

WCDR in Kobe Jan. 18, 2005

Cluster 4 Reducing the underlying risk factor

*Importance to Improve Seismic Safety
of*

*Buildings and Houses for Reduction of
Earthquake Disaster*

Tsuneo OKADA

*Professor Emeritus of University of Tokyo
President of Japan Building Disaster Prevention
Association*

KOBE in 1995 (Great Hanshin/Awaji Earthquake Disaster)



Jan. 19, 2005

WCDR in Kobe
T.OKADA

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-

	Collapse or Severe	Moderate	Minor or Less	Total
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

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*

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)*

Recommendation-1

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

sweep up seismically vulnerable buildings and houses. (it would be possible)

Recommendation-2

- *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 quick inspection of damaged buildings/houses, and train qualified inspectors.*

Recommendation-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.