

# Fire Safety with Concrete Products

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# Referenced NCMA TEK

- TEK 5-8B: Detailing Concrete Masonry Fire Walls
- TEK 7-1C: Fire Resistance Rating of Concrete Masonry Assemblies
- TEK 7-2: Balanced Design Fire Protection
- TEK 7-3A: Firestopping for Concrete Masonry Walls
- TEK 7-4A: Foam Plastic Insulation in Concrete Masonry Walls

All available free on line –

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# Components of Balanced Design

1

Automatic Detection Systems (Alarms)



2

Automatic Suppression Systems  
(Sprinkler Systems)



3

Compartmentation -  
using non-  
combustible  
materials  
(Concrete Masonry)

# Firewall Performance



# Firewall Performance



# Firewall Performance



# Consequence of No Firewalls

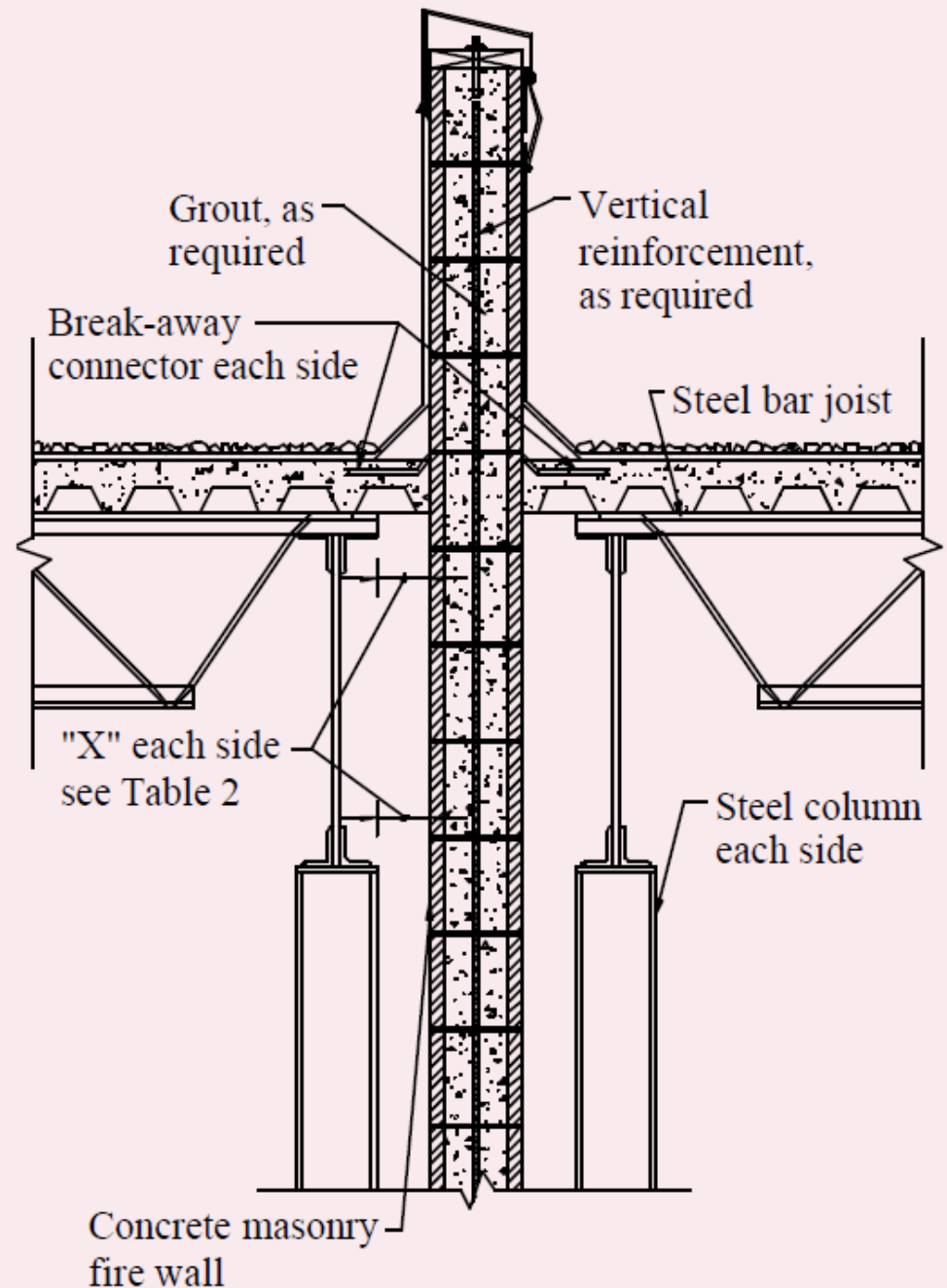


# New Orleans Fire

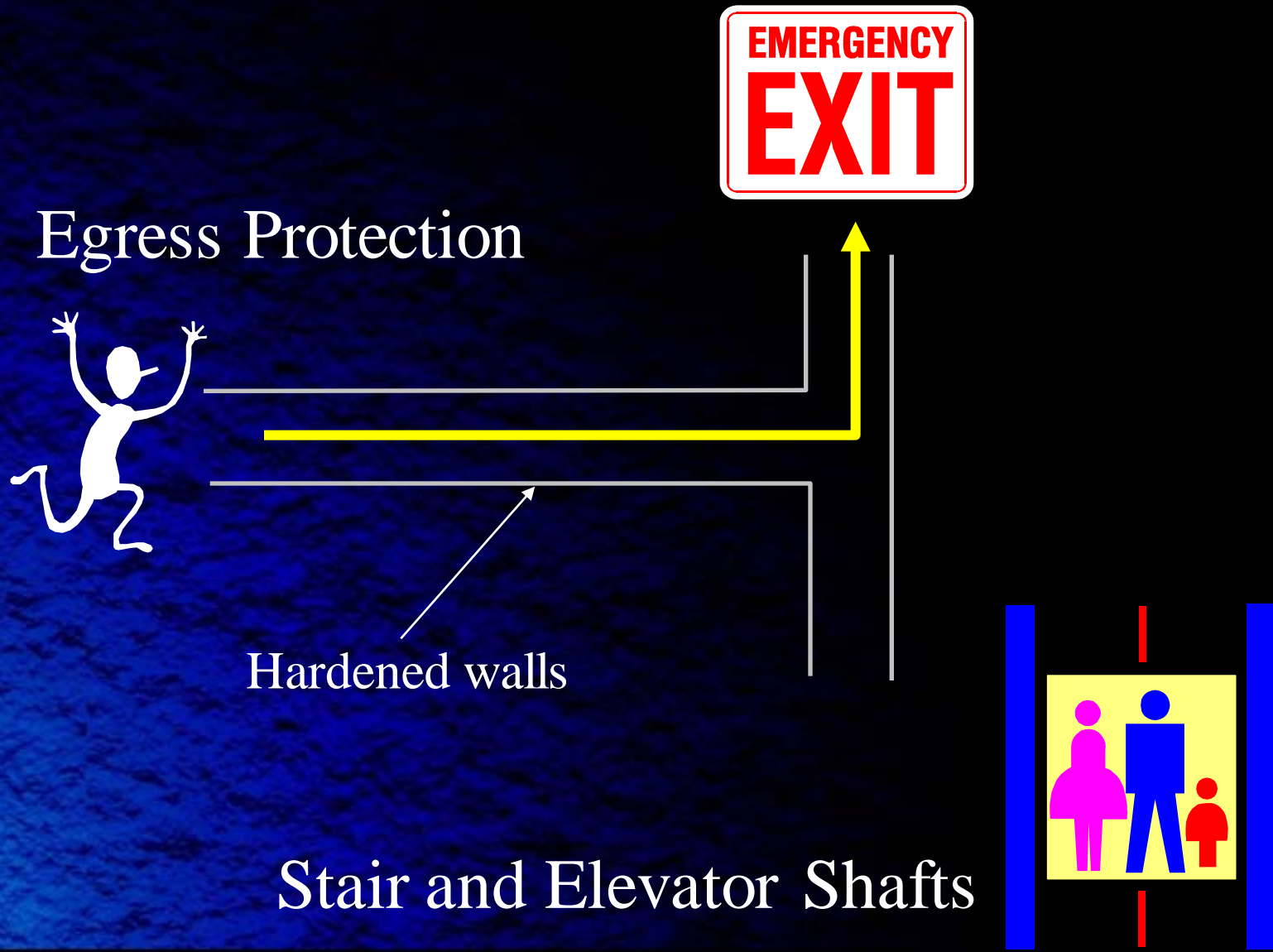




# Independent Support and Breakaway Connectors to Prevent Firewall Collapse



# Robustness

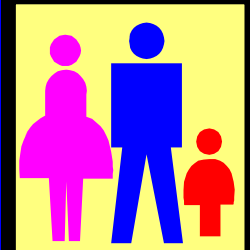


Egress Protection



Hardened walls

Stair and Elevator Shafts



# Concrete Fire Ratings



ASTM E 119

Three methods for determining ratings:

1. Fire Testing
2. Listing Service
3. Calculation Method



# Concrete Fire Ratings Per the Building Code

Three methods for determining ratings:

