Global Connections Day

Countermeasures for Large Earthquakes Taken in Japan and Promotion of Seismic Buildings by Industry/Academia/Government Partnership

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Japan Conference of Building Administration

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1. Large Earthquakes Recently Occurred in Japan

1. Large Earthquakes Recently Hit Japan

1995: Hashin/Awaji Earthquake

Date/Time:	March 11th. 2011 at 14:46
Magnitude:	9.0
Human Damage:	21,839 persons dead or missing
Building Damage:	127,830 buildings totally collapsed
Remarks:	Most casualties were crushed by building collapses or falling furniture

Photos by Kobe City Office

1. Large Earthquakes Recently Hit Japan

2011: East-Japan Large Earthquake

Date/Time: January 17th, 1995 at 05:46
Magnitude: 7．3
Human Damage: 6,437 persons dead or missing
Building Damage: 104,906 buildings totally collapsed
Remarks: Tsunami damage was much serious than damage by building collapse.

Photos by Sato

1. Large Earthquakes Recently Hit Japan

2011: East-Japan Large Earthquake

Disaster Reduction→Seismic shelters became popular

From website of Ichijo Komuen Co.

1. Large Earthquakes Recently Hit Japan

2016: Kumamoto Earthquake

Date/Time:	April 14th. 2016 at 21:26
Magnitude:	6.5
Human Damage:	50 persons dead
Building Damage:	8,673 buildings totally collapsed
Remarks:	M=7.0 after-quake occurred at 01:25 on 16th, 28hrs after the first quake.

From KIROKUMA website

From KIROKUMA website

1. Large Earthquakes Recently Hit Jap

愛知県 Aichi Prefectural Government

2018: Osaka Earthquake

Date/Time:	Junel 18th. 2016 at 07:58
Magnitude:	6.1
Human Damage:	5 persons dead
Building Damage:	12 buildings totally collapsed
Remarks:	An illegal block wall collapsed and incurred a casualty

