Yusuhara Wooden Bridge Museum

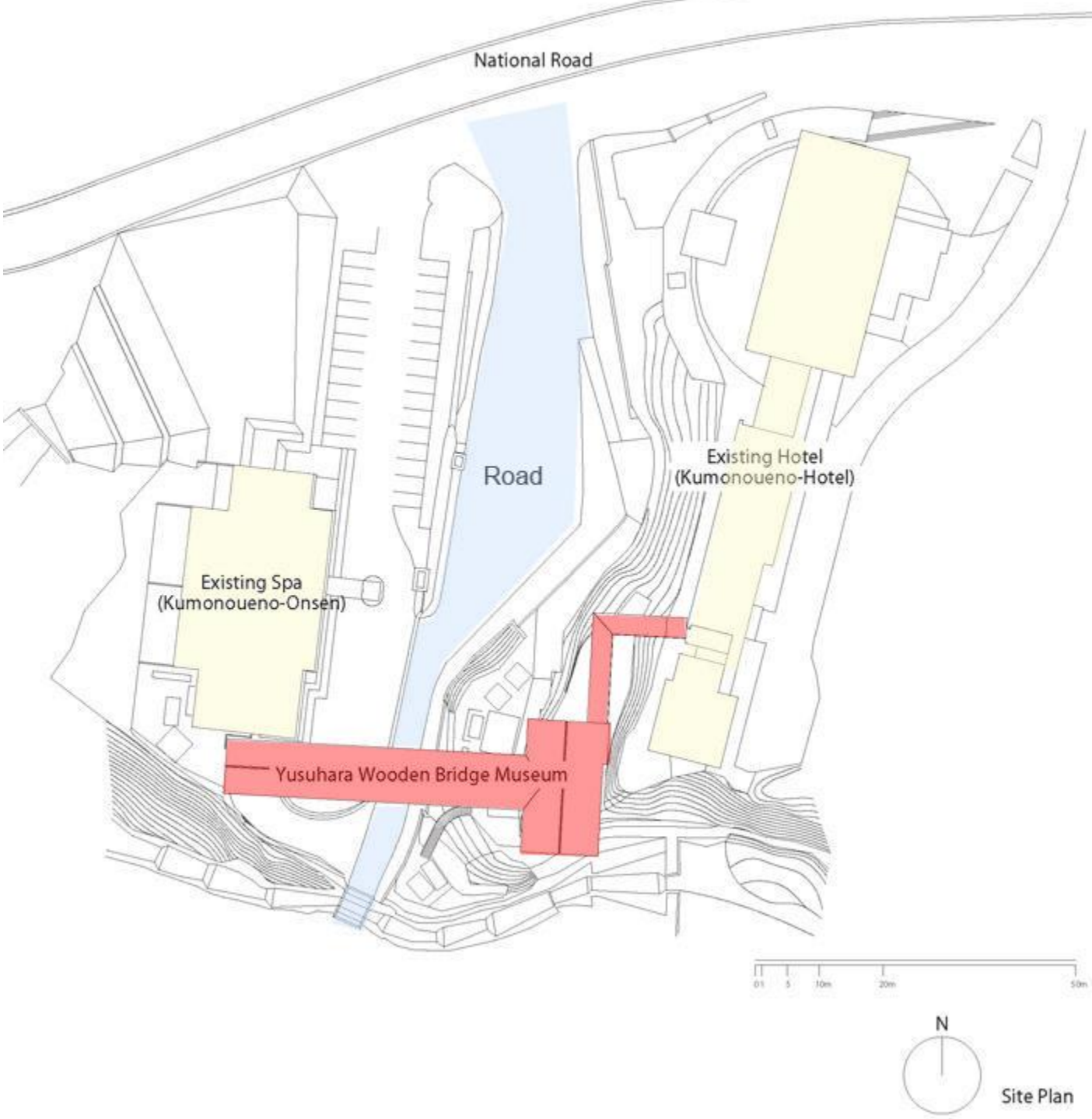
Lei Shao, Guang Yang,
Alan Thetford, Abraham Obregon

Background

- **Architect:**
  Kengo Kuma & Associates
- **Location:**
  Yusuhara-cho, Takaoka-gun,
  Kochi Prefecture, Japan
- **Client:**
  Tomio Yano, Mayor of Yusuhara
- **Site area:**
  14,736.47 sqm
- **Completion Date:**
  2011

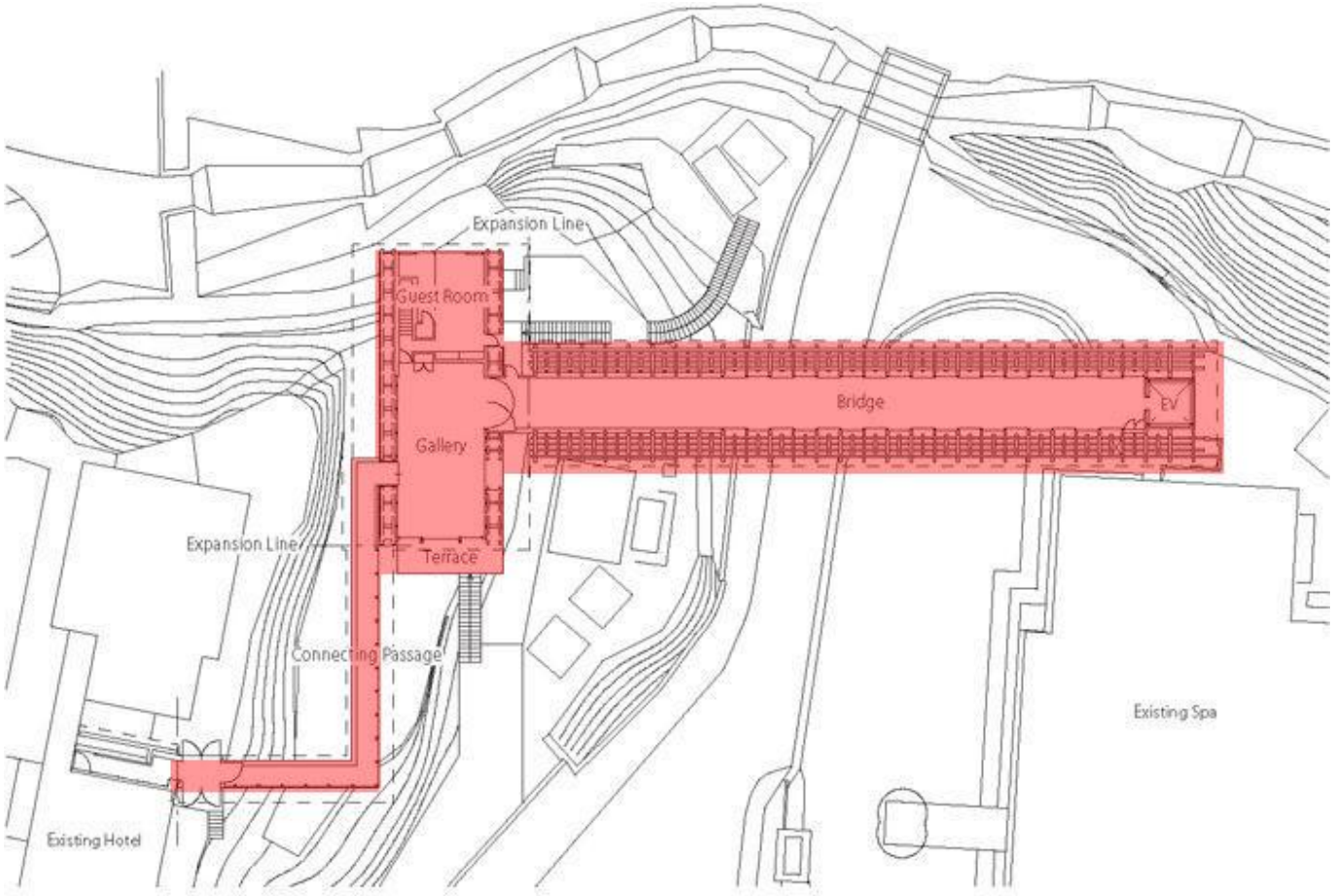
Site Plan

The museum is intended to link two public buildings with a bridge-typed facility. The two buildings have long been separated by the road in between.