1. Fire Testing

2. Listing Service

3. Calculation  
Method



Underwriter's Laboratory

UL 618  
UL Standard  
for Safety for  
Concrete Masonry Units

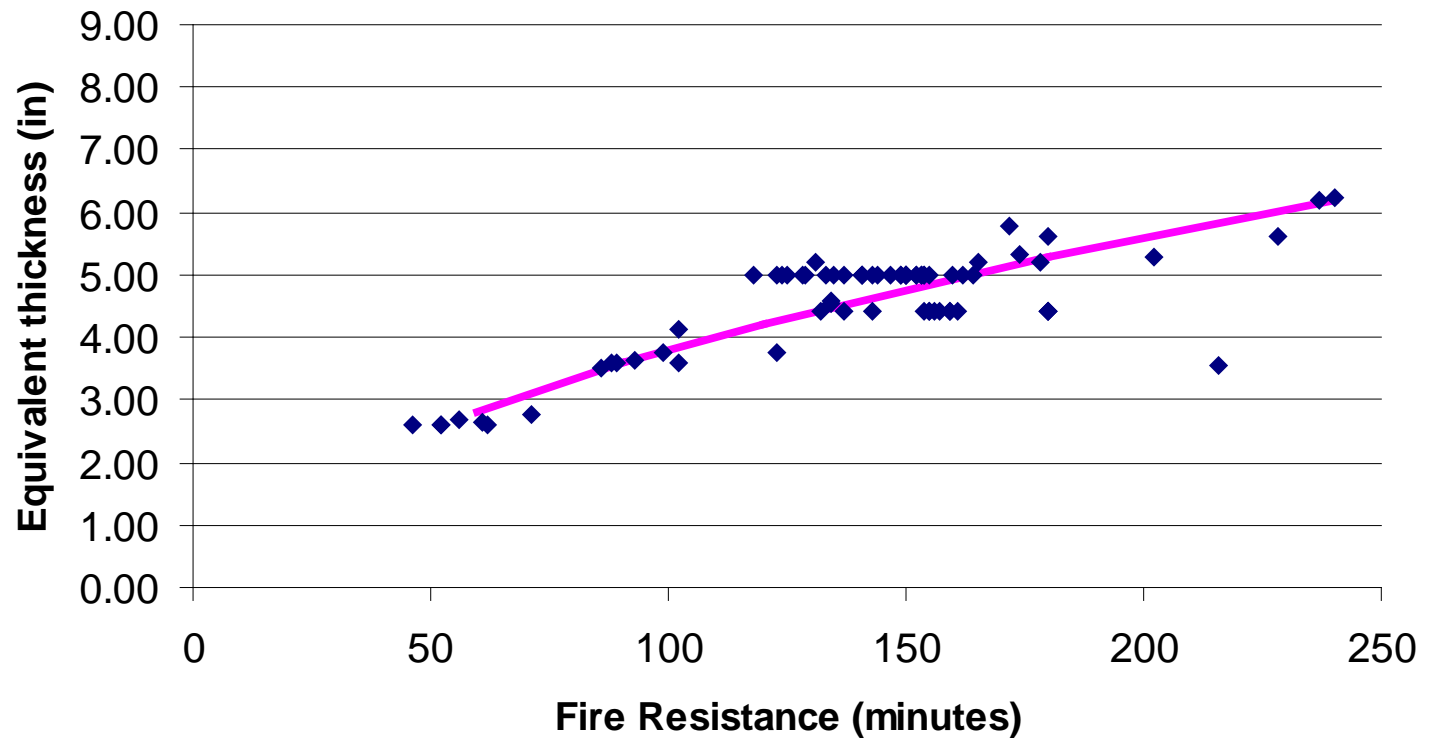
# ASTM E119

## Fire Rating Criteria

- Structural – failure to support load
- Passage of heat or flame sufficient to ignite cotton waste
- Temperature rise on the unexposed surface 250 degrees F over ambient
- Failure under hose stream - walls and partitions

# Concrete Masonry Fire Ratings

Fire Test Data - Calcareous and Siliceous Aggregate



3. Calculation Method

# Calculated Fire Resistance Method

Fire ratings for concrete products are a function of:

- Aggregate type
- Equivalent thickness

