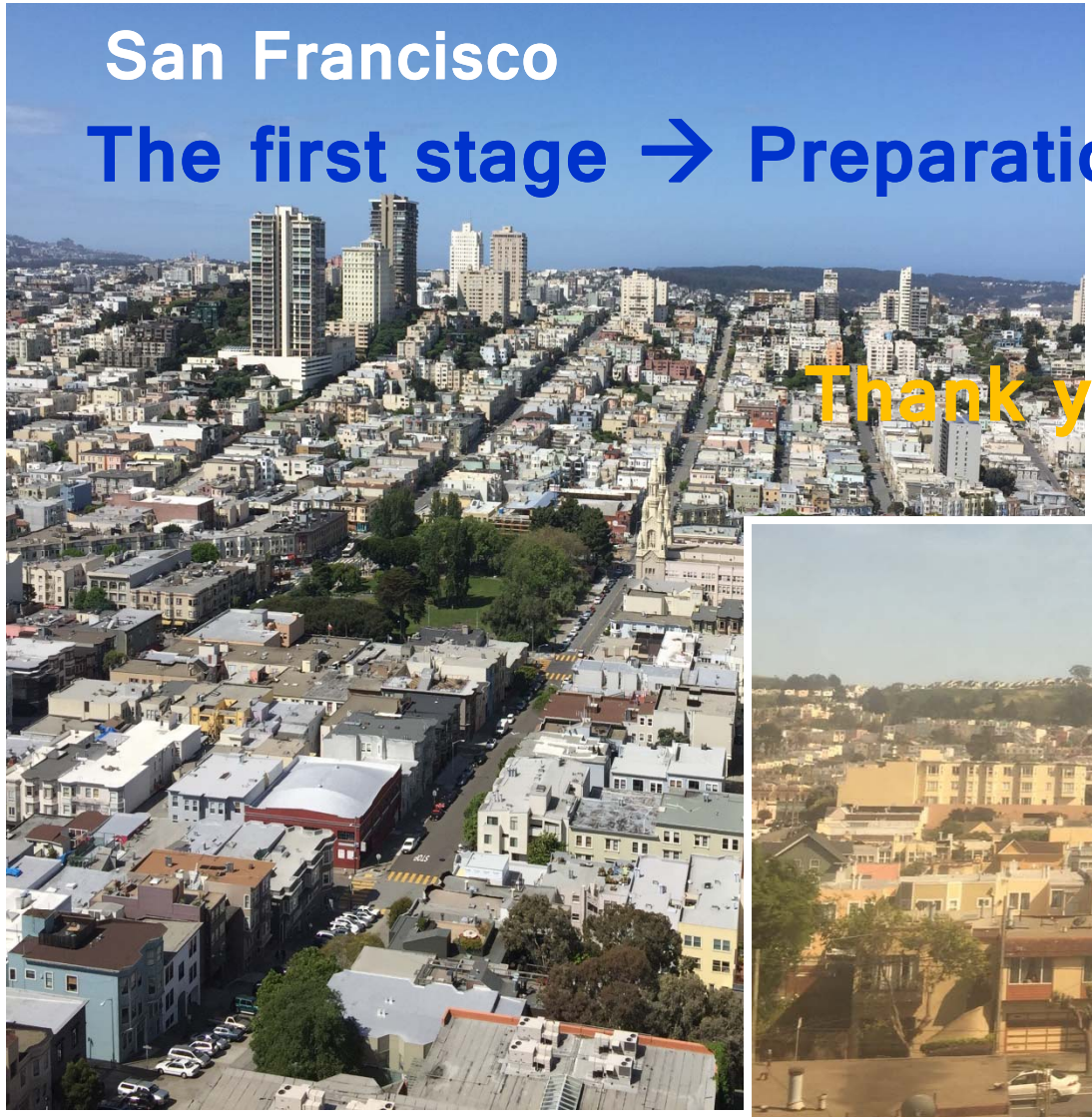
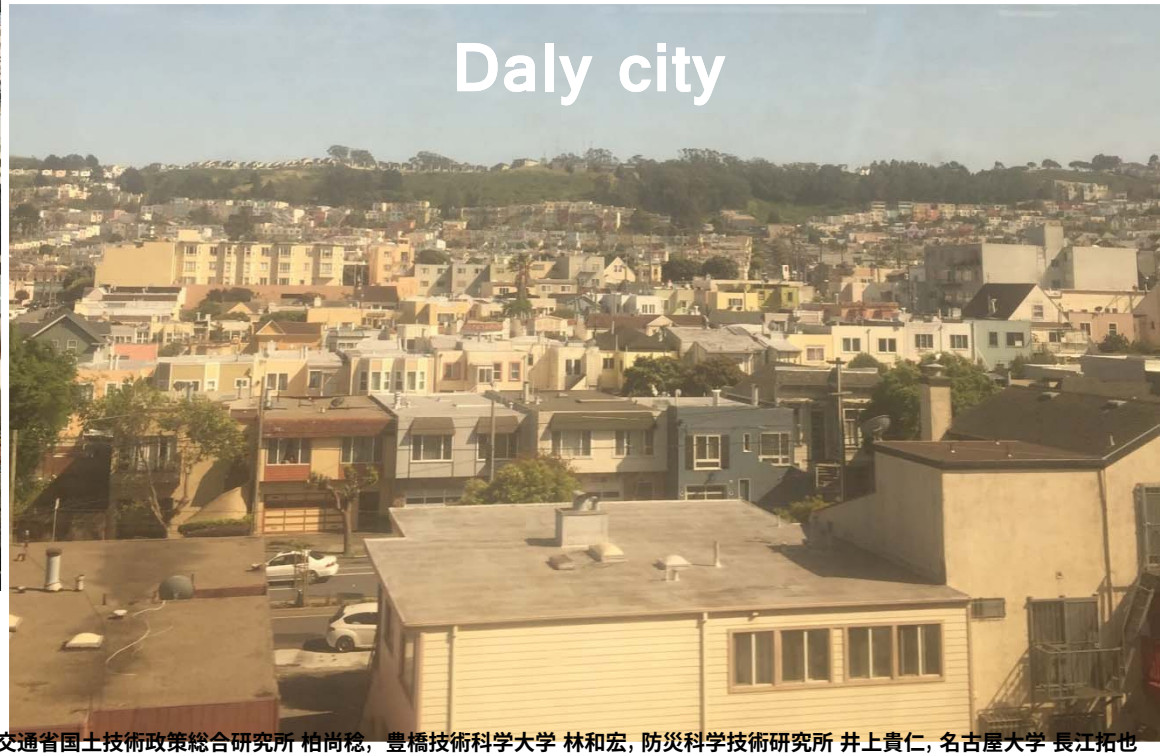