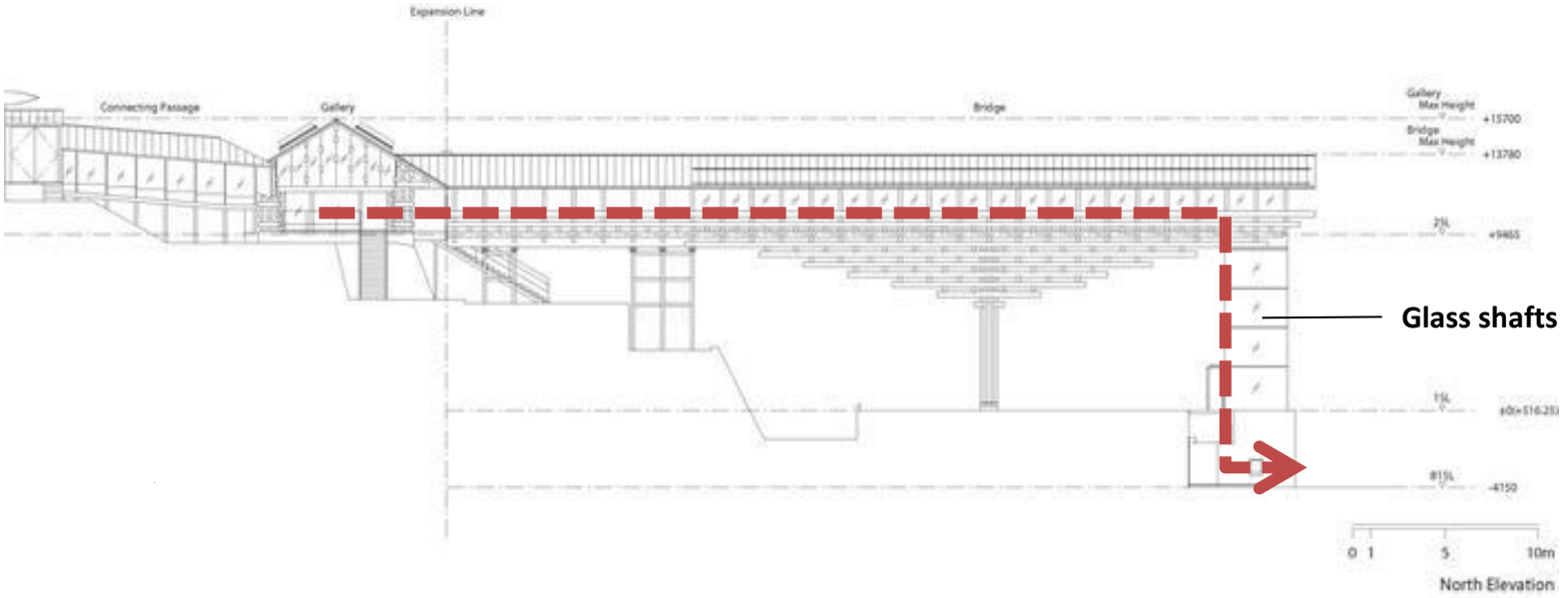


Floor Plan

The building functions not only as a passage between the two existing structures but also as a gallery with guest rooms. It is an ideal location for artist-in-residence programs



Circulation



The Architect

1954 - Born in Yokohama, Kanagawa Prefecture, Japan
1979 - Studied architecture at
The University of Tokyo
1985 - Graduate School, Visiting Scholar
at Columbia University
1987 - Established Spatial Design Studio
1990 - Established Kengo Kuma & Associates
1994 - Lecturer at Columbia University
(New York, USA)
2007 - Visiting Professor at UIUC
(Chicago, USA)
2009-Present - Professor at The University of Tokyo

Kengo Kuma

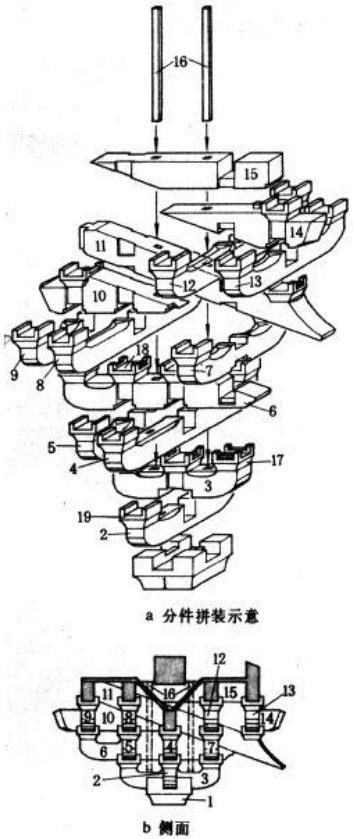
Material Theory

His works show the continuity with Japanese traditions with the clarity of structural solutions, implied tectonics, and importance of light and transparency. Kengo Kuma also goes further to explore the possibilities of materiality. He utilizes technological advancements which can challenge unexpected materials, such as stone, into providing the same sense of lightness and softness as glass or wood. By using of light and transparency materials, his work also attempt to establish a relationship between a space and the nature around it.

Material Theory

"You could say that my aim is 'to recover the place'. The place is a result of nature and time; this is the most important aspect. I think my architecture is some kind of frame of nature. With it, we can experience nature more deeply and more intimately. Transparency is a characteristic of Japanese architecture; I try to use light and natural materials to get a new kind of transparency." –Kengo Kuma (Bognar, B. (2009). *Material Immaterial: The New Work of Kengo Kuma*. New Yrok: Princeton Architectural Press.)

Dougong

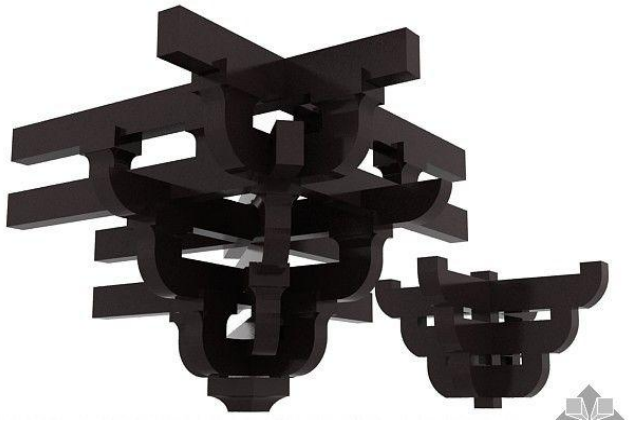


a 分件拼装示意

b 侧面

宋式补间铺作斗栱构造示意

1 栌斗 2 泥道栱 3 单材华栱 4 慢栱 5 瓜子栱 6 华头子里转第二跳华栱 7 瓜子栱 8 慢栱 9 令栱 10 耍头 11 下昂 12 慢栱 13 令栱 14 耍头 15 衬方头 16 昂栓 17 交互斗 18 齐心斗 19 散斗



Dougong

- Wooden supports essential to the timber frame structure of traditional Japanese and Chinese buildings because the walls in these structures are not load-bearing.
- Multiple interlocking bracket sets are formed by placing a large wooden block (dou) on a column to provide a solid base for the bow-shaped brackets (gong) that support the beam or another gong above it.
- Provides increased support for the weight of the horizontal beams that span the vertical columns or pillars by transferring the weight on horizontal beams over a larger area to the vertical columns.
- This process can be repeated many times, and rise many stories. Adding multiple sets of interlocking brackets or dougong reduces the amount of strain on the horizontal beams when transferring their weight to a column.
- Multiple dougong also allows structures to be elastic and to withstand damage from earthquakes.

斗栱的柱子及阑额

柱上加栌斗

斗上加泥道栱

再加华栱，向里外出跳。

拱端加散斗及交互斗

加泥道慢栱

加华拱，一端为华头子（华头子在室外）。

加散斗及交互斗

加内檐令栱

加内檐耍头

加柱头枋

加散斗与齐心斗

加内檐罗汉枋

加下昂

加骑昂交互斗

加外檐令栱

加外檐耍头

加外檐散斗

加撩檐枋

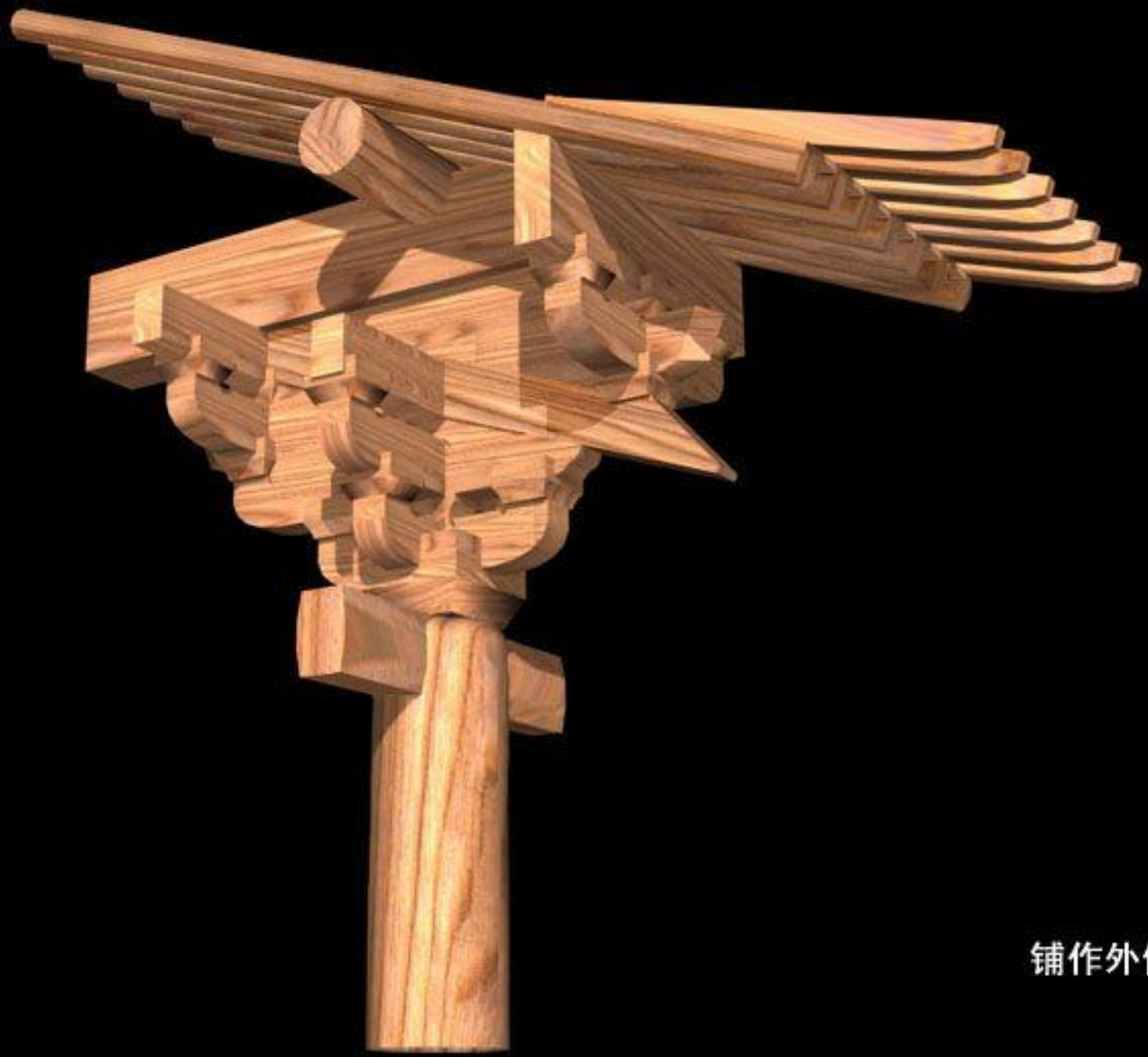
加衬方头

加　梁

加檐檩

加　椽

铺作内侧仰视



铺作外侧仰视

Analysis

- Bridge appears to balance on one central column
- Actually acts as 2-span continuous beam

