WCDR in Kobe Jan.18-22, 2005

Cluster 4 Reducing the underlying risk factor

Cluster 4.6 Policies for Safer Buildings / Houses

Keynote Speech

Improvement of Seismic Safety of Buildings and Houses

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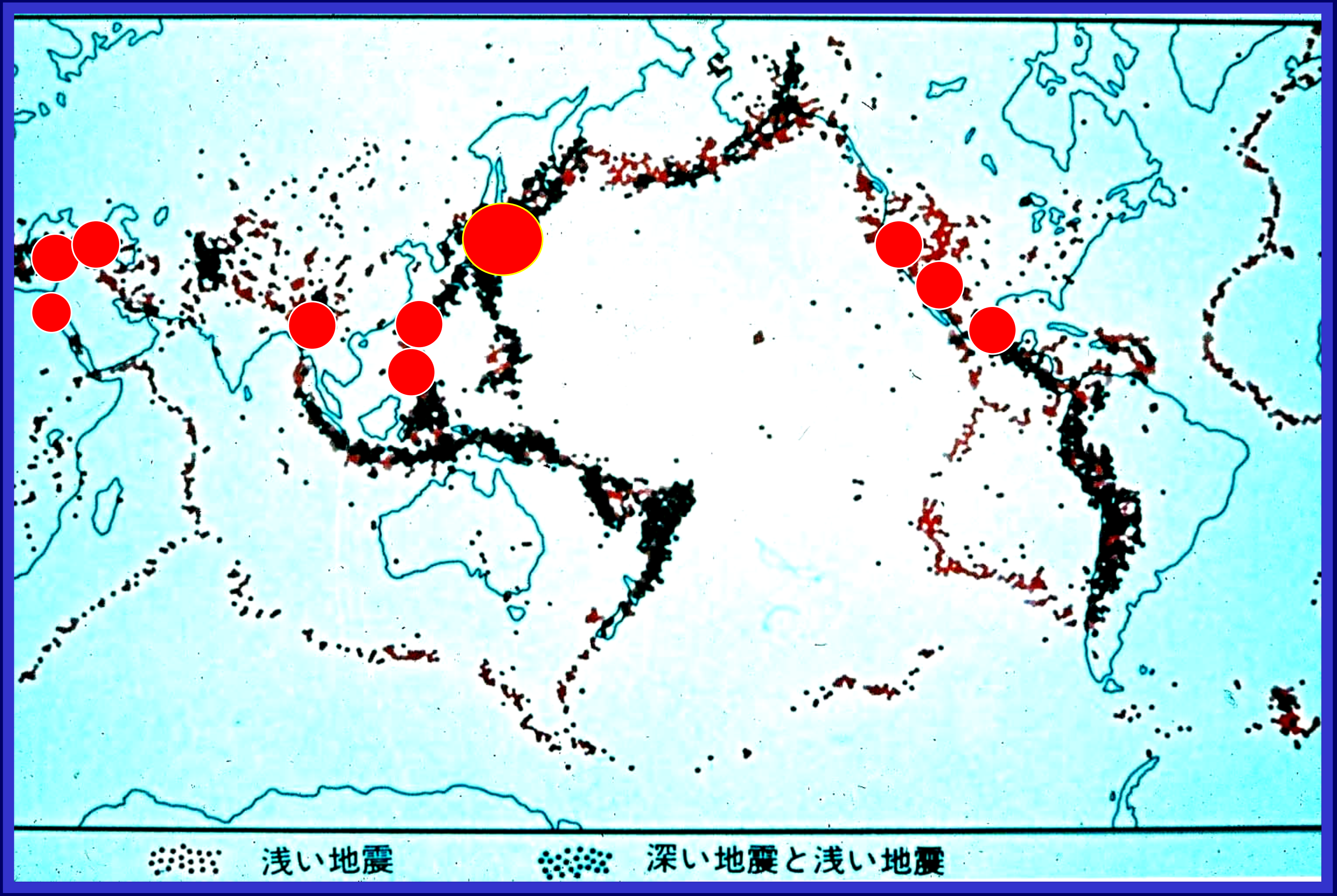
President of Japan Building Disaster Prevention Association

Distribution of Epicenters



TOKYO in 2005

KASUMIGASEKI bldg.
First High-rise in Japan

KOBE in １９９５ (Great Hanshin/Awaji Earthquake Disaster)

1999／11
Düzçe Earthquake

History of Earthquake Damage and Seismic Design & Seismic Evaluation in Japan

Structural Damage in Non-Engineered Buildings and/or
in Non-Earthquake Engineered buildings

First Age : Adoption of Seismic Design Codes
(1924)

Structural Damage in Insufficiently Engineered Buildings

(1971) Minor Revision of the seismic Design Codes
(1977) Promotion of Seismic Evaluation and
Strengthening of Existing Buildings

Second Age: Revision of the seismic Design Codes
(1981)

Functional Damage in Engineered Buildings

Third Age : Adoption of Performance-based Engineering
into Seismic Design Codes
(2000 -) for High-rise buildings, since 1960’s

Controlled Damage in Highly Engineered Buildings

Summary on Building Damage due to Kobe Earthquake

1. Buildings constructed after 1981 took less damage than those constructed before.
2. Seismic performances have been improved according to construction years.
3. If seismic evaluations and/or retrofits had been done, the damage would have been reduced much.