By Fire Defence Agency

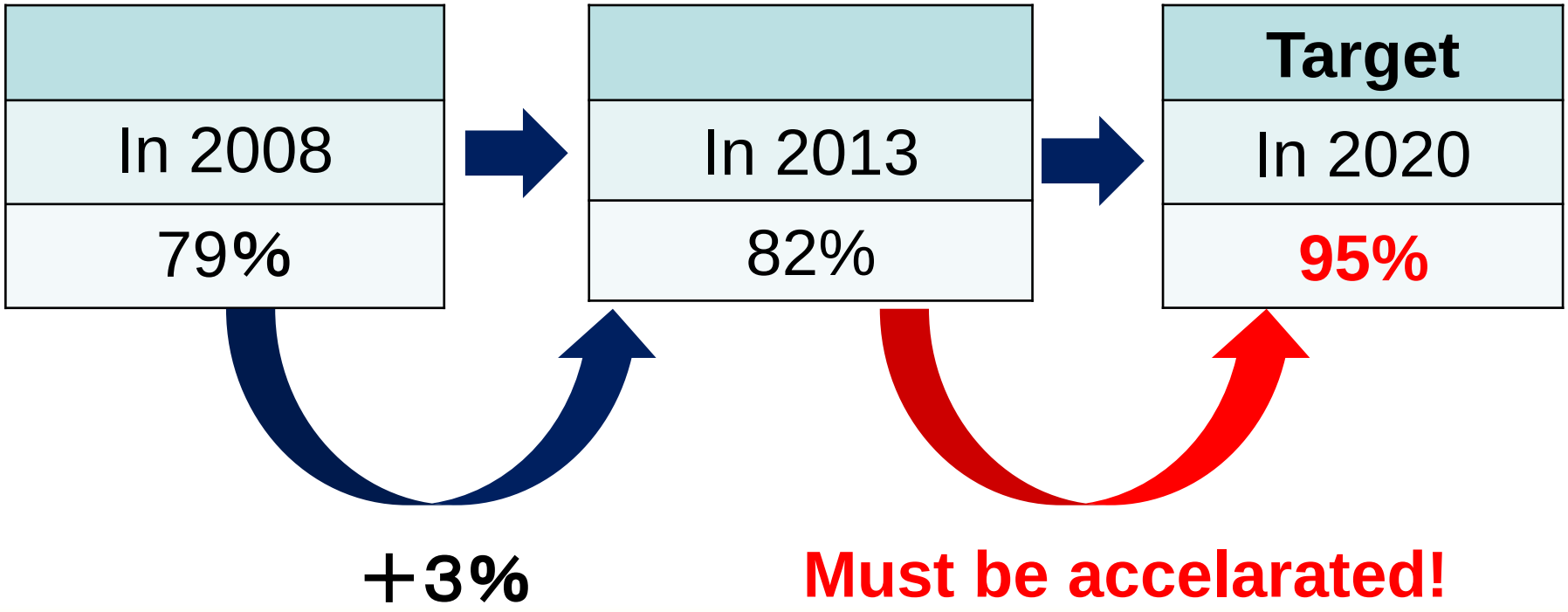
From Google

From

2. Measures to Facilitate Seicmic Building Construction

2. Measures to Facilitate Seismic Building Construction

Target of seismic building ratio of residential use



2. Measures to Facilitate Seismic Building Construction

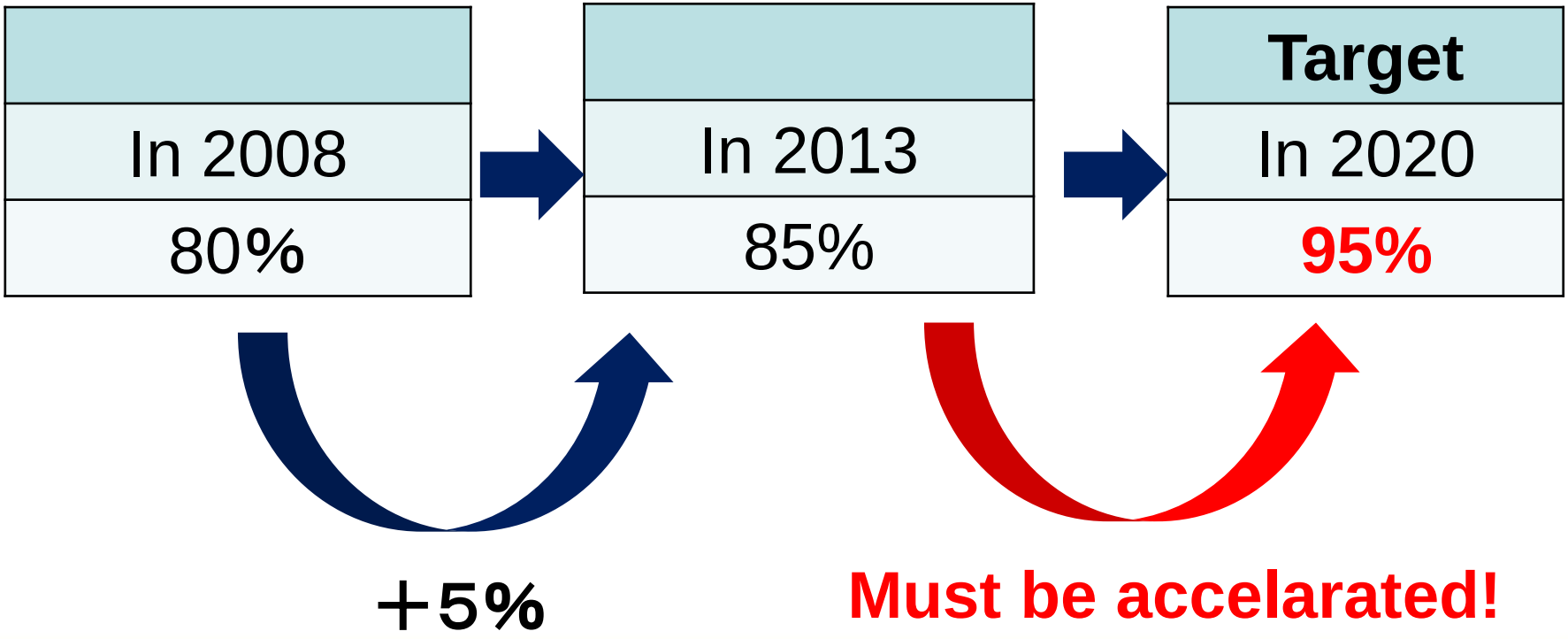
Increasing subsidy cooperatively by national, prefectural and city governments

	Subsidy (～2017)
Nation	23% of total cost for seismic retrofit
Pref.	Max: ¥900,000
City	Max: ¥900,000 50% of total cost etc.

Subsidy (2018～)
80% of total cost for seismic retrofit (max. ¥1,000,000)
Max: ¥1,000,000
Max: ¥1,000,000 80% of total cost etc.

2. Measures to Facilitate Seismic Building Construction

Target of seismic building ratio of large buildings*



*Large buildings: Buildings having floor areas exceeding a certain stanard where a number of unspecified people assemble e.g., school, hospital, department store, etc.

2. Measures to Facilitate Seismic Building Construction

Ammendment of “Act on Promotion of Seismic Retrofitting of Buildings (enacted Nov. 5th, 2013)

Tightening regulations for seismic retrofits diffusion

Mandatory requirements for seismic dianosis and publicizing the result

1) Large buildings: Buildings having floor areas exceeding a certain stanard where a number of unspecified people assemble e.g., school, hospital, department store, etc.

2) Buildings along roads for emergency use which are spcified by local governments

3) Buildings to be used for disaster prevention and evacuation base specified by prefectural governments

2. Measures to Facilitate Seismic Building Construction

1) Large Buildings

Results of the seismic diagnoses was reported by 2015.

Risk level of building collapse under a large earthquake	Number of collapsed buildings (%)
I High	Approx. 1,000 (9%)
II Middle	Approx. 700 (7%)
III Low	Approx. 8,800 (83%)
Not reported	Approx. 100 (1%)
TOTAL	10,600

2. Measures to Facilitate Seismic Building Construction

2) Buildings along roads for emergency use

Local governments specified emergency roads	Local governments publicized the seismic diagnoses results
15 prefs., 61 cities	Tokyo and Osaka prefecs., 3 cities

3) Buildings to be used for disaster prevention/evacuation base

Local governments specified emergency use buildings	Local governments publicized the seismic diagnoses results
29 prefs.	15 prefs.

2. Measures to Facilitate Seismic Building Construction

Ammendment of “Act on Promotion of Seismic Retrofitting of Buildings (enacted Nov. 5th, 2013)

Ammendment for stremlining seismic retrofits

1. Revision of “Certification of building seismic retrofit plans”

○Expand a scope of applicable buildings for the certification and provide incentives for floor area ratio and building coverage to the certified plans.

2. Loosening a requirement for seismic retrofit for condominiums

○Required number of votes of sectorial oweners to resolve execution of seismic retrofit was changed from ¾ or more to ½ or more.