Analysis

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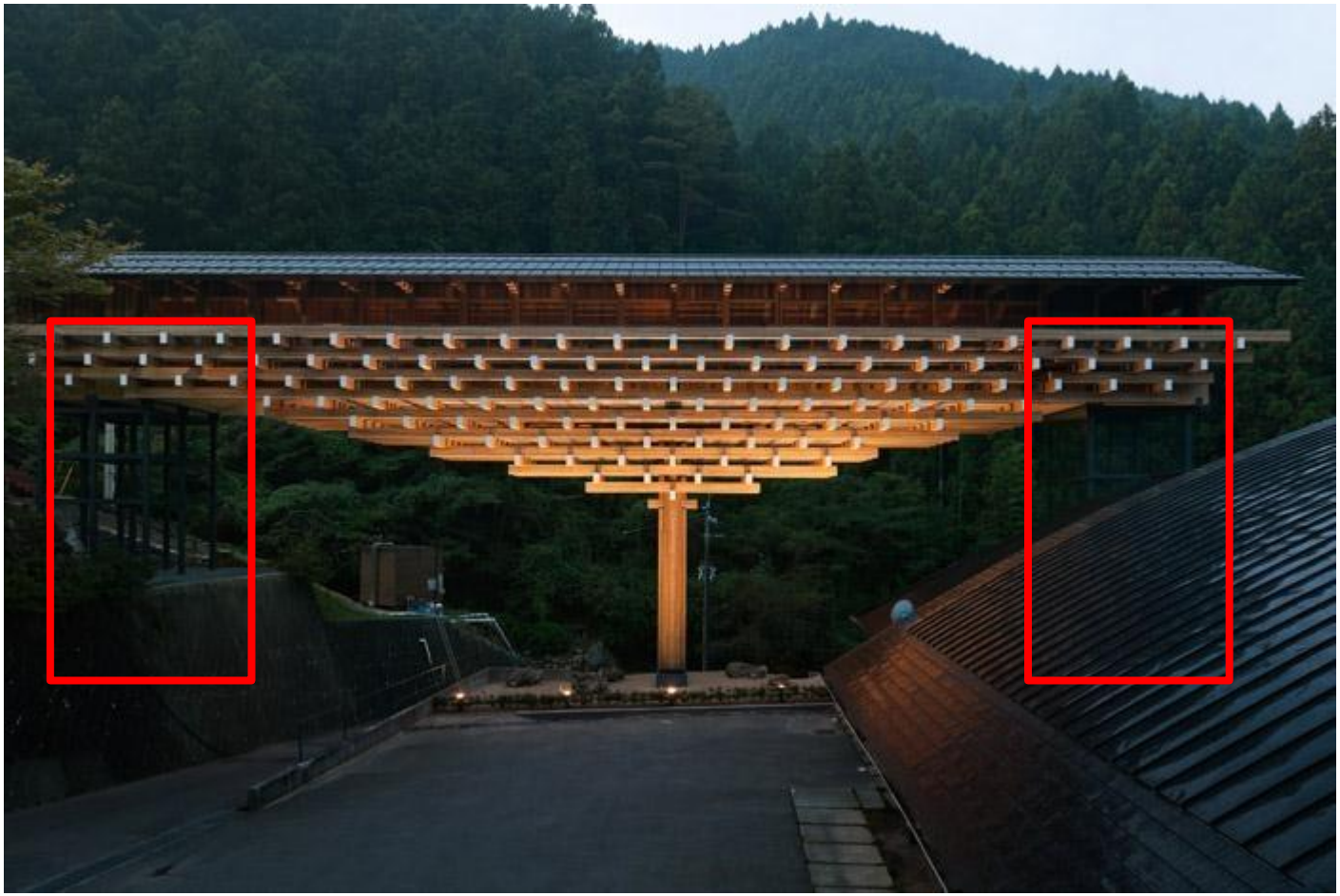
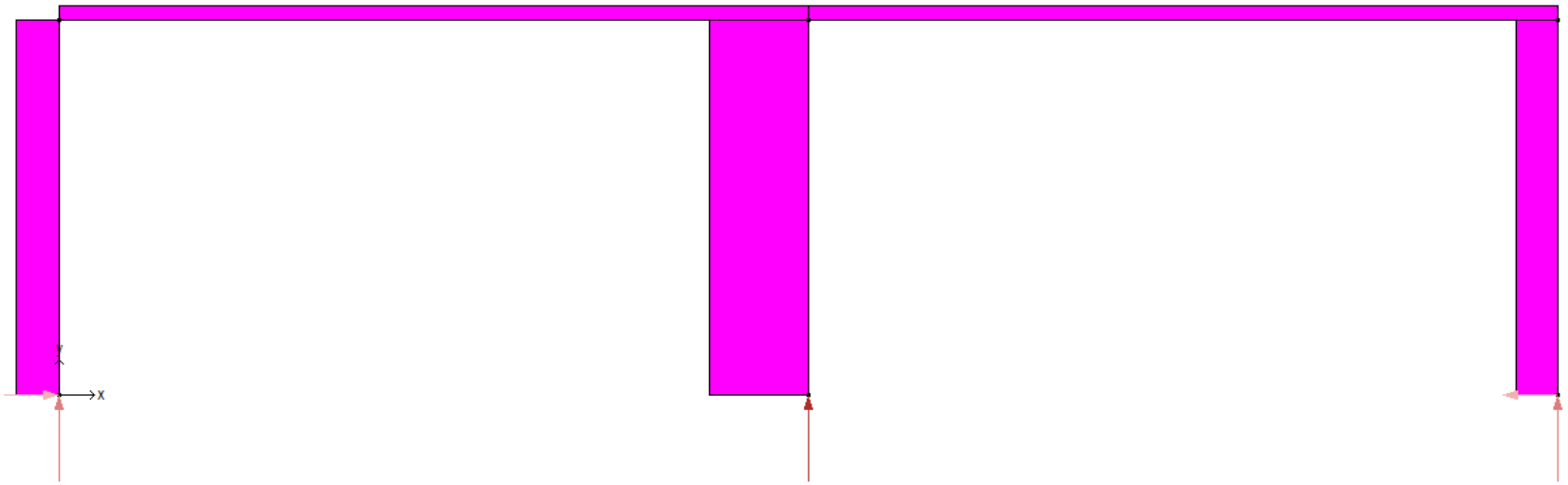
- Actually acts as 2-span continuous beam
- Transparent “columns” on ends



