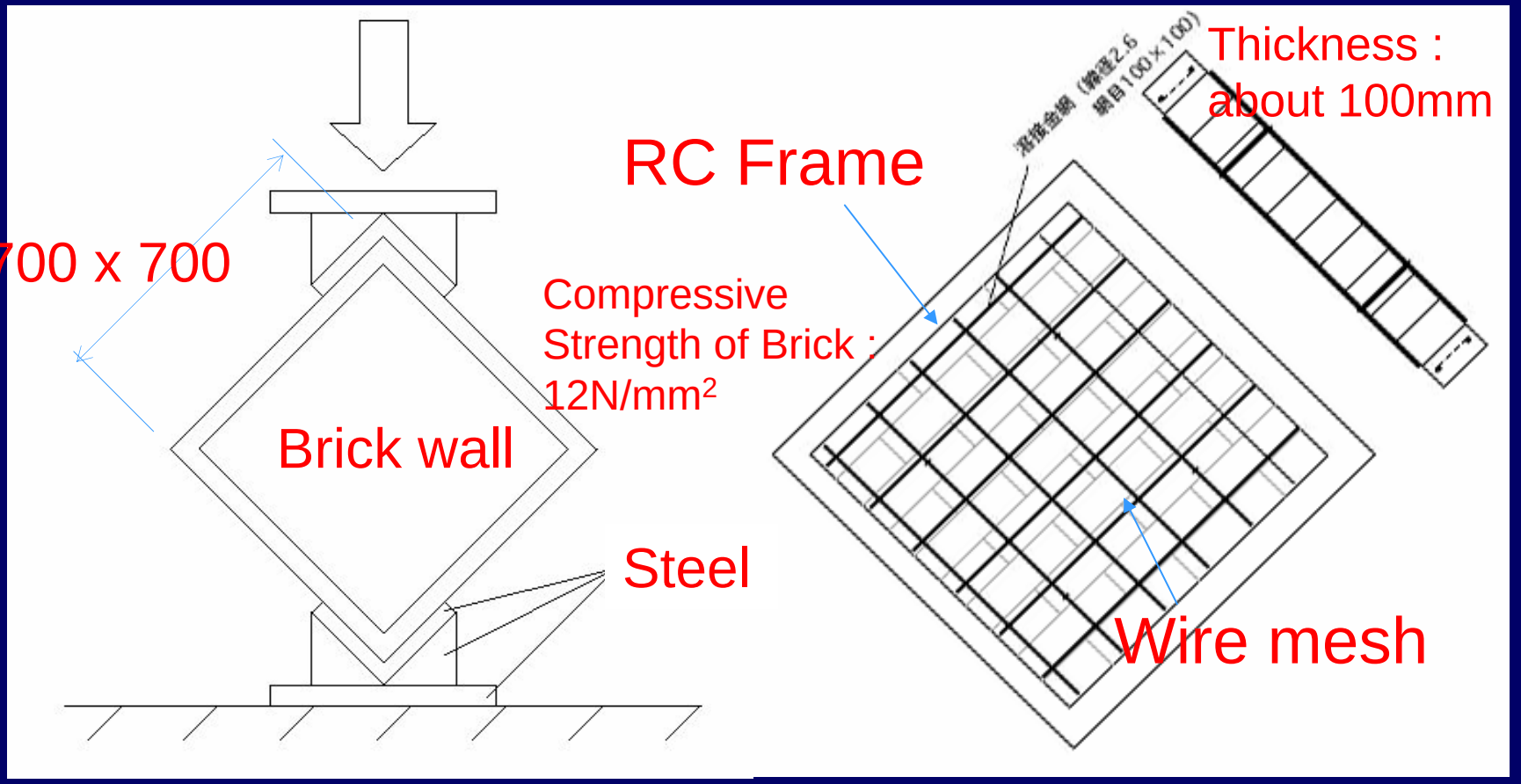
For shaking table tests

(1)Diagonal Compression Tests of Brick Masonry Wall

(2)Introduction of Simplified Evaluation Methods

Toshikazu Hanazato , Mie University

Diagonal compresstion tests of brick walls in Mie University

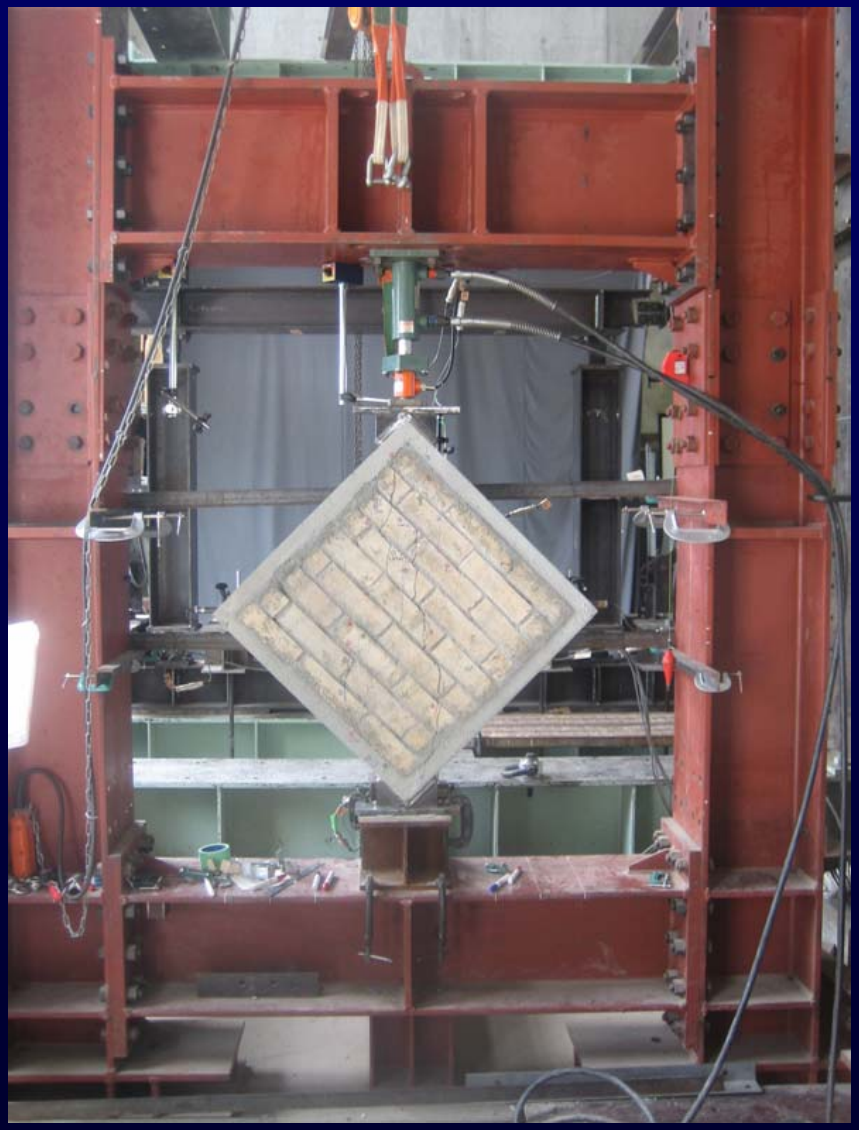


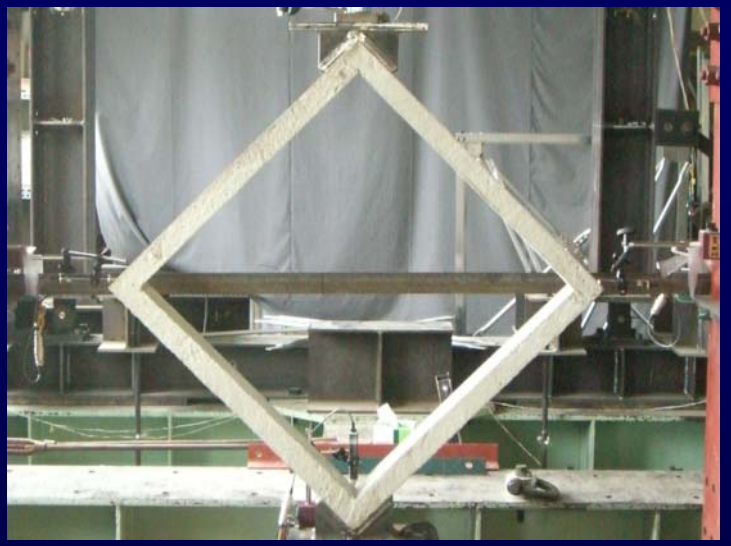