3. Starting labelling system to show seismic property

○ The label is to show that the building is certified to have a reliable level of seismic peoperty.

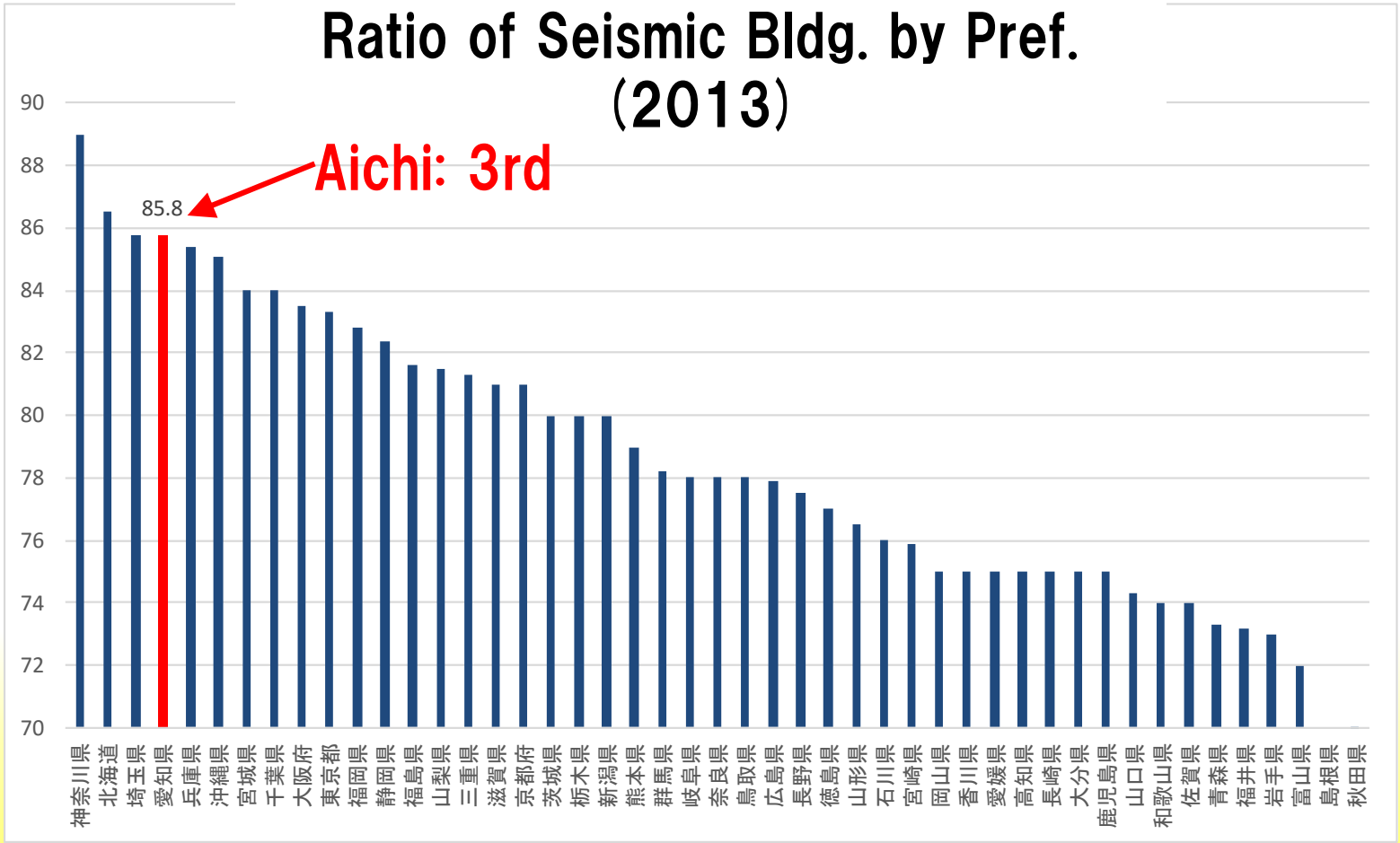
3. A Seismic Promotion Activity by Industry, Academia and Government Partnerhsip

3. Ind./Acad./Govt. Partnership for Seismic Promotion

Current Situation of Seismic Buildings in Aichi

Residential

＜Average＞
82%



3. Ind./Acad./Govt." Partnership for Seismic Promotion

Seismic Retrofit Promotion Plan (2012)

TARGET

95% of houses to be seismic resistant by 2020

Ratio of Seismic Houses

2003 78% → 2013 85%

7%up!!