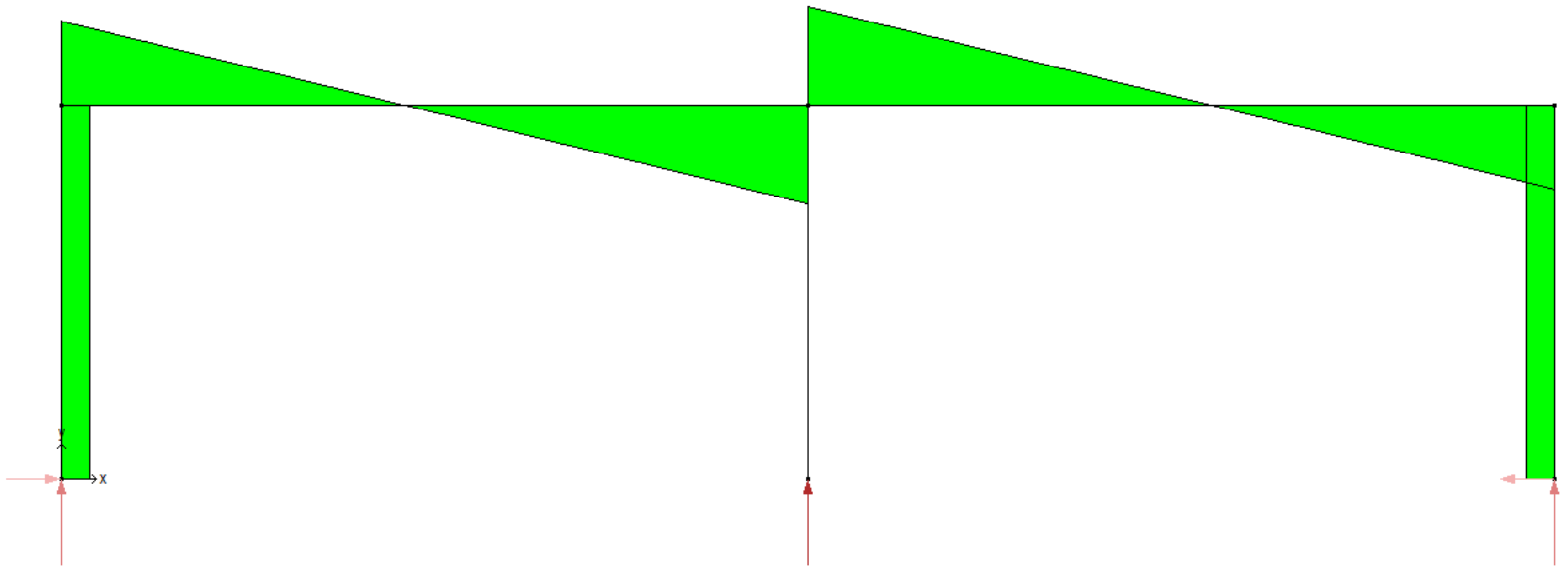
Analysis

Simple 2-Span Continuous Beam - Axial



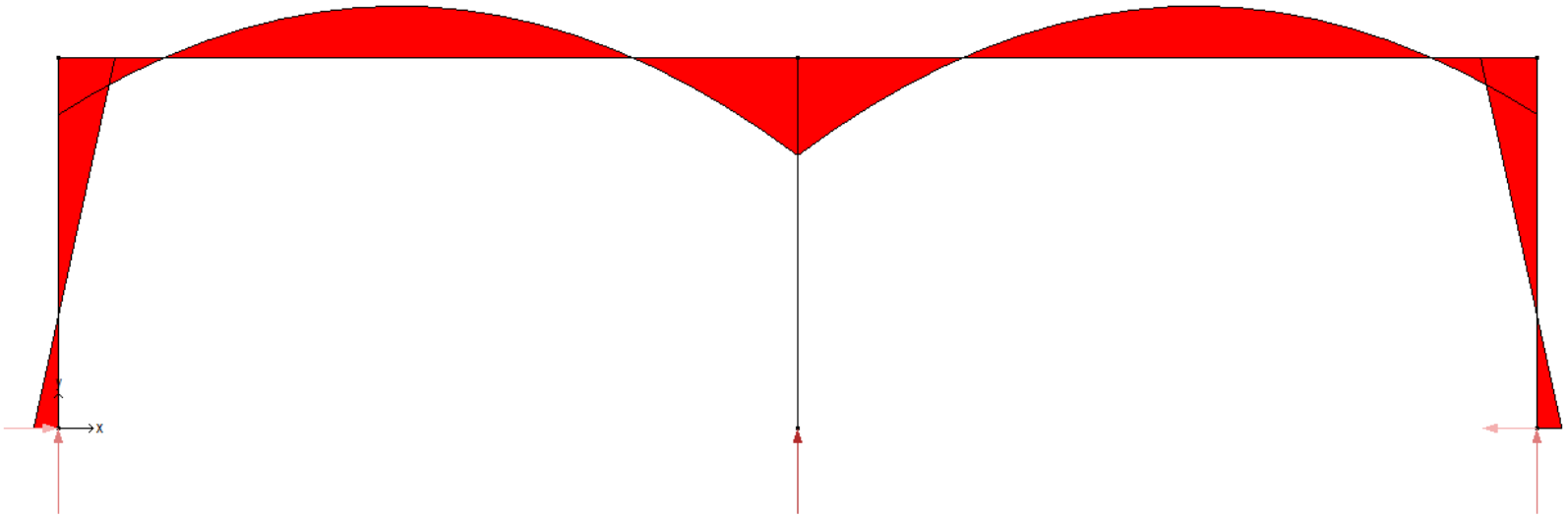
Analysis

Simple 2-Span Continuous Beam - Shear



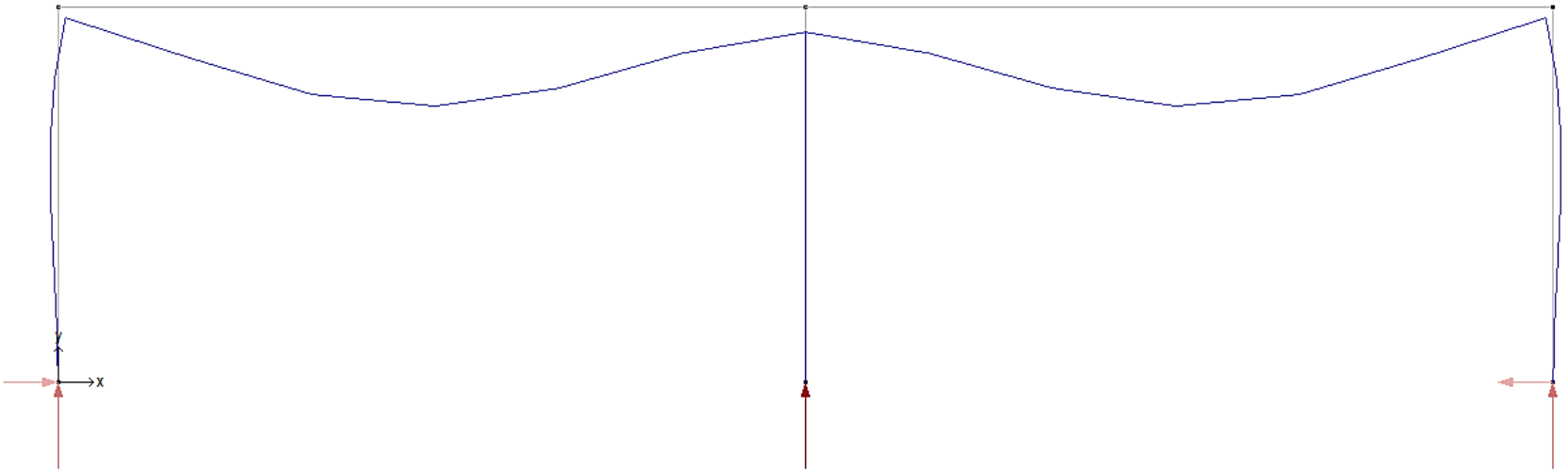
Analysis

Simple 2-Span Continuous Beam - Moment