Damage Statistics of Buildings

−1995 Hyogo-ken Nambu Earthquake−

Total	Collapse or Severe	Moderate	Minor or Less	
1～2 Storied (wooden)	46,022 (9.4%)	42,208 (8.6%)	401,046 (82.0%)	489,276 (100%)
3 storied or more	3,081 (6.4%)	3,273 (6.7%)	42,165 (86.9%)	48,519 (100%)

Ministry of Construction 1995

Damage Statistics of Reinforced Concrete School Buildings

	Pre-1971	1971-1981	Post-1981	Total
Collapse	18 (5%)	2 (1%)	0	20 (3%)
Severe	24 (7%)	9 (5%)	0	33 (5%)
Moderate	90 (27%)	39 (24%)	11 (8%)	40 (22%)
Minor	41 (12%)	21 (13%)	7 (5%)	69 (11%)
Slight or No	159 (48%)	95 (57%)	115 (87%)	369 (59%)
Total	332(100%)	166 (100%)	133(100%)	631(100%)

AIJ 1995, Okada et al 2000

Why Seismic Evaluation and Retrofit Had Not Been Implemented Much ? (Okada 1995)

1) A seismic retrofit is less attractive for owners, architects, engineers, researchers, constructors, administrators and politicians than new building construction.

2) Since a return period of a big earthquake is usually very long, owners are apt to hesitate to spend money for seismic retrofit of existing buildings.

3) Since a seismic retrofit is more complicated than a design and construction of a new building, it is usually troublesome for architects and engineers, and less paid.

4) Since the Japanese Building Code is not retroactive, a seismic retrofit is not legally enforced.

Actions for Seismic Retrofit in 1995

- Hyogo-ken Nanbu Earthquake
  (Jan.)
- Quick Report on Building Damage (MOC)
  (March)
- Notice for Promotion of Seismic Retrofit (MOC)
  (March)
- Report on Damage of School Buildings (AIJ)
  (March)
- Network for Promotion of Seismic Retrofit
  (April)
- Special Law for Earthquake Countermeasures
  (Subsidy for Seismic Retrofit of School Buildings)
  (June)
- Recommendations of AIJ
  (July)
- Disaster Prevention Basic Plan revised (LA)
  (July)

Seismic Grades of School Buildings (Public Primary and Secondary Schools) [MEXT-7]

		Total of Buildings	133, 490	100%
Post- 1982	(A)	Assumed Safe	45, 903	34. 4%
Pre - 1981	(B)	Evaluated Safe	6, 871	5. 1%
	(C)	Evaluated Unsafe and Retrofitted or Reconstructed	8, 210	6. 2%
	(D)	Not Evaluated but Assumed Safe	15, 500	11. 6%
		(Sub Total of Safe Buildings)	76, 484	57. 3%
	(X)	Evaluated Unsafe but Not Retrofitted	11, 891	8. 9%
	(Y)	Not Evaluated but Assumed Unsafe	45, 115	33. 8%

133, 490 100%

Recent Activities on Seismic Retrofit

- Estimation of Amount of Vulnerable Buildings
  (Fire Agency, Cabinet Office & MEXT 2002-2003)
- Promotion of Seismic Retrofit of School Buildings
  (MEXT 2002-2003)
- Adoption of Seismic Retrofit of Buildings and Houses as the Highest Prioritized Measure in the National Master Plan of Earthquake Preparedness to Tokai-Earthquake
  (Central Disaster Management Council May, 2003)
  (Cabinet meeting approved July, 2003)

- Establishment of Supporting Systems for

History of Earthquake Damage and Seismic Design & Seismic Evaluation

Structural Damage in Non-Engineered Buildings and/or in Non-Earthquake Engineered buildings

First Age : Adoption of Seismic Design Codes
(1920's - 1940's)

Structural Damage in Insufficiently Engineered Buildings

Second Age: Revision of the seismic Design Codes
(1980's - 1990's)

Promotion of Seismic Evaluation and Strengthening of Existing Buildings

Functional Damage in Engineered Buildings

Third Age : Adoption of Performance-based Engineering into Seismic Design Codes
(2000's -) for High-rise buildings, since 1960's

Controlled Damage in Highly Engineered Buildings

Recommendation-1

1) In order to sweep up seismically vulnerable buildings and houses,

- Do not make vulnerable buildings and houses,
- Evaluate seismic safety of existing buildings and houses and retrofit, and
- Conduct quick inspection and restore of damaged buildings and houses.

Recommendation-2

2) Utilizing excellent technologies developed in the 20th century for real practices,

- Prepare various types and levels of seismic design codes for various types of new buildings and houses,
- Develop evaluation standards and retrofit guidelines for various types of existing buildings and houses, and
- Establish guidelines for inspection of damaged buildings/houses, and train qualified inspectors.

Recommendation-3

3) Not only most sophisticated seismic design and construction technologies but also suitable

level of technologies considering building use, life cycle, economic condition etc. be developed

and implemented.

However, the concepts should be the same.

Discussion s in Cluster 4 (Jan.18,05)

- *Improvement of seismic safety of buildings and houses is one of the most important issues for disaster reduction.*
- *Adoption of seismic design codes, evaluation and retrofit guidelines is urged.*

  Implementation is also very important.
- *Priorities due to building uses be considered for effective implementation. (schools, hospitals, houses)*
- *Action Plan is important such as:*

  To retrofit all vulnerable hospitals by 20xx.