Harmonization of Design Codes in the Asian Region

Concrete Building Code in Taiwan

Shyh-Jiann Hwang (National Taiwan University)

Committee of Concrete Engineering
Chinese Institute of Civil and Hydraulic Engineering
Outline

- Status of Concrete Codes
- Current Concrete Codes in Taiwan
- Code Development in CICHE
Status of Concrete Codes
Status of Design Codes in Taiwan

<table>
<thead>
<tr>
<th>Drafted by</th>
<th>Approved by</th>
</tr>
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<tbody>
<tr>
<td>Government</td>
<td>Legislative Body</td>
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<tr>
<td>Engineering Societies</td>
<td>Government</td>
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</table>

Diagram:
- Regulations
- Design Codes
- Standards and Specifications
Status of Concrete Building Codes

Building Design Codes

Design Code & Specification for Structural Concrete

Test Standards, Chinese Nation Standard, Material Specification, etc.

Drafted by:
Chinese Institute of Civil and Hydraulic Engineering (CICHE)

Approved by:
Construction and Planning Administration (CPA), Ministry of Interior
Current Concrete Codes in Taiwan
# Draft of Design Code

<table>
<thead>
<tr>
<th>Design Code</th>
<th>Publisher</th>
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<tbody>
<tr>
<td>Design Code for Structural Concrete</td>
<td>CPA</td>
<td>2002</td>
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<td>Design Code and Commentary for Structural Concrete (土木 401-86a)</td>
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<td>1997</td>
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# Draft of Construction Code

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<tr>
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<td>Specification for Structural Concrete</td>
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<td>CICHE</td>
<td>1999</td>
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</table>
Lessons from Chi-Chi Earthquake

Vertical Faulting = 9.0m
Lessons from Chi-Chi Earthquake

Damages of School Buildings

293 elementary and high schools were completely or partially damaged.
Lessons from Chi-Chi Earthquake

Bridge Damages
Model of Taiwan Concrete Codes

American Concrete Institute

Building Code Requirements for Structural Concrete (ACI 318-95) 1995

Chinese Institute of Civil and Hydraulic Engineering

Design Code and Commentary for Structural Concrete (土木 401-86a) 1997

Construction Code and Commentary for Structural Concrete (土木 402-88a) 1999
# Code Units in Taiwan

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<tr>
<th>Length</th>
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<th>Time</th>
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<tr>
<td>m</td>
<td>kgf</td>
<td>kg</td>
<td>sec</td>
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Design Code for Structural Concrete

- General Requirements
- Analysis and Design
- Flexural and Axial Loads
- Shear and Torsion
- Development and Splices of Reinforcement
- Two-way Slab System
- Walls
- Footings
- Precast Concrete
Design Code for Structural Concrete

- Composite Concrete Flexural Members
- Prestressed Concrete
- Shells and Folded Plate Members
- Strength Evaluation of Existing Structures
- Special Provisions for Seismic Design
- Structural Plane Concrete
- Appendix: Strut-and-tie Model
  - Anchoring to Concrete
  - Working Stress Design
Specification for Structural Concrete

- General Requirement
- Concrete Materials
- Concrete Mixtures
- Formwork
- Steel
- Joints and Embedment
- Concrete Mixing and Conveying
- Concrete Placing
- Concrete Finishing
Specification for Structural Concrete

- Concrete Curing and Protection
- Mass Concrete
- Prestressed Concrete
- Self-Compacting Concrete
- Shot Concrete
- Quality Control
- Examination and Inspection
- Evaluation and Acceptance of Concrete
- Check and Acceptance
Code Development in CICHE
## Task Force of Concrete Codes

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<tr>
<th>Establishment</th>
<th>Year</th>
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<td>Chinese Institute of Hydraulic Engineering</td>
<td>1931</td>
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<td>1936</td>
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<tr>
<td>Chinese Institute of Civil and Hydraulic Engineering (CICHE)</td>
<td>1974</td>
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<td>Committee of Concrete Engineering</td>
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## Development of Design Code

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Prepared by: Working Group on Concrete Design
Committee of Concrete Engineering
Chinese Institute of Civil and Hydraulic Engineering
Design Code of 土木 401-56 (1967)

Reference
- Taiwan Power Company, “Design Code of Reinforced Concrete”
- ACI 318-63

Content
- Working Stress Design
Design Code of 土木 401-59 (1970)

Reference
- 土木 401-56
- ACI 318-63

NEW
- Ultimate Strength Design (Appendix)
Design Code of 土木 401-68 (1979)

Reference
- 土木 401-59
- ACI 318-77

NEW
- Ultimate Strength Design (Text)
- Working Stress Design (Appendix)
- Special Provisions for Seismic Design (Appendix)
Design Code of 土木 401-80 (1991)

Reference

- 土木 401-68
- ACI 318-89

NEW

- Special Provisions for Seismic Design (Text)
Design Code of 土木 401-84
(1995)

Reference
- 土木 401-80
- ACI 318-89

NEW
- Commentary
Design Code of 土木 401-86 (1997)

Reference

- 土木 401-84
- ACI 318-95

NEW

- Drawings and Specifications
- Structural Plain Concrete
- Unified Design Provisions for RC and PC
Design Code of 土木 401-86a

CICHE

(2002)

CPA

Reference
- 土木 401-86
- Building Design Code, CPA
Design Code of 土木 401-93

(2004)

Reference

- 土木 401-86a
- ACI 318-02

NEW

- Load Factors
- Strength Reduction Factors
- Strut-and-Tie Model
- Anchoring to Concrete
## Development of Construction Code

<table>
<thead>
<tr>
<th>Construction Code</th>
<th>Year</th>
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<td>402-57</td>
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<td>402-70</td>
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<td>402-88a</td>
<td>2002</td>
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<td>402-94</td>
<td>2005</td>
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Prepared by: Working Group on Concrete Construction  
Committee of Concrete Engineering  
Chinese Institute of Civil and Hydraulic Engineering
Construction Code of 土木 402-57 (1968)

Reference

- CICHE, “Construction Code of Concrete Engineering,” 1956
- ACI Committee 301, “ACI Standard Specifications for Structural Concrete for Building,” 1956

Reference
- 土木 402-57
- ACI 301-75
- ACI 318-77

New
- Prestressed Concrete

Reference
- 土木 402-70
- ACI 301-88
- ACI 318-89

New
- Commentary
- Concrete Conveying
- Special Concrete
- Quality Control

Reference

- 土木 402-80
- ACI 301-96
- ACI 318-95
Construction Code of 土木 402-88a

CICHE  (2002)  CPA

Reference
- 土木 402-88
- Building Design Code, CPA

Reference
- 土木 402-88a
- ACI 301-99
- ACI 318-05

New
- Self-Compacting Concrete
Recent Efforts

CICHE

CPA

上木 401-95

土木 402-94
Future Efforts

- Development of Concrete Codes
- Harmonization of Design Codes in the Asian Region
Thanks for your attention