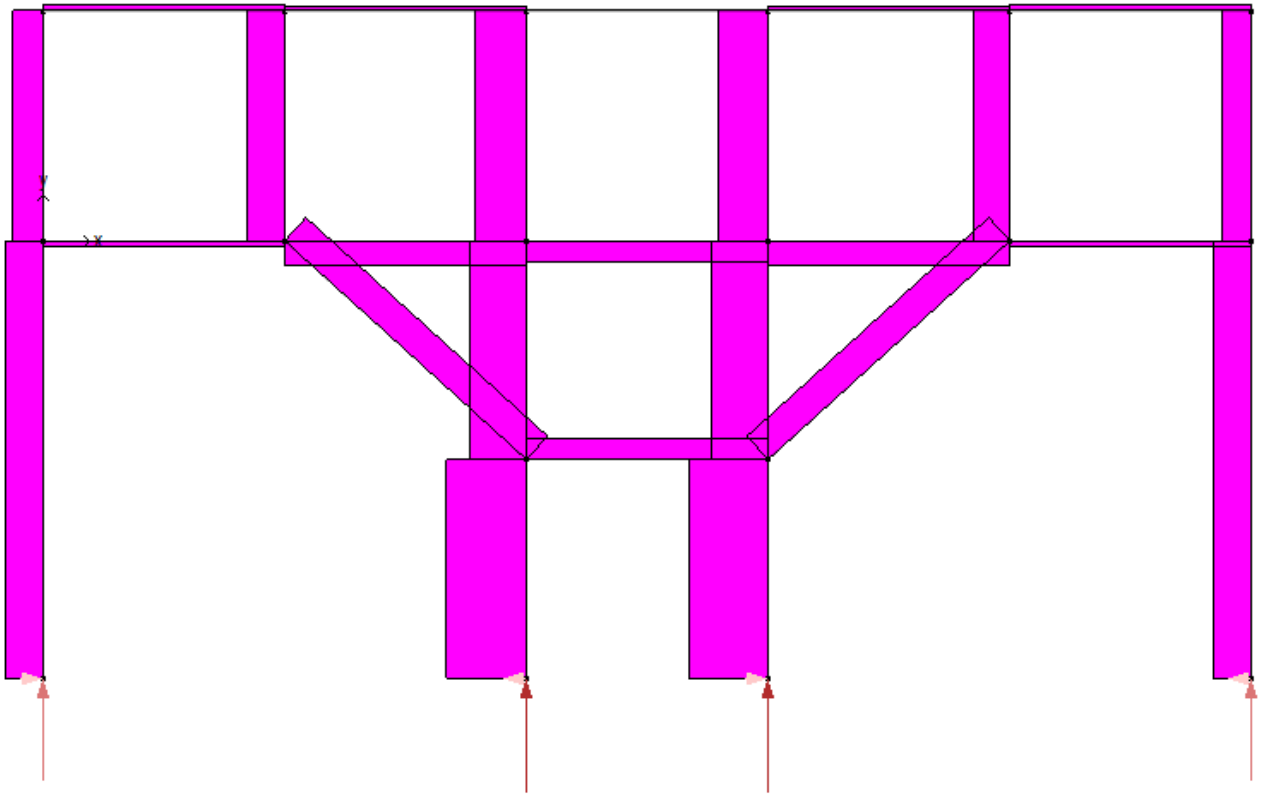
Analysis

Simple 2-Span Continuous Beam - Deflection



Analysis

Vertical Loading



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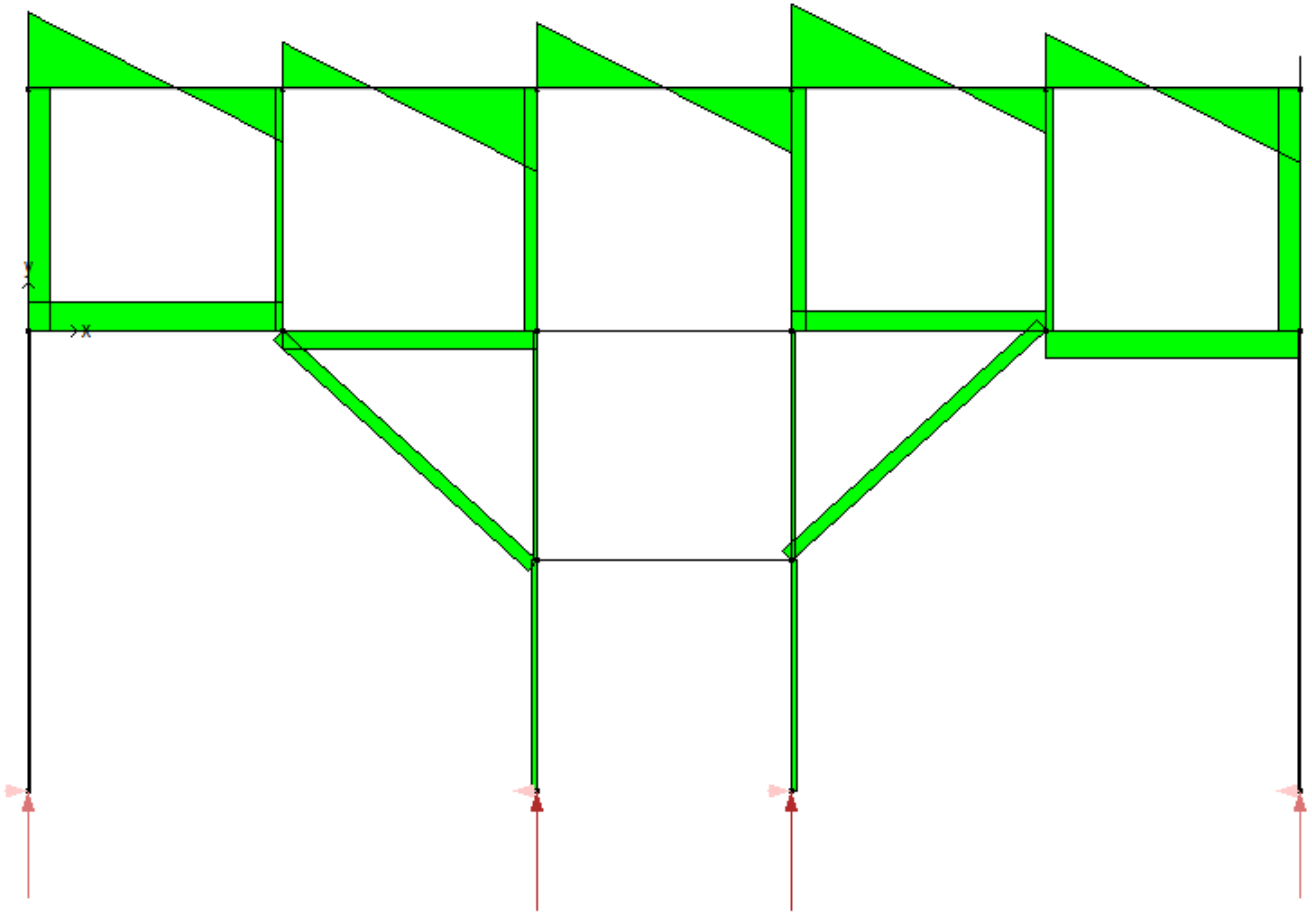

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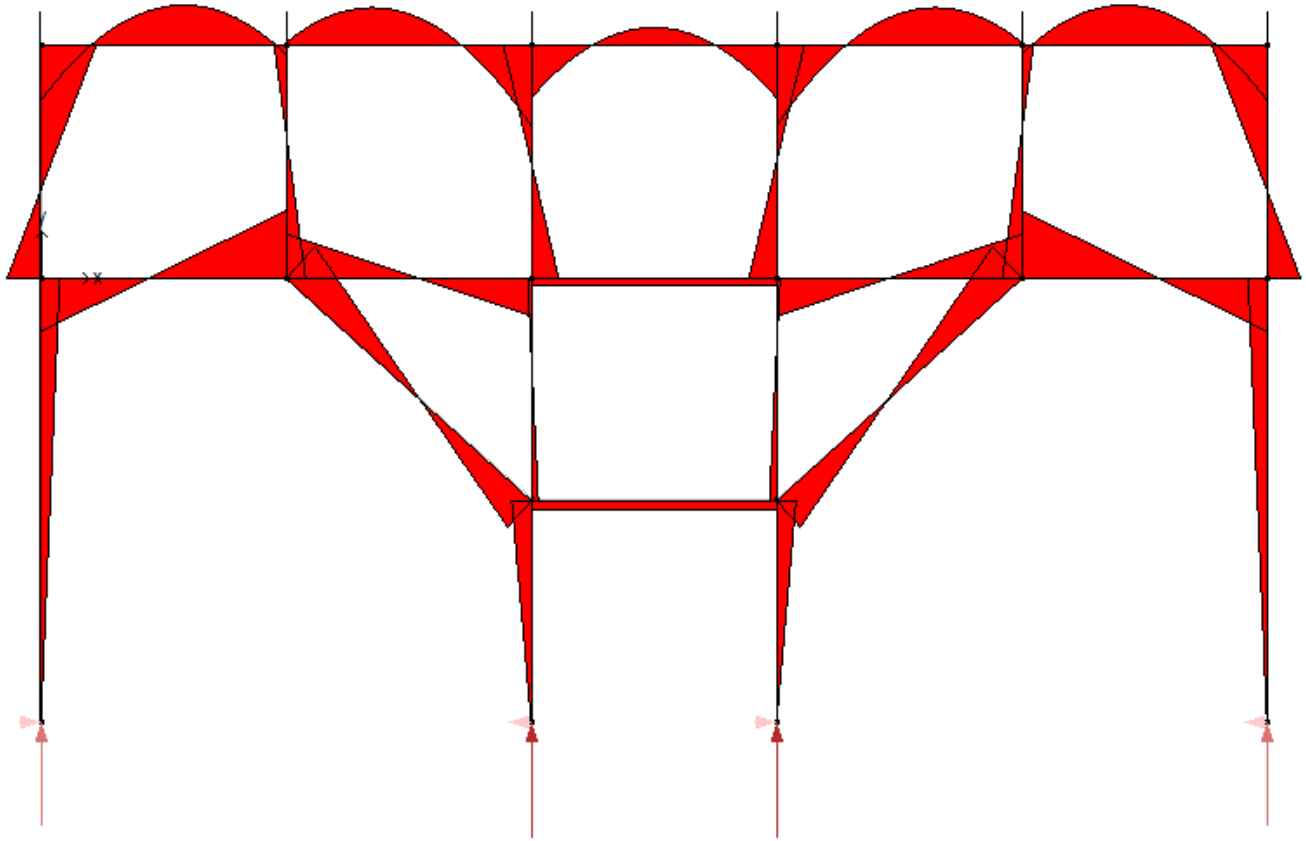