10%up required →

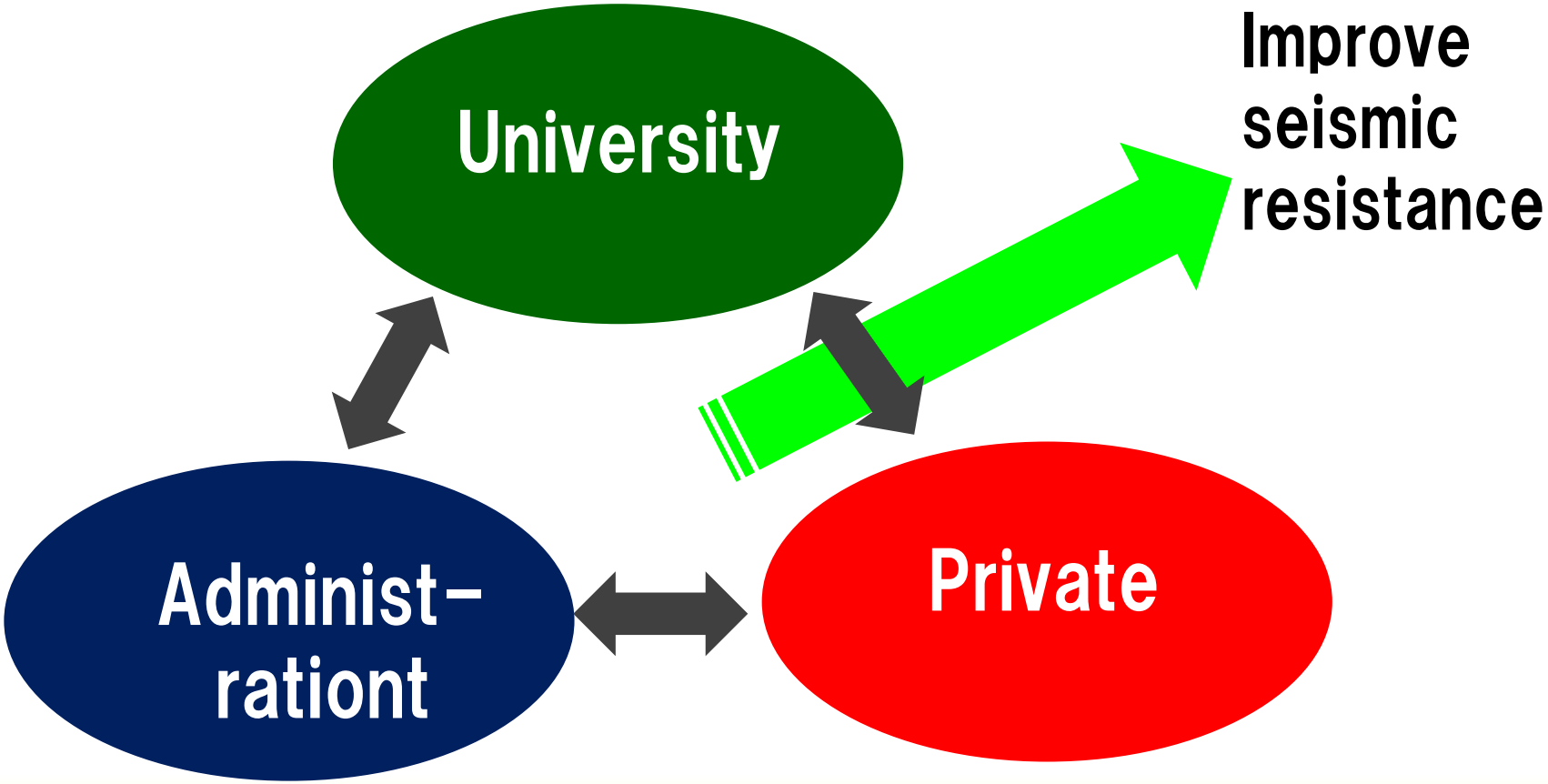
2020

95%

We must speed up the execution of seismic retrofit!

3. Ind./Acad./Govt. Partnership for Seismic Promotion

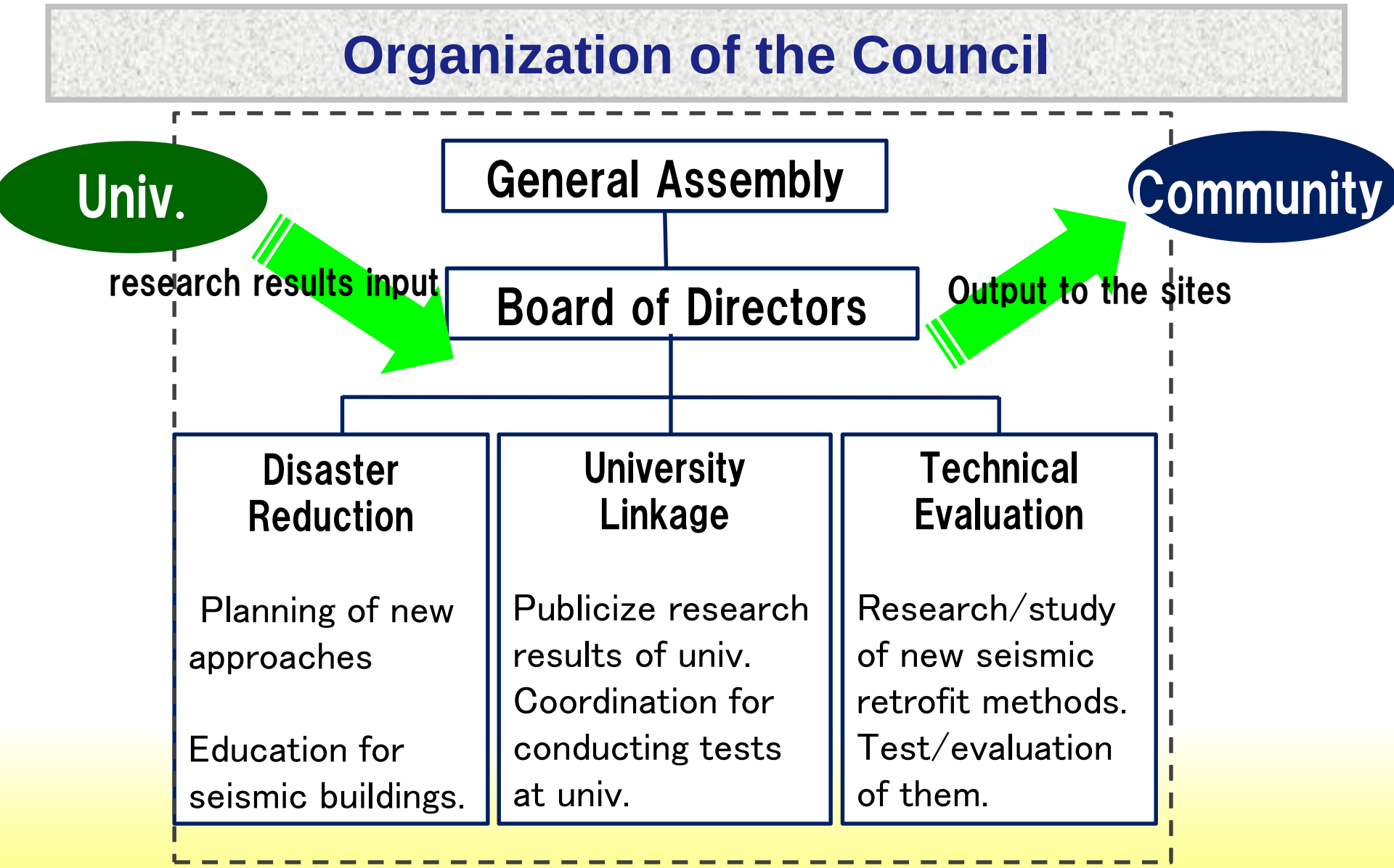
"Aichi Research Council for System Mitigating Earthquake Damage on Buildings"