Parametric experimental study to examine effect of strengthening methods on improvement of in-plane behavior of confined brick masonry wall

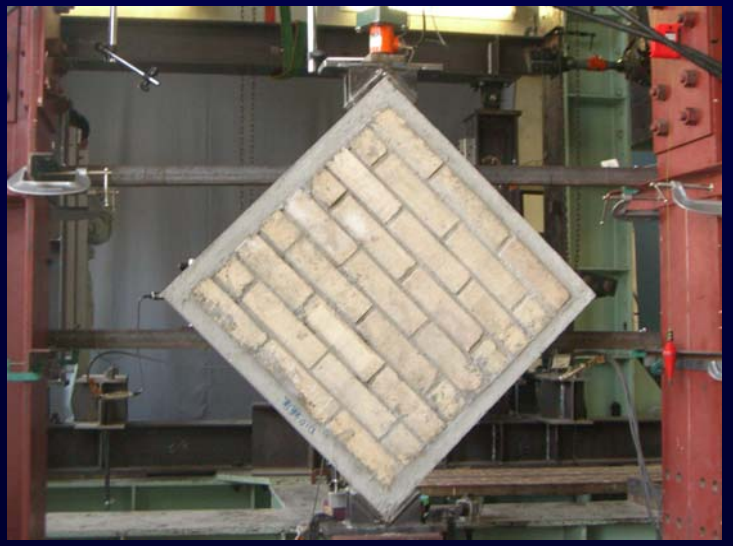
Parameter for the laboratory tests

Strengthening methods		Mortar sand : cement			Note
		1:8	1:6	1:4	
A	Without brick wall		○		Frame only
B	Fine wire mesh		○		
C	Thick wire mesh		○		
D	Rein-bar		○		
E	No-strengthening		○		Weak brick
F	No-strengthening	○F-1	○F-2	○F-3	