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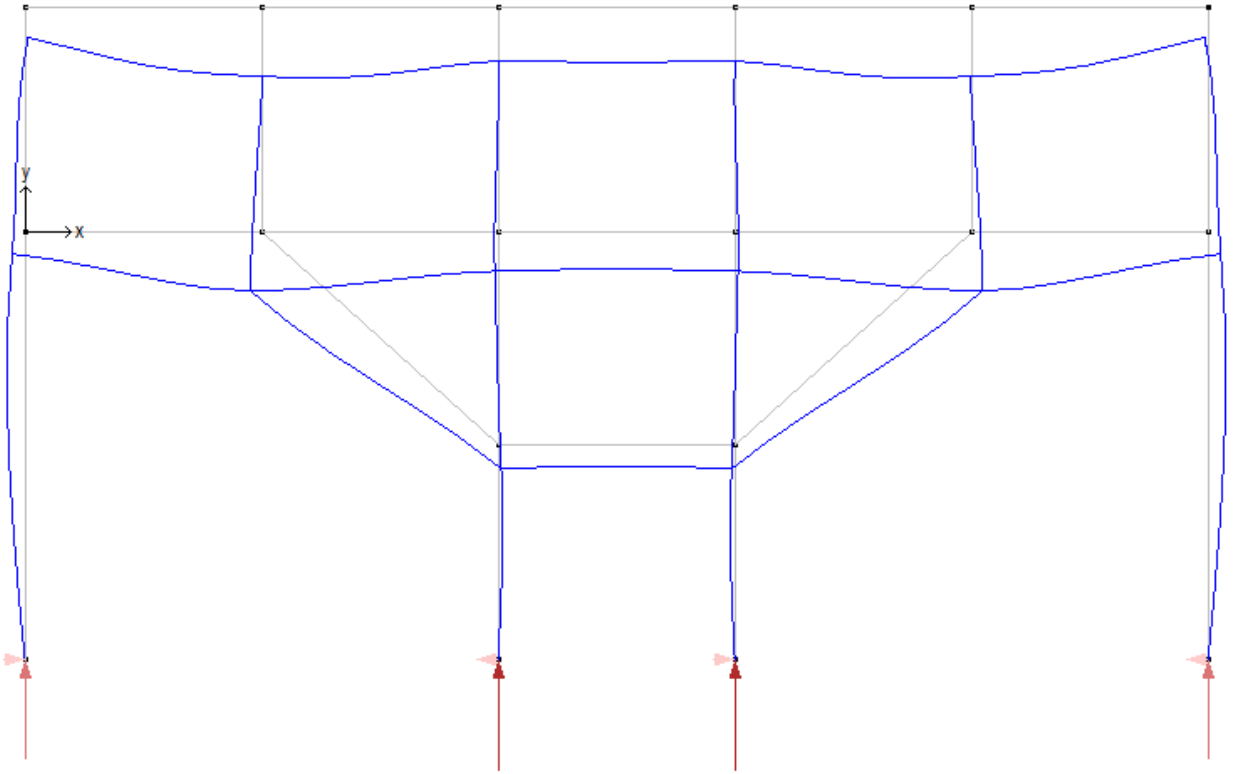
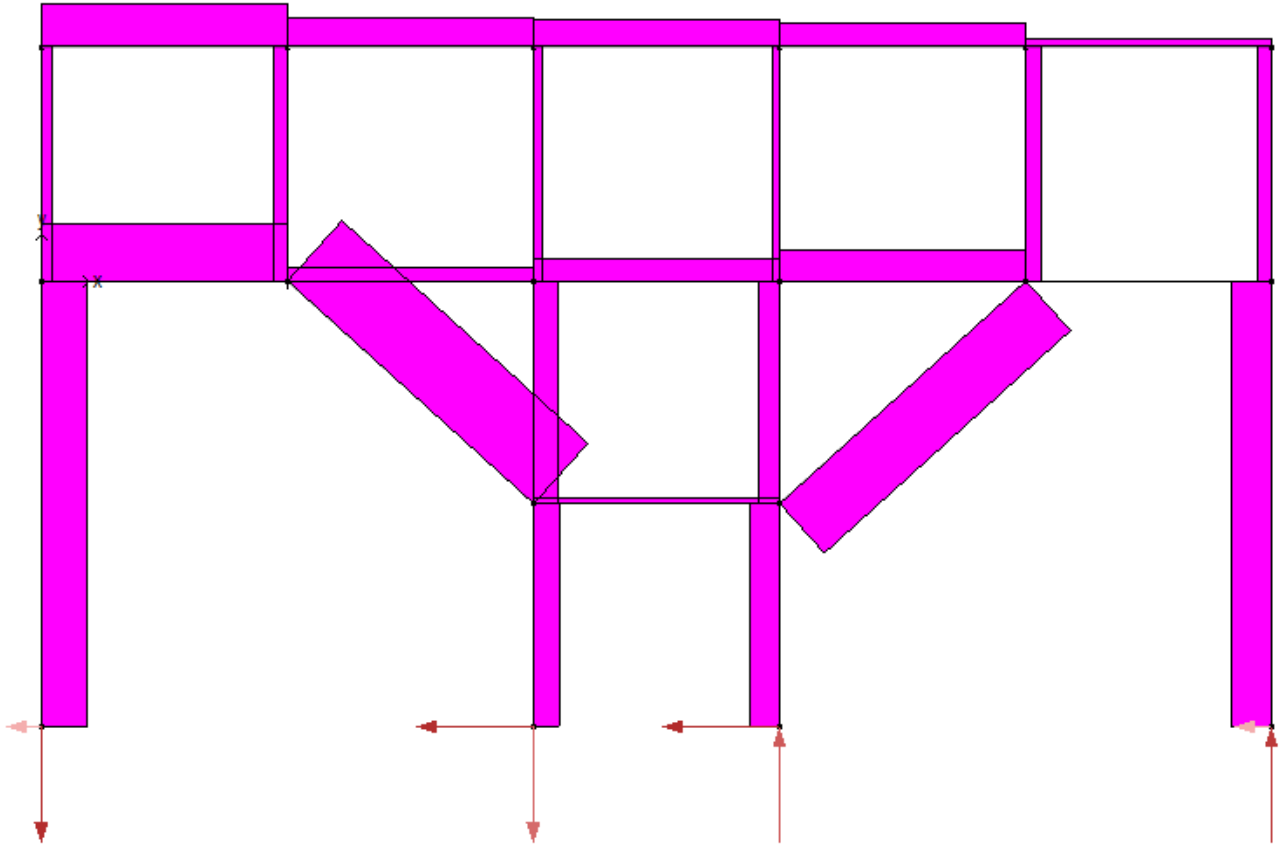


Analysis

Horizontal Loading



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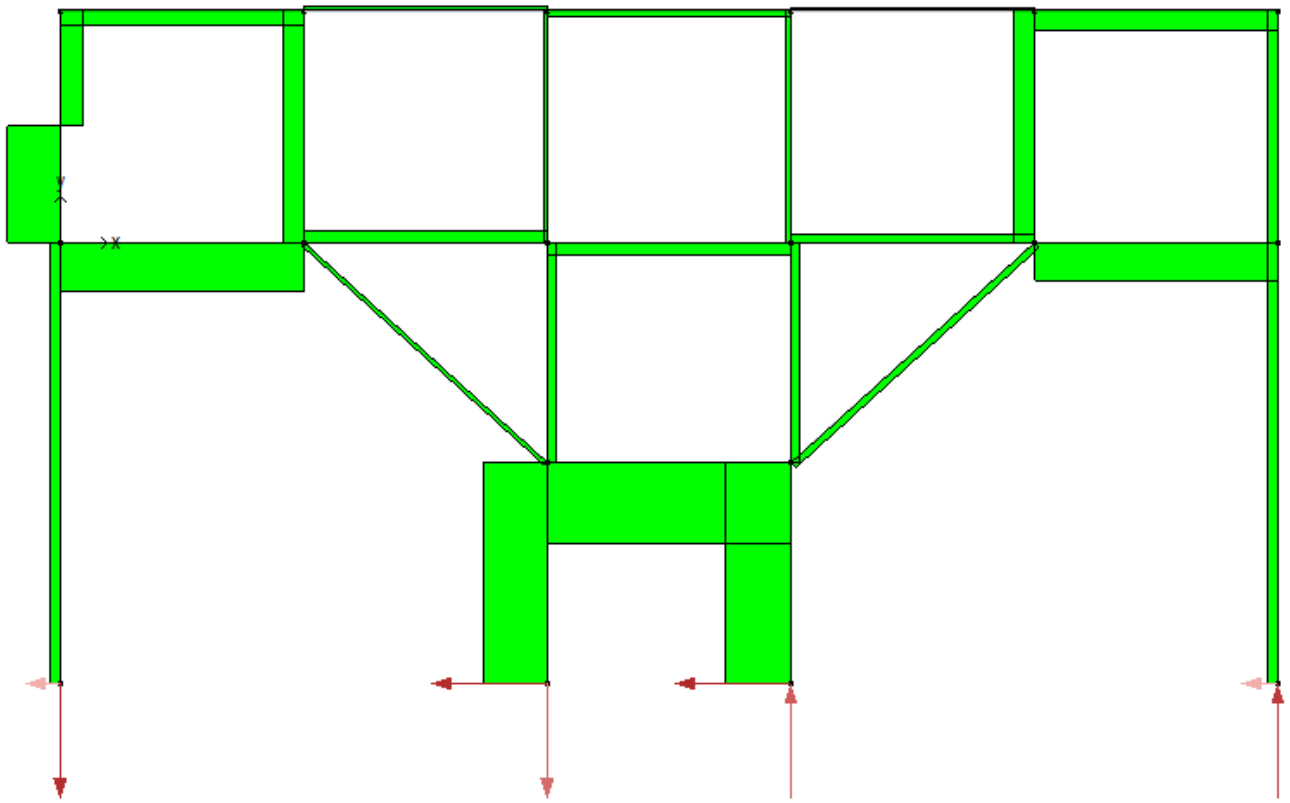