Members:

Universities, Industry Assoc., Private Companies, Government

3. Ind./Acad./Govt. Partnership for Seismic Promotion

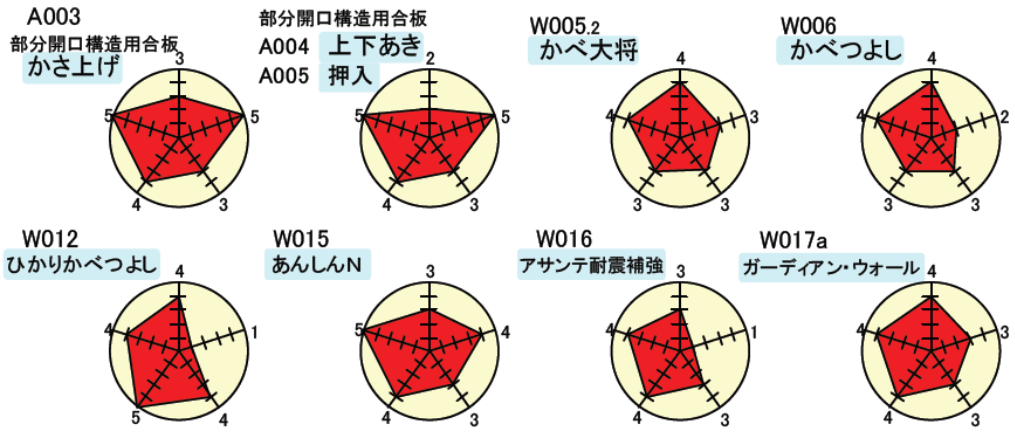


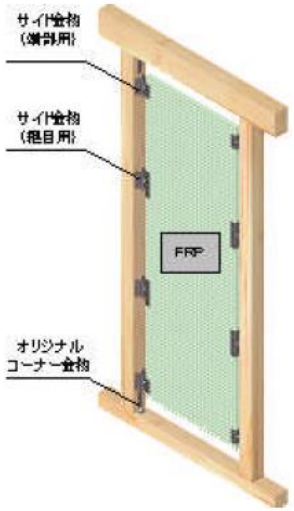
3. Ind./Acad./Govt. Partnship for Seismic Promotion

① Cost-Effective Retrofit Method – Tech. Develop.

- 93 techniques have been newly evaluated.
  （49 developed by Council, 44 developed by companies）

- Comprehensive evaluation on:
seismic strength, cost, workability, finishing, etc.