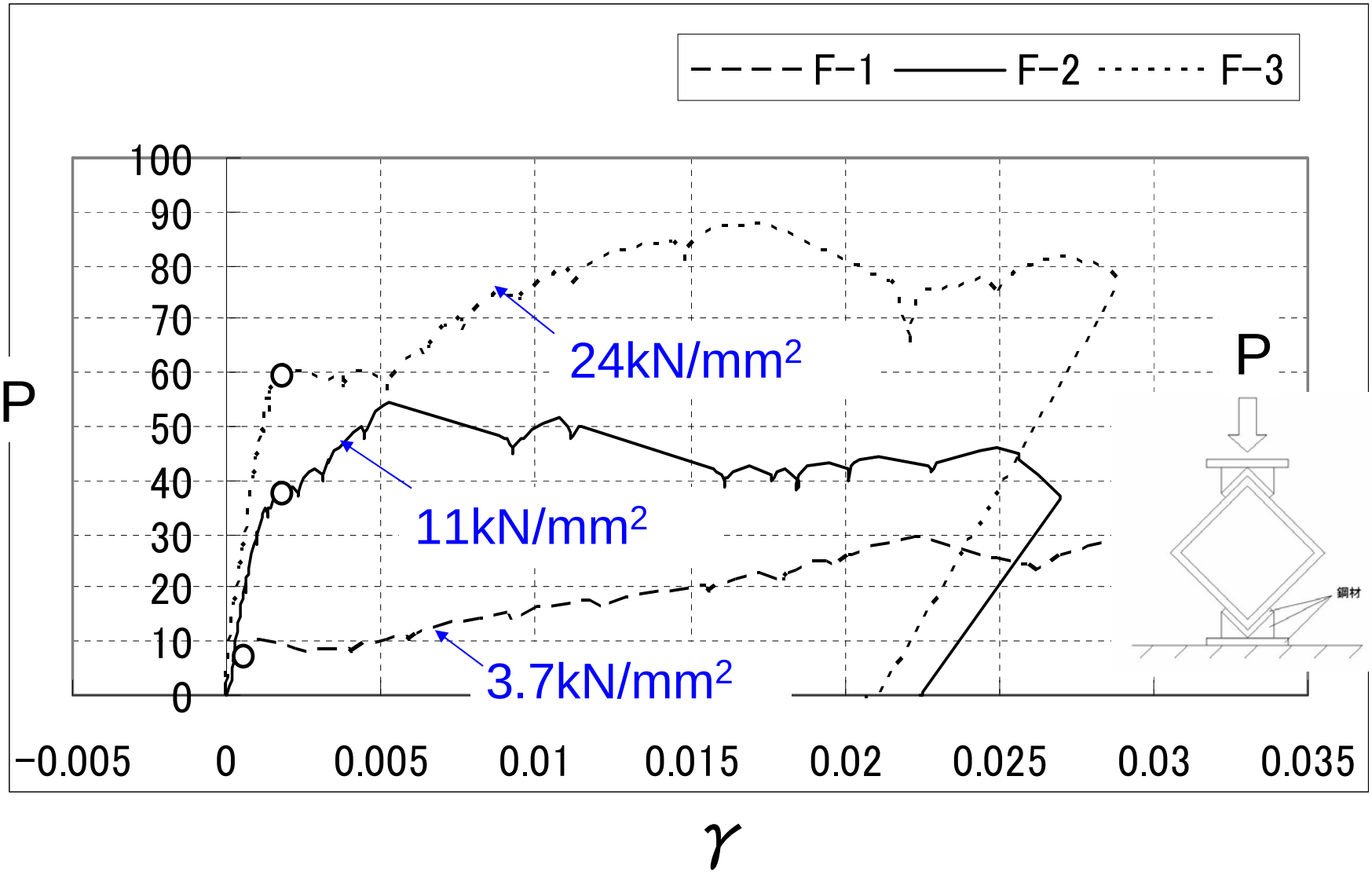
Diagonal compression tests



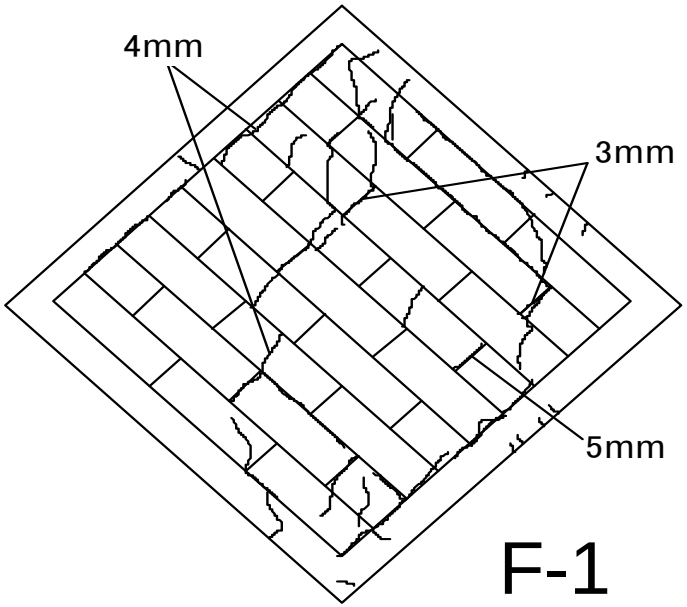




Load-strain relationship affected by mortar joint strength



Cracks at failure of wall



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