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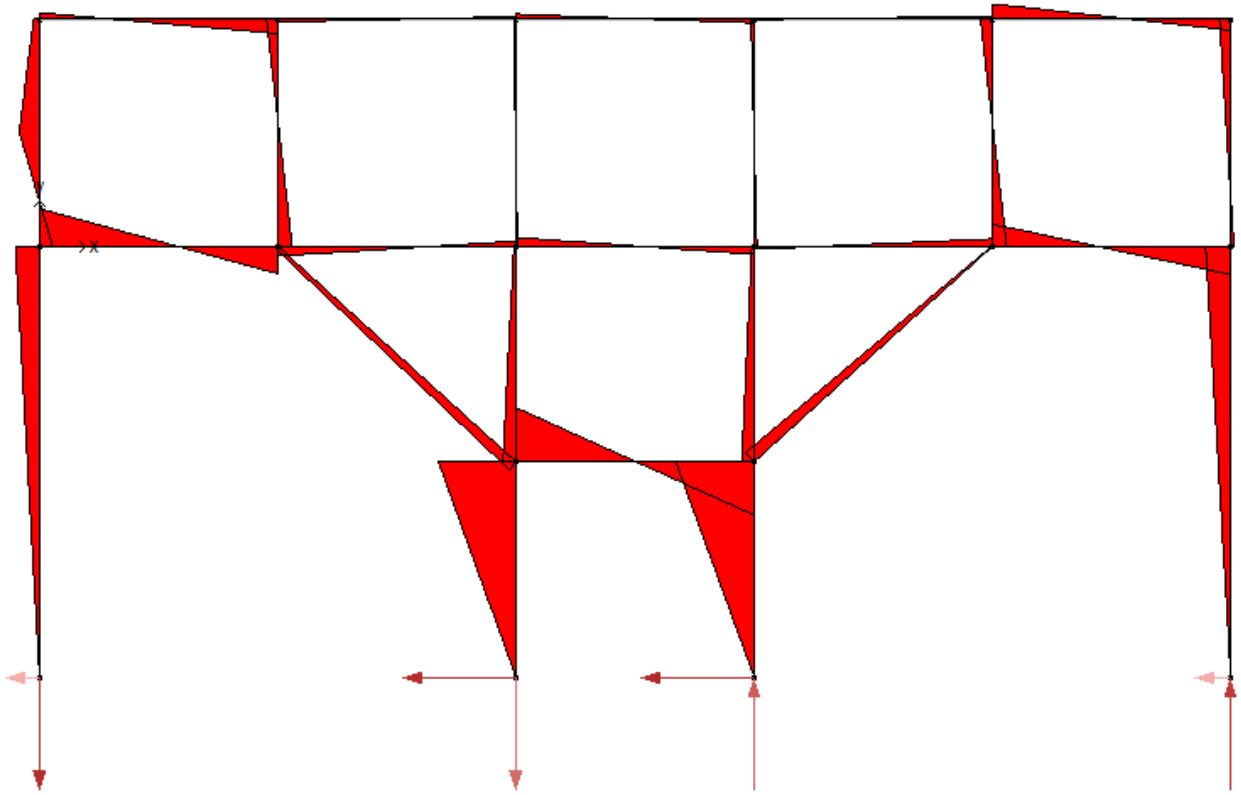

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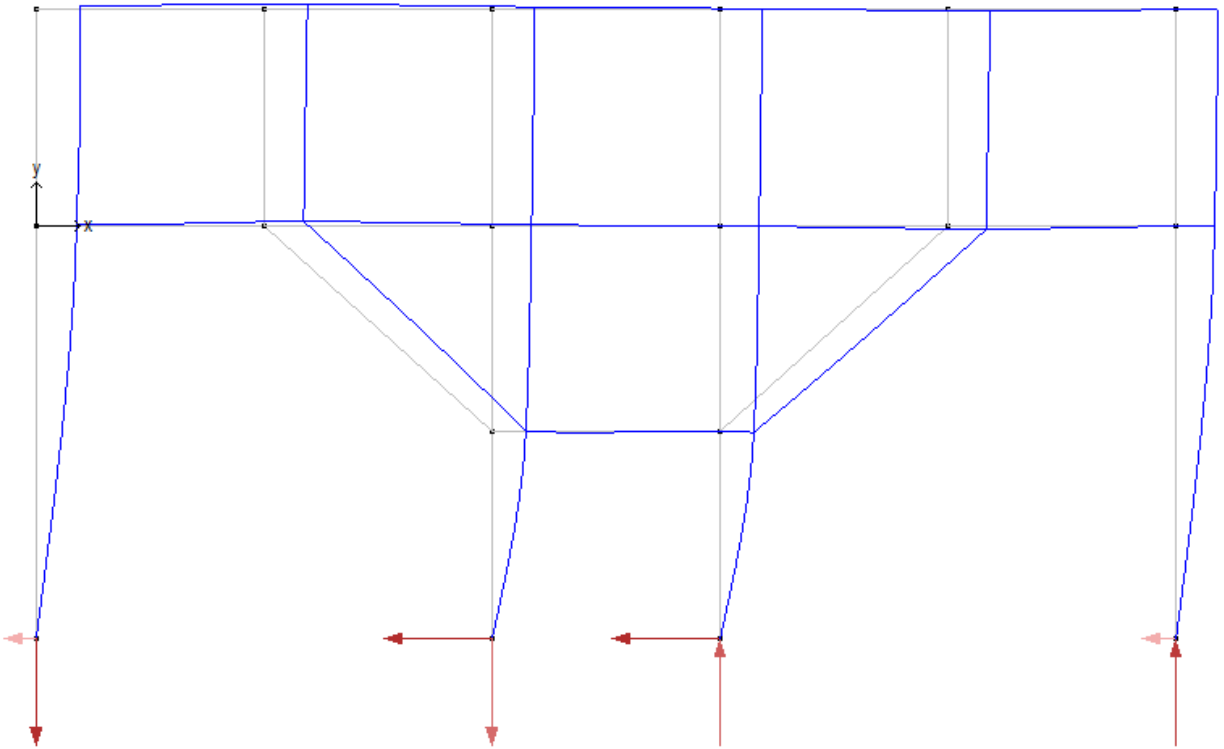
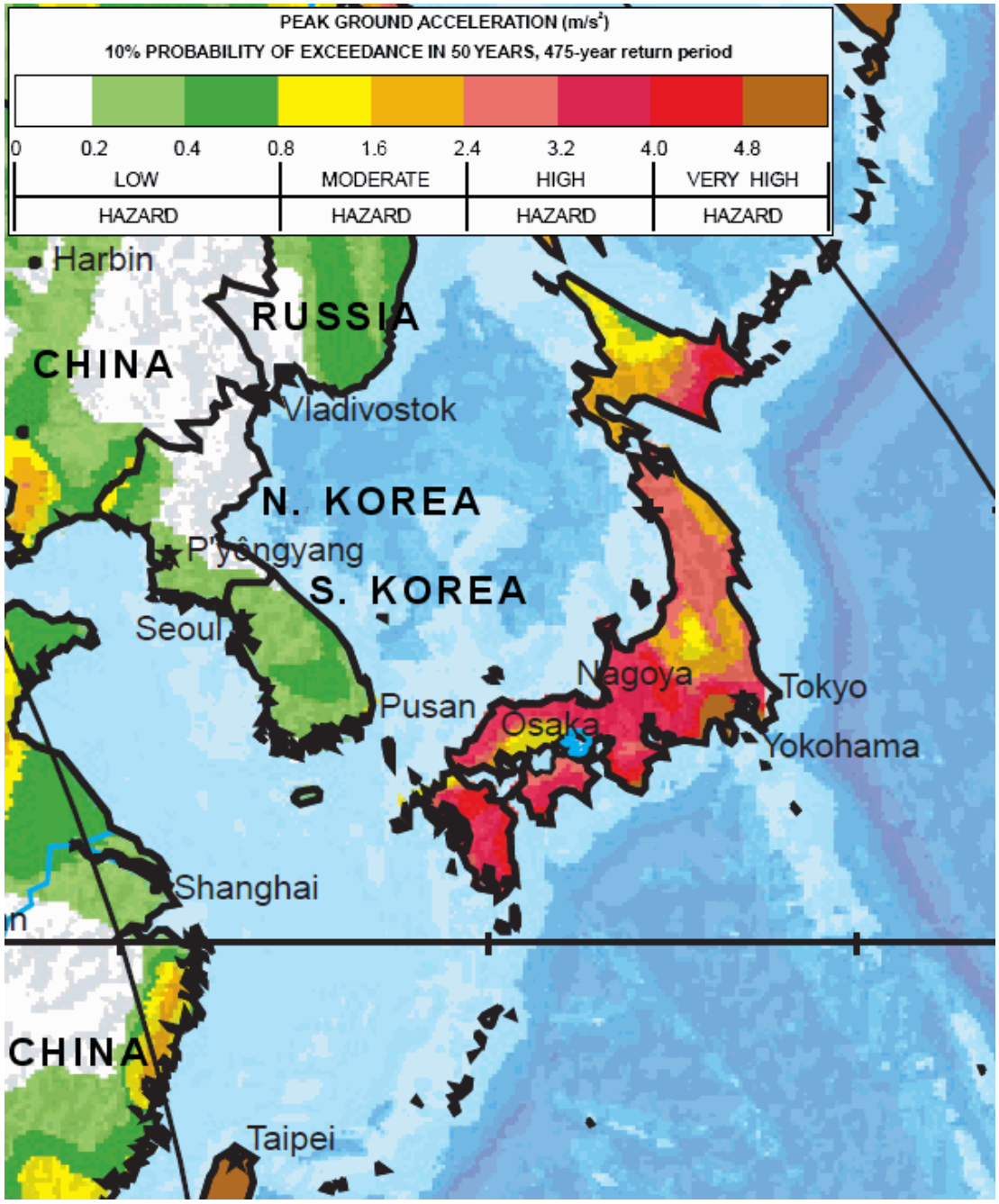