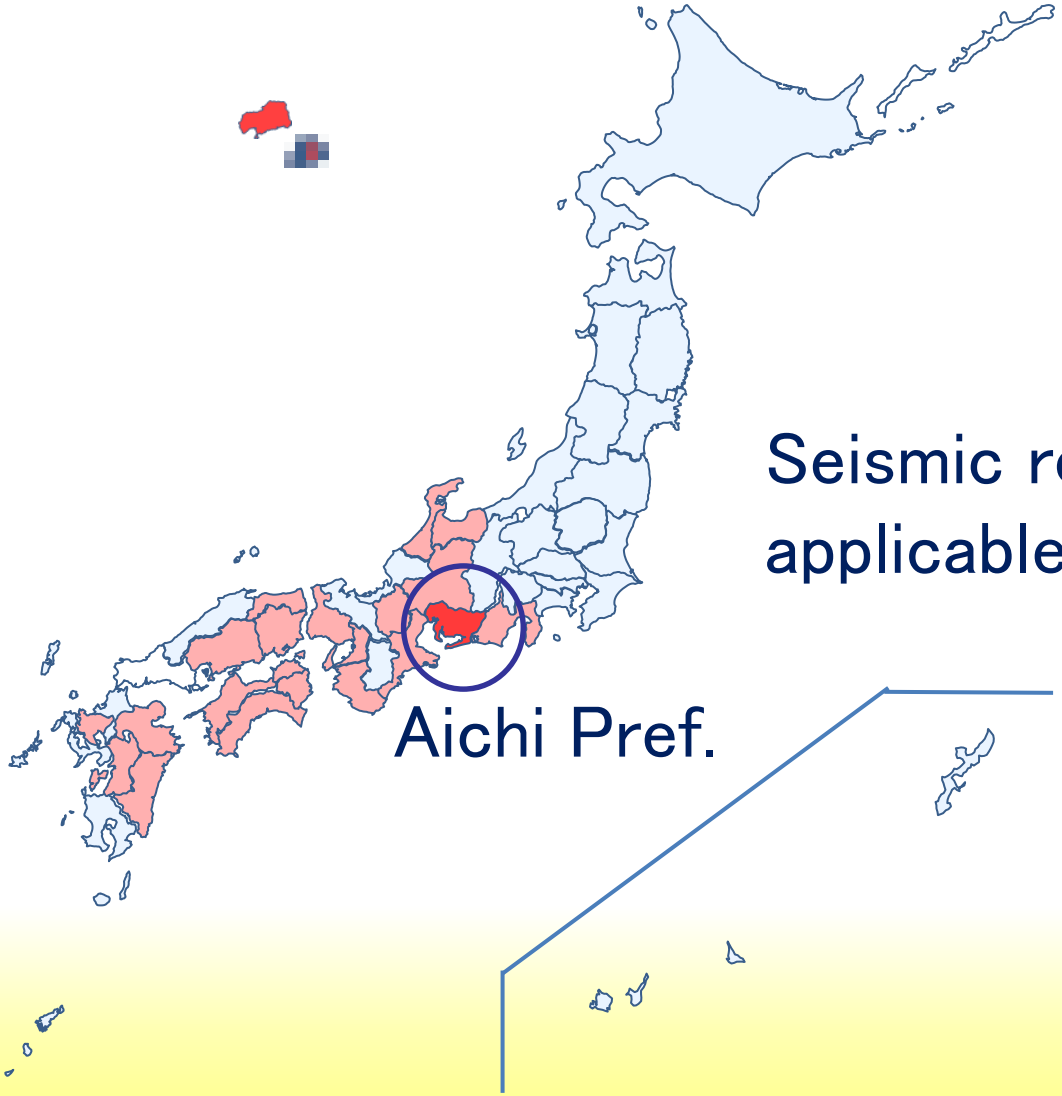




- Encourage and conducts tests of simple structures using plywoods to achieve cost reduction

3. Ind./Acad./Govt. Partnership for Seismic Promotion

① Cost-Effective Retrofit Method – Tech. Develop.



Seismic retrofit subsidy is applicable for 21 prefectures.

3. Ind./Acad./Govt. Partnership for Seismic Promotion

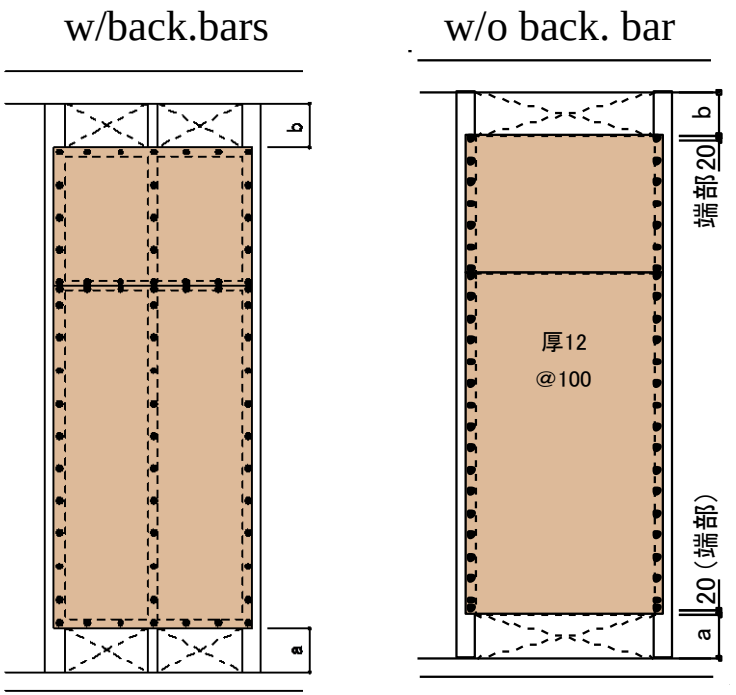
① Cost-Effective Retrofit Method – Tech. Develop.

Eg. 1 Developed by Council ①

Wall reinforced by structural plywood

●Plywood is not connected to the beam nor the groundsill.

●Fix crossbars at the flooring and celling heights and to intall stuctural plywoods between them.



w/back.bars	w/o back. bar
N50@<150	N50@<100
On 4 sides	On 2 sides
Thick: 9mm<	Thck; 12mm<

Wall Ratio: w/backing bars	4.16	kN/m
w/o backing bar	3.64	kN/m

3. Ind./Acad./Govt. Partnership for Seismic Promotion

① Cost-Effective Retrofit Method – Tech. Develop.

Eg. 2 Developed by Council ②

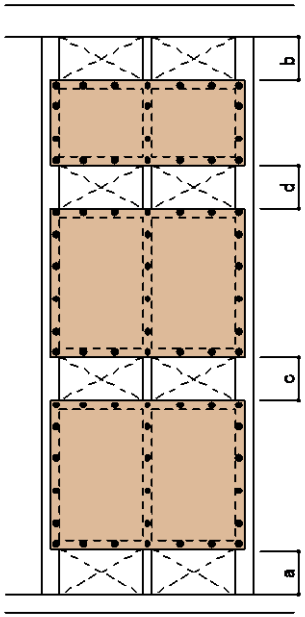
Wall reinforced by structural plywood in closet

●Fix crossbars inside the closet at flooring, celling, middle and top shelves heights and install structural plywoods to fill the spaces between the bars.