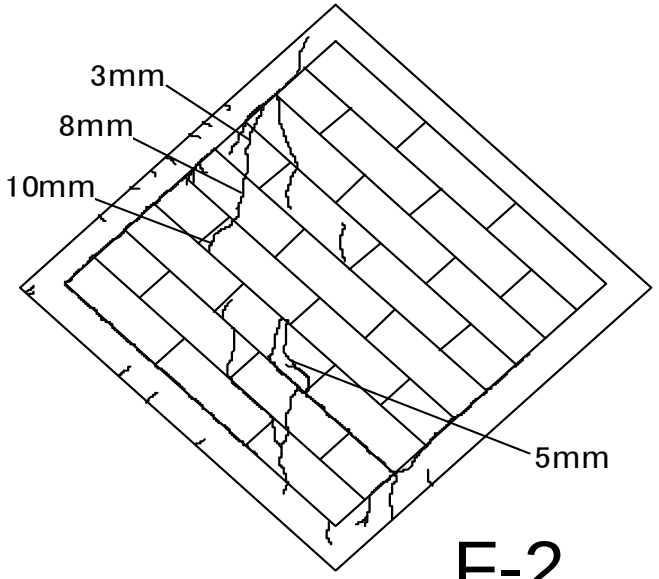

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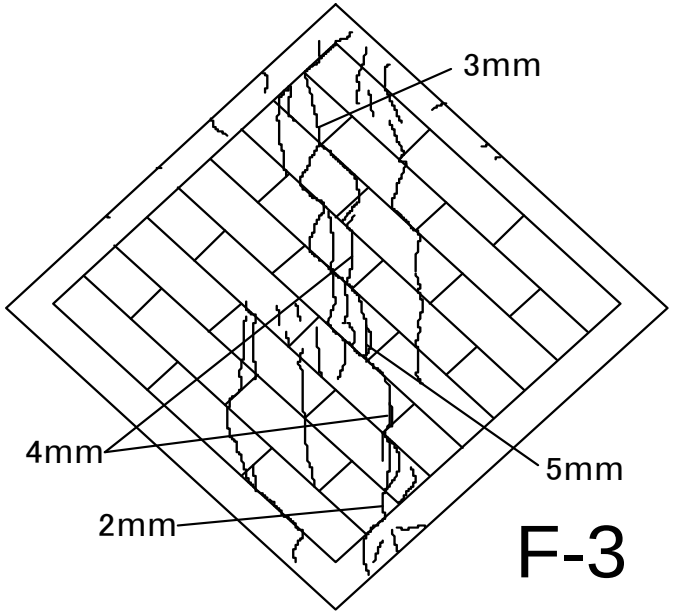

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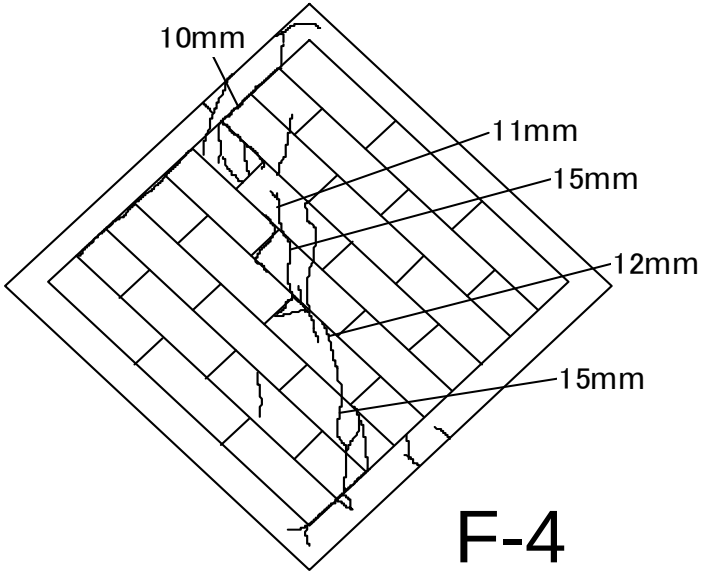

