The Confined Masonry Initiative

International Disaster and Risk Conference, Davos, Switzerland, May 30 – June 3, 2010
The Confined Masonry Initiative

presented by

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RC moment frames vs Confined Masonry

**RC**
columns first,
walls later

**CM**
walls first,
columns later
RC moment frames vs Confined Masonry

**RC**
columns first, walls later

**CM**
walls first, columns later
RC frames are ‘hi-tech’ systems

(because ALL of these conditions must be respected)

• **Steel must be:**
  – In the right place
  – With the right connections
  – Of the right quality and diameter
  – Properly tied
  – With the right embedding

• **Concrete must be:**
  – Of the right mix
  – Poured and vibrated properly
  – Cured properly

• **Formwork must be:**
  – Watertight
  – Properly braced

And

• **Structural concept must be**
  – Right

• **Walls must be**
  – Anchored properly or
  – Detached properly
RC frames in low-tech environments

(Several or all of these conditions apply)

- **Steel is not:**
  - In the right place
  - With the right connections
  - Of the right quality and diameter
  - Properly tied
  - With the right embedding

- **Concrete is not:**
  - Of the right mix
  - Poured and vibrated properly
  - Cured properly

- **Formwork is not:**
  - Watertight
  - Properly braced

And

- **Structural concept isn’t**
  - Right

- **Walls are not**
  - Anchored properly or
  - Detached properly
Typical problems with concrete works
RC frames are too complex

For safe construction simpler systems are needed

Confined Masonry is one of them
RC moment frames vs Confined masonry

Load paths (poetically speaking...)

RC
Complex

CM
Simple
Construction of CM buildings
Low rise CM buildings
CM buildings after a quake

Research by M. Tomasevic, Slovenia
Compilation and analysis of existing material
Confined Masonry DESIGN Guideline, Draft

Downloadable at www.confinedmasonry.org
Promotion through the internet
Post EQ opportunities: Practical training

Demo building

Full scale training models

On the job training

Training of inspectors
CM training necessary even where already in use
Confined Masonry RESEARCH NEEDS

Research needs are primarily needed to characterize the structural action and load-sharing mechanisms of confined masonry (CM) systems under in-plane as well as out-of-plane seismic loads, requiring both experimental as well as analytical studies. Several serious research efforts have been made to address many aspects of confined masonry behavior, especially in Central and South America. It appears that a collaborative and concerted effort will help resolve many issues more conclusively. In the following, research areas have been listed which need further investigation along with those which require lends initiative:

I. Analysis Aspects of Confined Masonry
   • Modeling issues
     o Idealization of CM system (modeling for the analysis procedure for both in-plane and out-of-plane response (e.g., system of strut and tie, average column model for coupling beams, micro-modeling of masonry, FEML, etc.).
     o Simplified analysis procedures
       • Qualifying criteria, such as limitations on building size, layout of openings in walls, expected seismic loading, etc.
       • Leads to prescriptive design and detailing of CM components

   • Capacity and fragility curves
     o Structural behavior of CM in terms of “general” load-deformation response (pushover curve) and failure patterns/mechanisms
     o Fragility curves for comparison with other structural systems and for loss-estimation studies

II. Structural Design Aspects for Confined Masonry
   • Response reduction (or behavioral) factors
     o Rational estimate based on key CM parameters which control its seismic performance (e.g., wall density, building characteristics, seismic zone, site soils, etc.)

   • Primary structural requirements in terms of strength/stiffness for various components/elements of CM
     o Out-of-plane resistance and height/thickness ratios (Current limits appear to be conservative. Do it true even if the wall is damaged due to in-plane action?)
     o Minimum size of tie-columns (usually controlled by wall thickness)
     o Frame vs. wall lateral stiffness (Is it controlling factor? Does it influence CM from infilled frame? Should there be a limit on lateral stiffness of confining elements?)
     o Openings – restrictions on size and spacing/location of openings, tie-columns around openings (Should they be different from non-tie-columns at wall ends?)
Research example: need for seismic bands?
Welcome to the Confined Masonry Network Website

The Confined Masonry Network is dedicated to promote structurally safe and economical housing worldwide by bringing quality confined masonry into the design and construction mainstream.

Recent Activities:
- Promoting Confined Masonry in Haiti: Translating Materials for Use There
- DRAFT Global Design Guidelines Now Available for Review

What is Confined Masonry Construction?
The Confined Masonry Network is a project of an international consortium of individuals and organizations. Partnering organizations are listed here. The network is an ever-expanding group of global experts in design and construction of Confined Masonry with backgrounds in architecture, engineering and education dedicated to promote safe and economical housing worldwide by bringing quality confined masonry into the design and construction mainstream. The Network is facilitating the collection and exchange of global knowledge from international experts in Confined Masonry construction to peer review existing guidelines in different regions and to formulate a global set of prescriptive construction guidelines and a global design guideline for this construction type, with reference to key regional differences in construction methods and materials.

Read more about the Confined Masonry Network
Thank you and