●Possible to complete reinforcement work without damaging the flooring, ceiling and middle/top shelves.

Wall Ratio:	w/backing bars	3.12	kN/m
	w/o backing bar	1.82	kN/m

w/back. bars

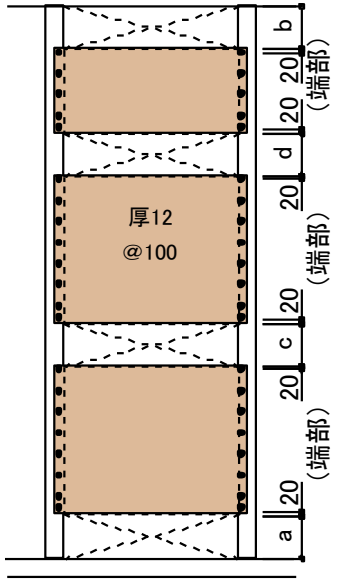


N50@<150

On 4 sides

Thick: 9mm<

w/o back. bar



N50@<100

On 2 sides

Thick: 12mm<

3. Ind./Acad./Govt. Partnership for Seismic Promotion

① Cost-Effective Retrofit Method – Tech. Develop.

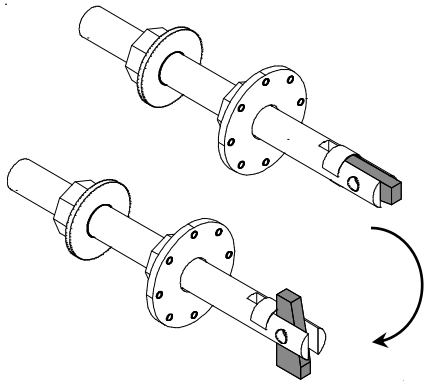
Eg. 3 Developed by Company ①
"I-One"

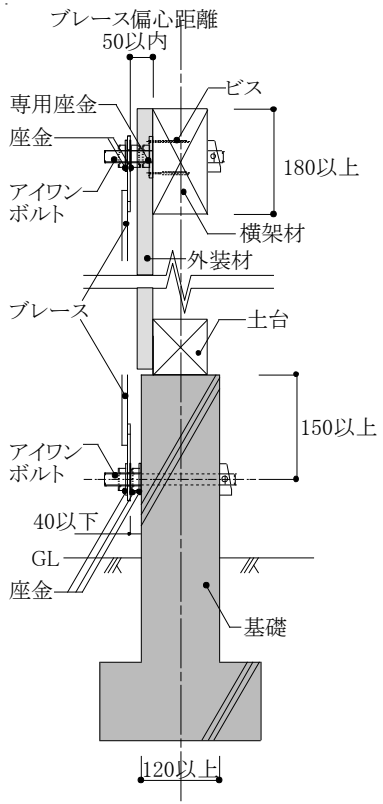
●Fit one-side bolts from outside of the beam and the foundation, and fix braces to them.

●The work does not give any affects to the residents living spaces and exterior materials.

●Can be applied to windows as it can secure lighting.

＜I-one bolt＞



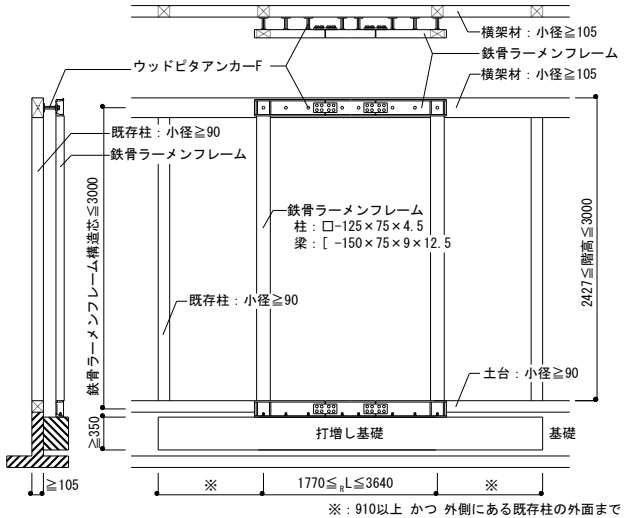


Wall Ratio: 4.1 kN/m

3. Ind./Acad./Govt. Partnership for Seismic Promotion

① Cost-Effective Retrofit Method – Tech. Develop.