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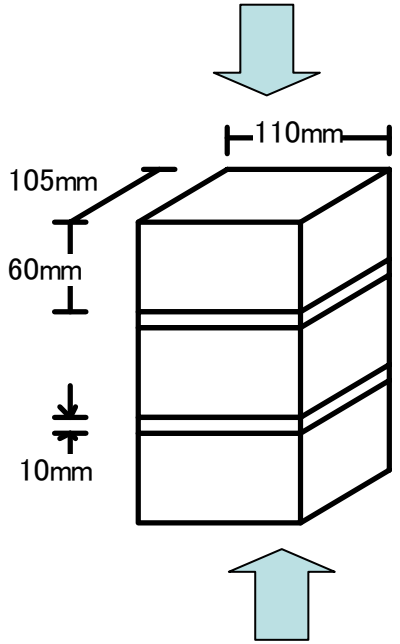
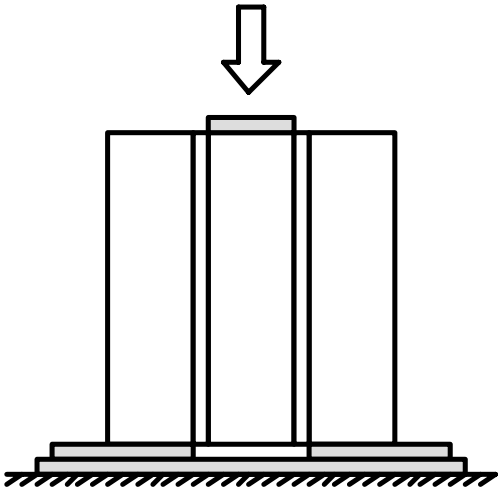
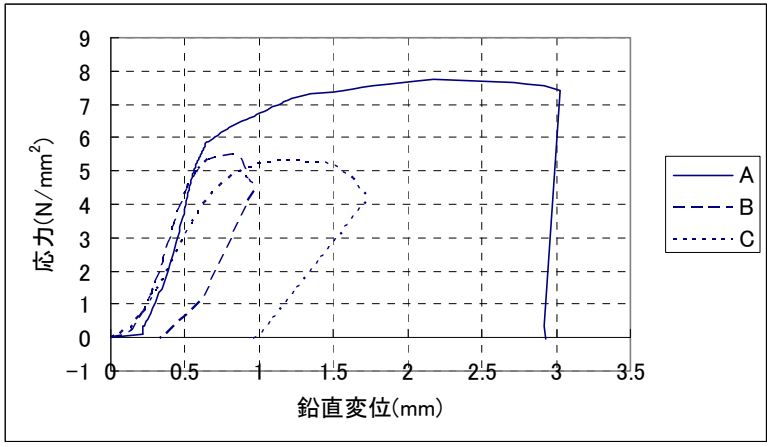




Compression test of prism specimen

Shear test of mortar joint



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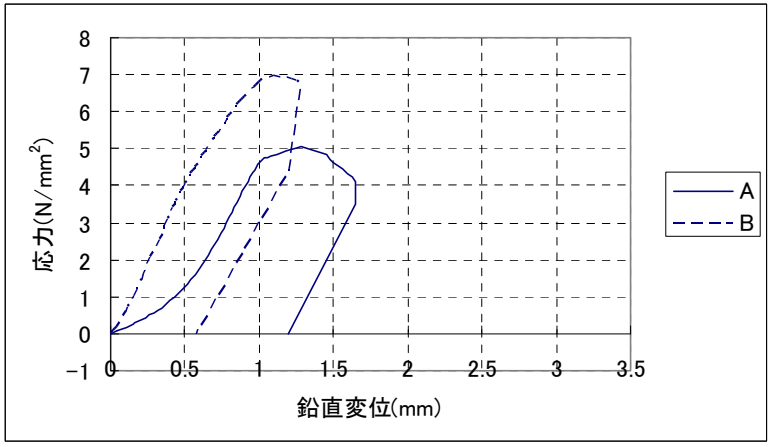

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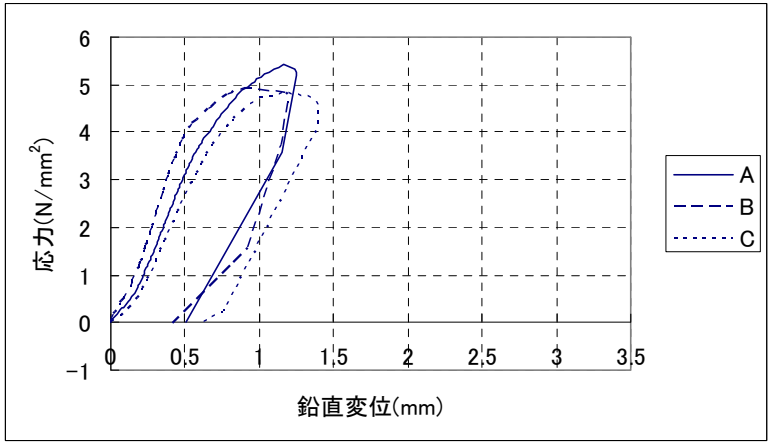