The first stage → Preparation for the test podium

Thank you for your attention.



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Theme I: Comprehensive loss assessment procedure in a pilot metropolitan residential area

- Design practitioner (experiences of 4 base isolation hospitals)
- Researcher (foundation and soil)
- Gas company(Nagoya Univ. project section)
- Electricity company(Nagoya Univ. project section)
- House makers(affordable repairing method)
- Structural engineers(response assessment)
- Insurance company(loss assessment)
- Consultants(hazard analysis)

→ Interaction with social science matters

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2017/07/14 US-Japan workshop Resolution

Densely populated residential district and Non−structural component Group (1 and 4)

Typical 3−story wooden houses (current design base) will be set on their soil podiums.

*Blind prediction and monitoring competition for the extracted pilot residential system response and damage (soil, wood structure, utility function, indoor)

The system includes underground pipes of gas, water and sewer. Electricity is planned, too.

*Performance comparisons of different specifications. Development and testing of resilient utility system including US specifications such as water and gas lines.

One is frame structure, the other is wall structure.

*New technologies for improved performance and resilience of entire residential system.

The loss assessment and structural performance assessment will be the target.

*Implementation actions of developed loss assessment to the US society (A pilot San Francisco block) <u>based on the advantage of remained 3 years and comprehensive investigation team.</u>

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