Eg. 4 Developed by Company ②
“Wood-Pita Frame”



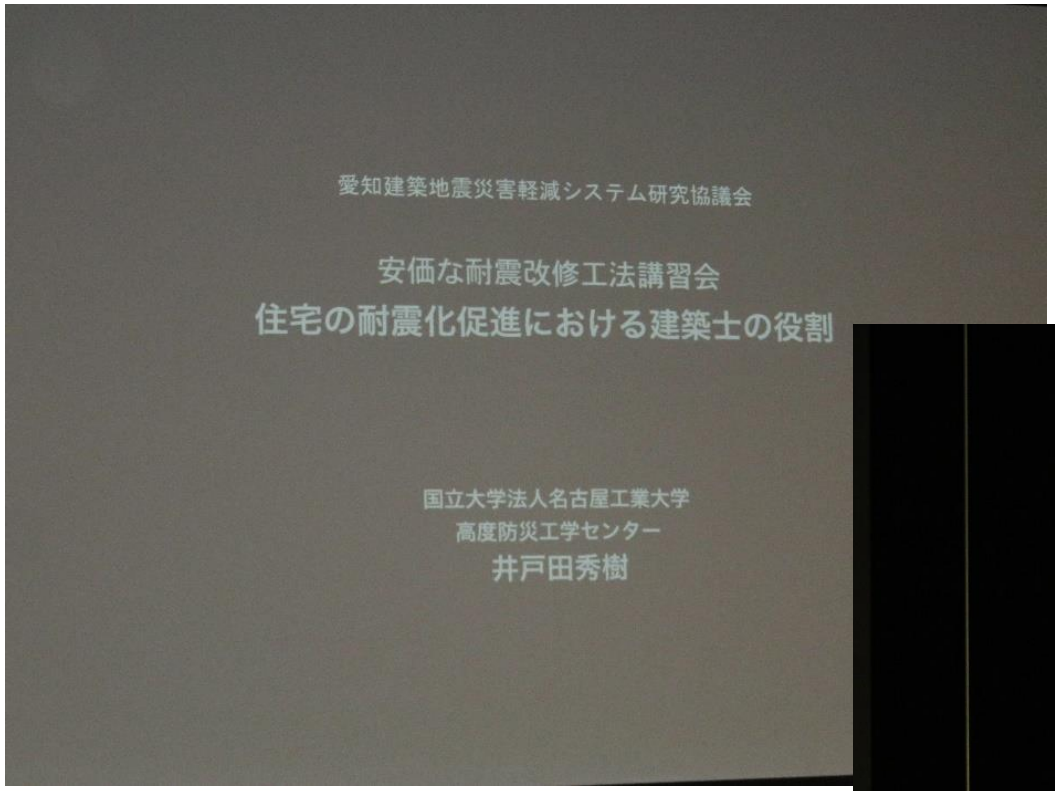
- The upper part of the steel rigid frame is connected to the building by specially developed metal fixtures, and the bottoms, to the additional foundation by anchor bolts.
- Short construction term→cost reduction
- Able to be installed on windows/doors.

Wall Ratio: **5.5** kN/unit

3. Ind./Acad./Govt. Partnership for Seismic Promotion

② Cost-Effective Retrofit Method – Education/Diffusion

Architects/Engineers, Carpenters, Contractors



3. Ind./Acad./Govt. Partnership for Seismic Promotion

③Course for Seismic Building Advisor - Education

Train seismic bldg. advisors who work locally – 625P registered

Roles of seismic building advisors

①Promote necessity of seismic diagnoses/retrofits in the community.

②Consultation to the people in communities about fixing furniture and seismic buildings.

③ Provide technical advices at local disaster prevention activities.

3. Ind./Acad./Govt. Partnership for Seismic Promotion

④Community-based Activities to Suport Seismic Bldg.

Visit individual houses to raise awarenes of the residents

3. Ind./Acad./Govt. Partnership for Seismic Promotion

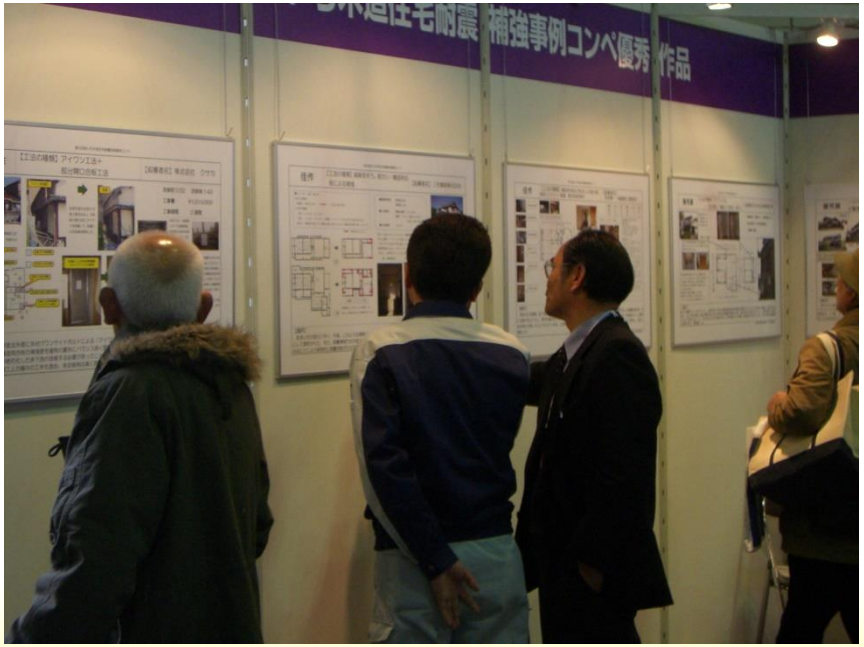
⑤Despatch Lecturers

Sending the Council members from universities to regional courses as instructors and lecturers.

3. Ind./Acad./Govt. Partnership for Seismic Promotion

⑦Competition of Seismic Retrofit Projects

Unique, effective and attractive seismic retrofit projects are collected which are widely known to the public.



3. Ind./Acad./Govt. Partnership for Seismic Promotion

Lastly…..

Creation of a cross sectorial partnership among industry, academia and government sectors is most important to enhance buildings seismic property and to reduce the building damage, based on the mutual respect and understanding of the mission of each sector.