C:S=1:8

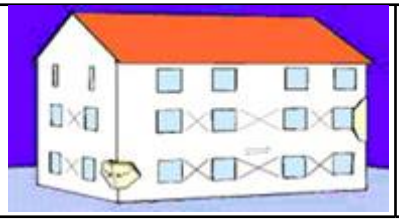
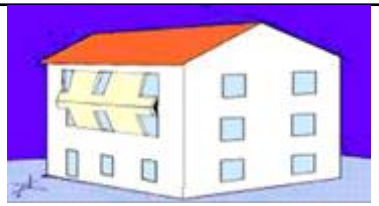
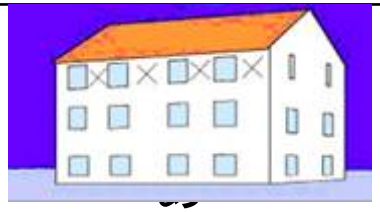
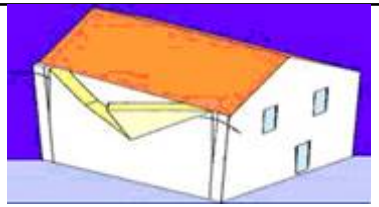
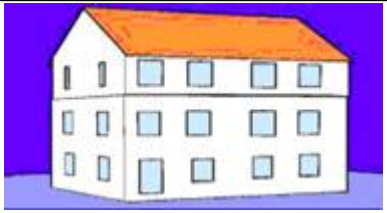
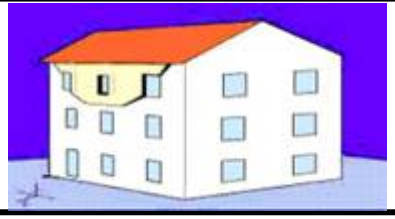
Compression tests of prism specimen

(2)Introduction of Simplified Evaluation Methods

Simplified evaluation methods : applicable for all construction engineers to carry out seismic calculation.

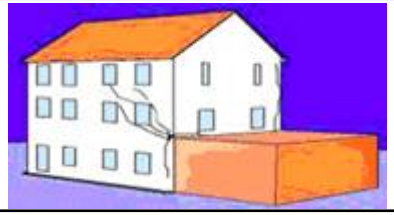
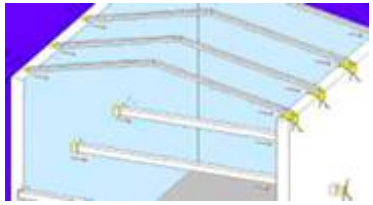
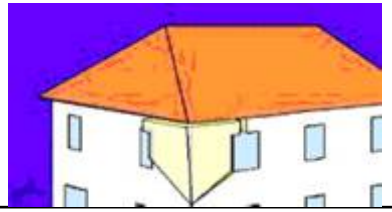
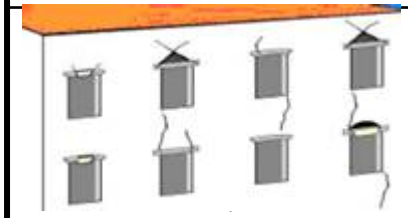
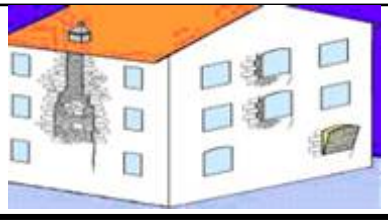
2-steps : 1) wall calculation method
2) Simplified formula to evaluate in-plane and out-of-plane resistance

Failure modes of brick masonry building (1)

Shear failure of wall	Buckling failure of wall
 	 
Shear failure of wall	Bending failure of wall
 	 
Bending failure of wall	Sliding failure
 	 
Partial bending failure of wall	Failure by irregular settlement
 	 

Note: this figure was drawn by Dr. T. Aoki (JCI committee)

Failure modes of brick masonry building (2)