Analysis

Analysis

- Seismic areas in Japan



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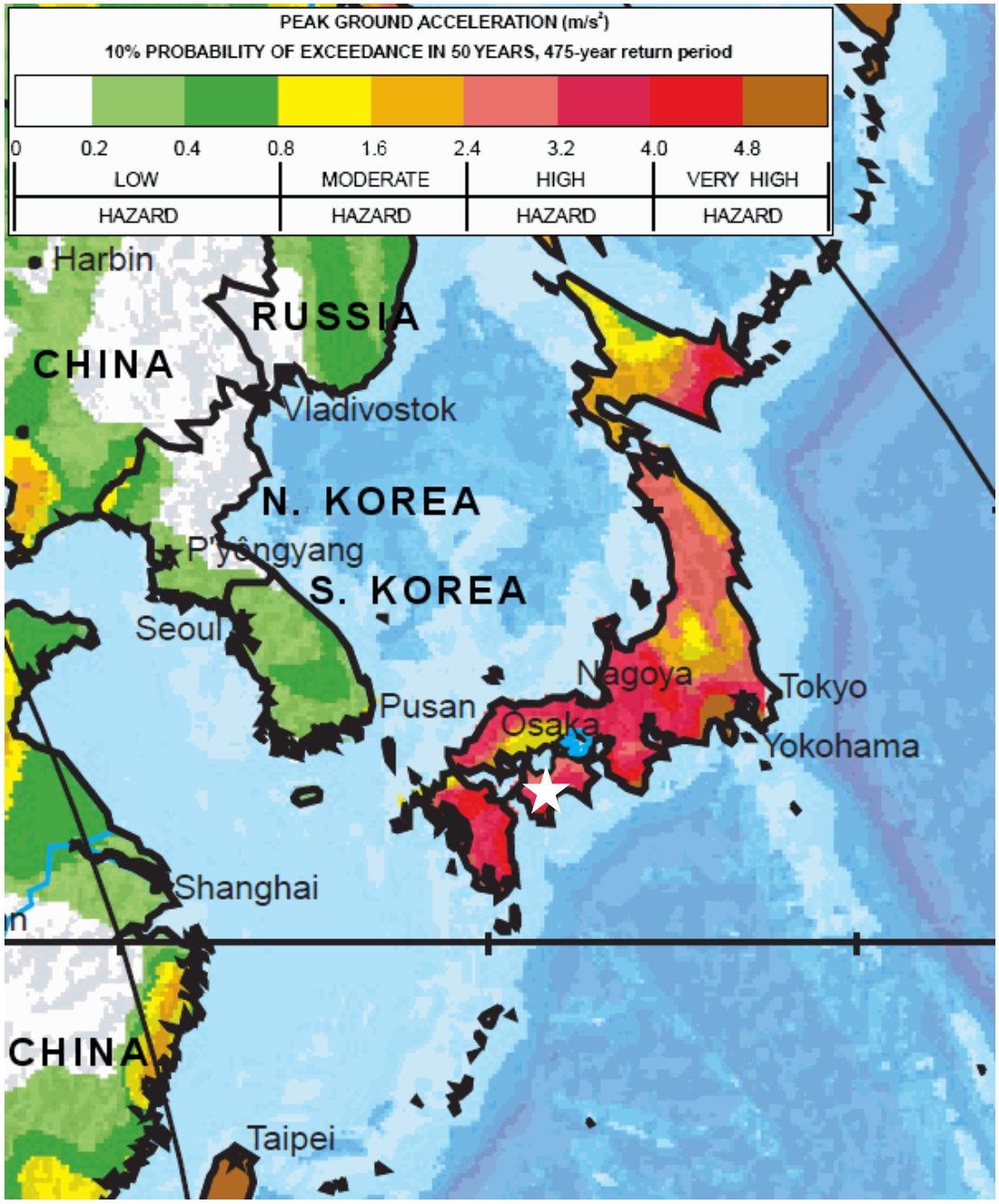
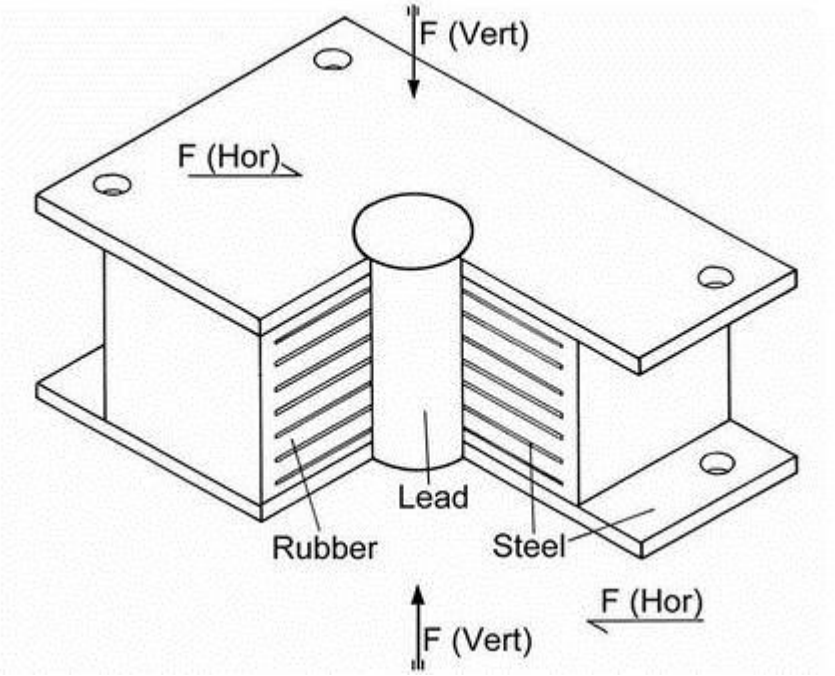


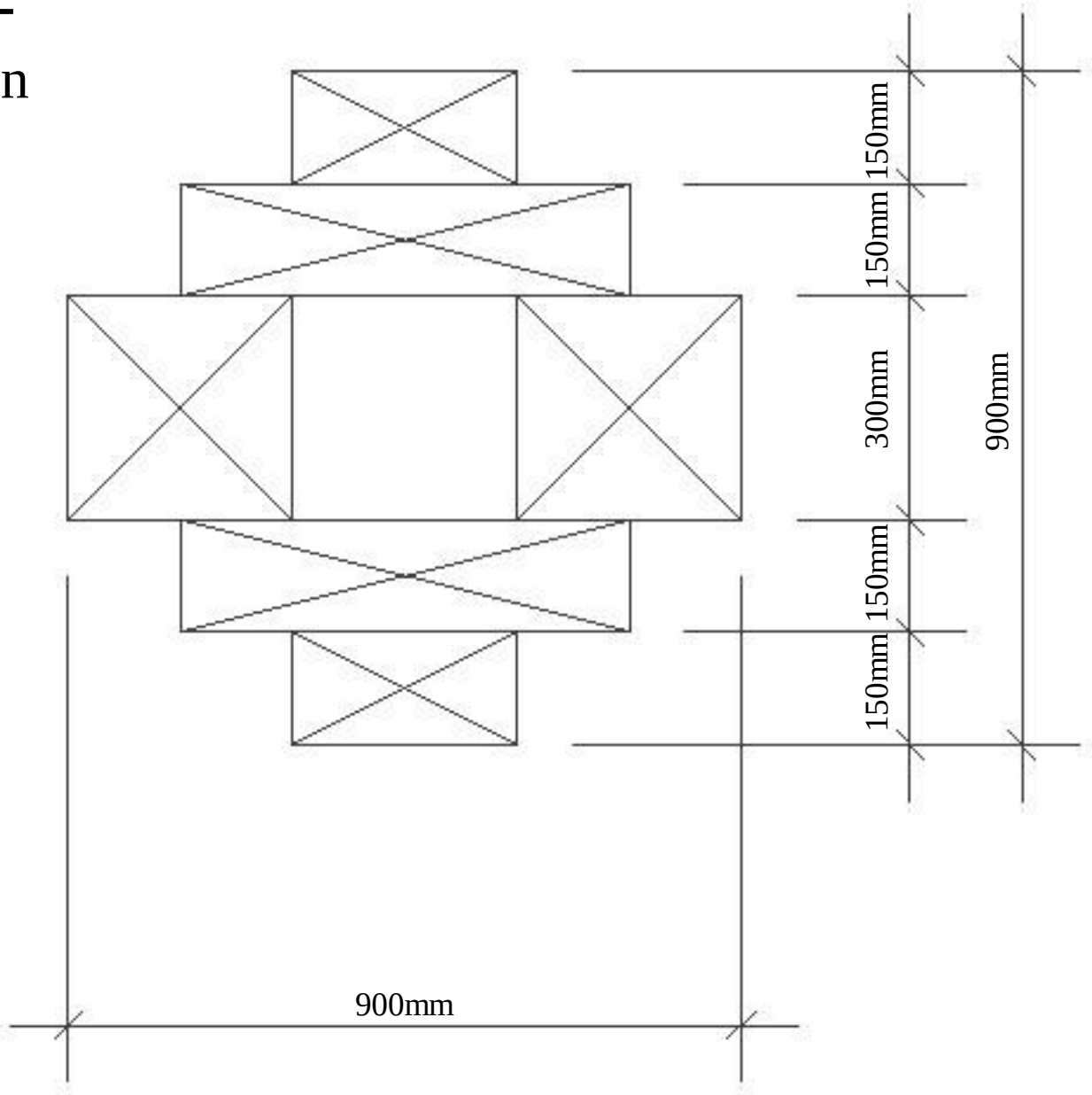
Analysis

- Base isolation to help with seismic loads
- Loose-fitting joinery provides shock absorption
- Wood has inherent flexibility
- Lead returns to original shape
- Rubber helps with flexibility
- Steel provides vertical strength



Analysis

- Main column



Analysis

- Lateral bracing
  - Grid/Net

Analysis

- Connections
  - Bolted
  - Joinery