Failure due to collision		Failure at tympanum	
			
Pulling out of beam		**Bending failure at upper part of wall**	
			
Failure at lintel and arch		**Failure at roof**	
			
Material failure			
			

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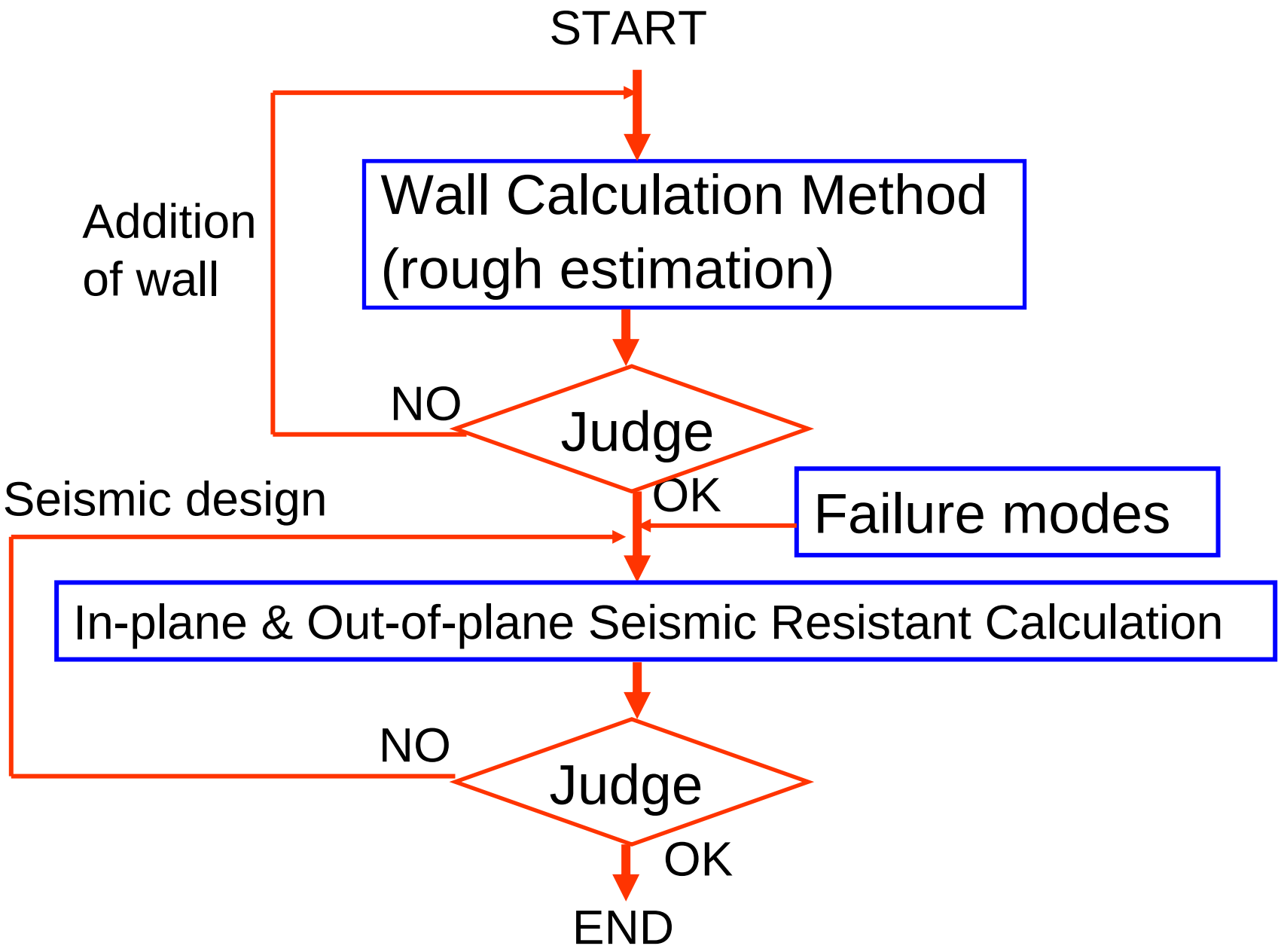


Flowchart of Proposed Simplified Seismic Evaluation

Simplified Estimation Methods Proposed in the past studies

G. Magenes and G. M. Calvi (1997)

In-plane seismic resistance (1)

For mortar joint failure ;

$$V_d = Dt\tau_u \qquad (\tau_u = \min(\tau_{cs}, \tau_{ws}))$$

$$\tau_{cs} = \frac{1.5c + \mu p}{1 + \frac{3c\alpha_v}{p}} \quad : \quad relevant\ to\ the\ cracked\ section$$

$$\tau_{ws} = \frac{c + \mu p}{1 + \alpha_v} \quad : \quad relevant\ to\ the\ whole\ section$$

Simplified Estimation Methods Proposed in the past studies

G. Magenes and G. M. Calvi (1997)

In-plane seismic resistance (2)

For brick failure ;

$$V_{d,b} = Dt\tau_b = Dt\frac{f_{bt}}{2.3(1+\alpha_v)}\sqrt{1+\frac{p}{f_{bt}}}$$

f_{bt} : *strength of brick*

p : *vertical stress*

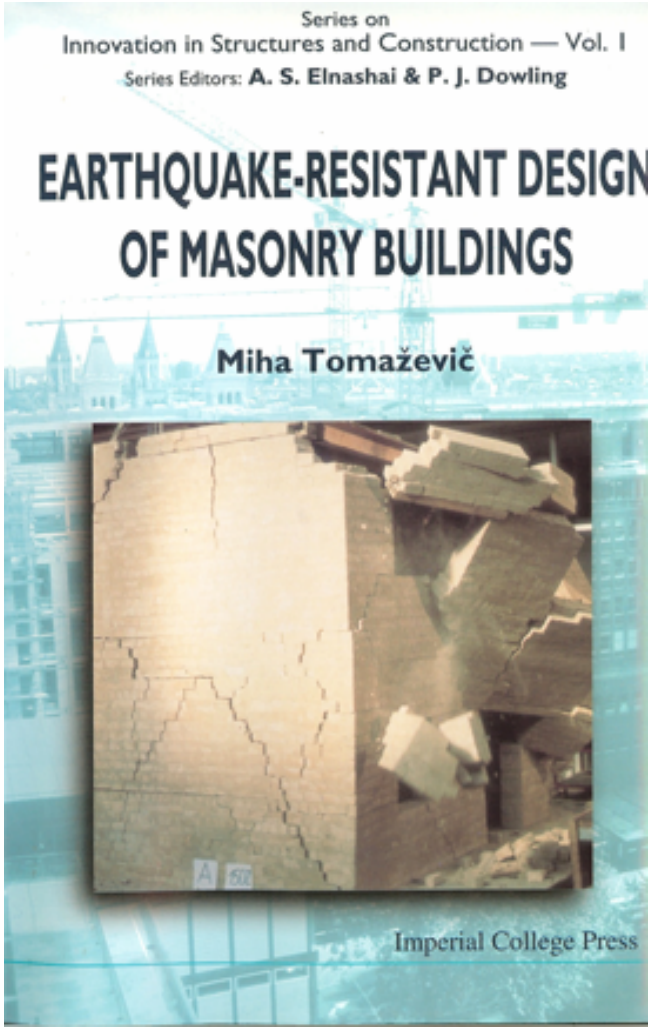
Simplified Estimation Methods Proposed in the past studies

Out-of-plane seismic resistance

EC6 and EC8

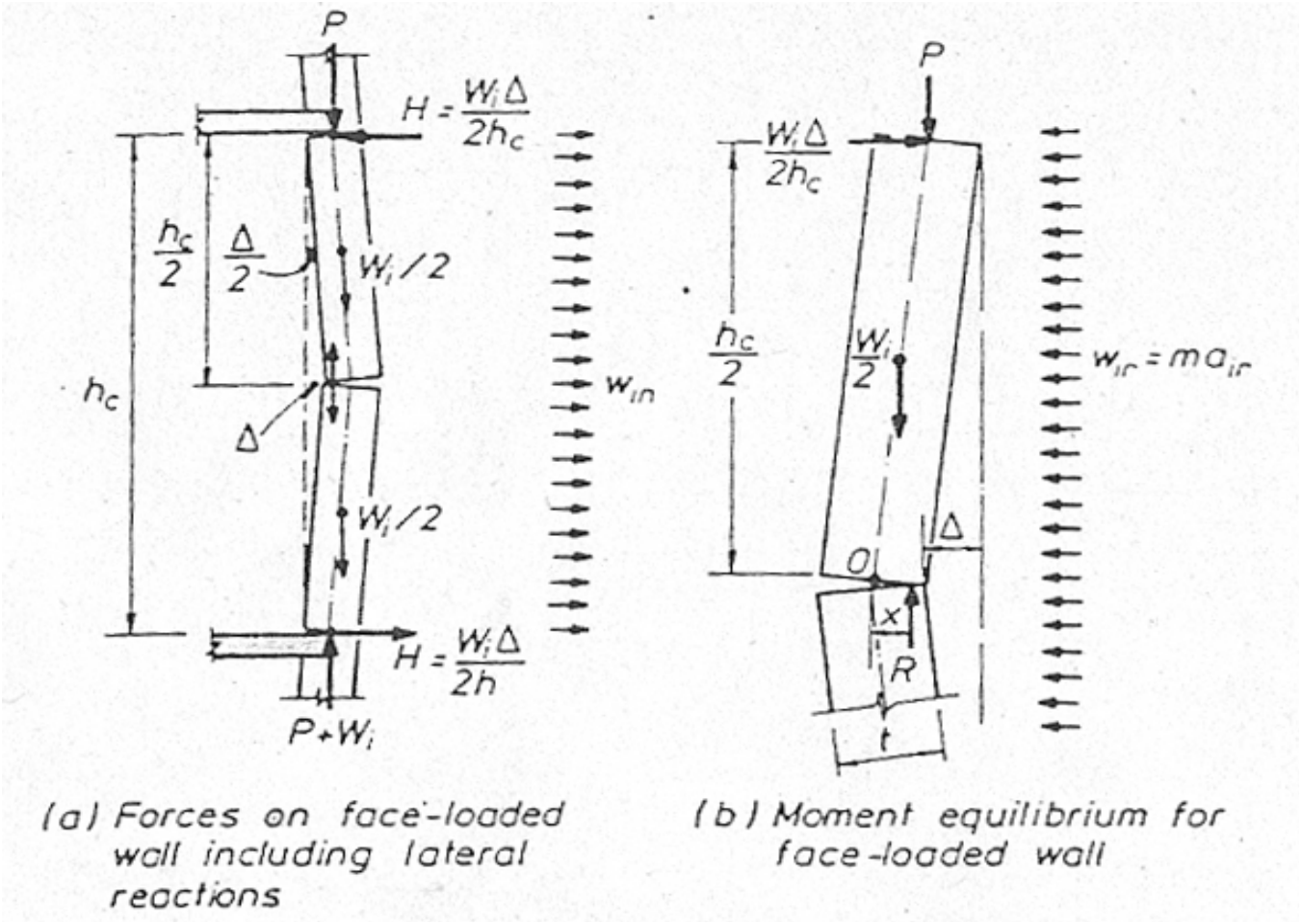
$$F_a = \frac{S_a \cdot W_a \cdot \gamma_a}{q_a}$$

$$S_a = \frac{3\alpha\left(1+\frac{Z}{H}\right)}{1+\left(1-\frac{T_a}{T_1}\right)^2}$$



Simplified Estimation Methods Proposed in the past studies

Out-of-plane seismic resistance



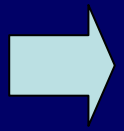
T.Paulay and M.J.N. Priestley (1992)

Prediction analysis and correlation study will be performed in the present project.

Simplified evaluation methods that will be proposed by the participating institutes can also be verified.

To disaster mitigation for developing countries

Non-Engineered Structure



Engineered Structure