# ACI 216.1 / TMS 216

ACI 216.1-07 / TMS-0216-07

**Code Requirements for  
Determining Fire Resistance  
of Concrete and Masonry  
Construction Assemblies**

An ACI / TMS Standard

Reported by Joint ACI / TMS Committee 216



American Concrete Institute®



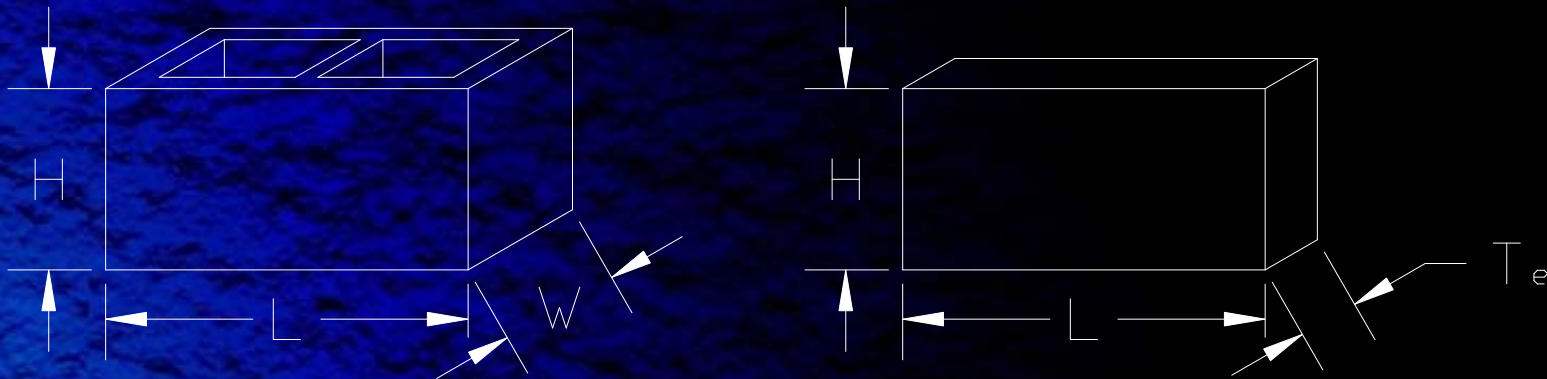
## *Applicable to:*

- Concrete
- Concrete masonry
- Clay brick and tile masonry
- Effects of finish materials on fire resistance
- Incorporated into the I-Codes



# Equivalent Thickness

Equivalent Thickness,  $T_e$ , is the solid thickness that would be obtained from the same volume of concrete without cores.



$$T_e = \% \text{ solid} \times \text{actual thickness}$$

# Applicable NCMA TEK on Fire Resistance\*

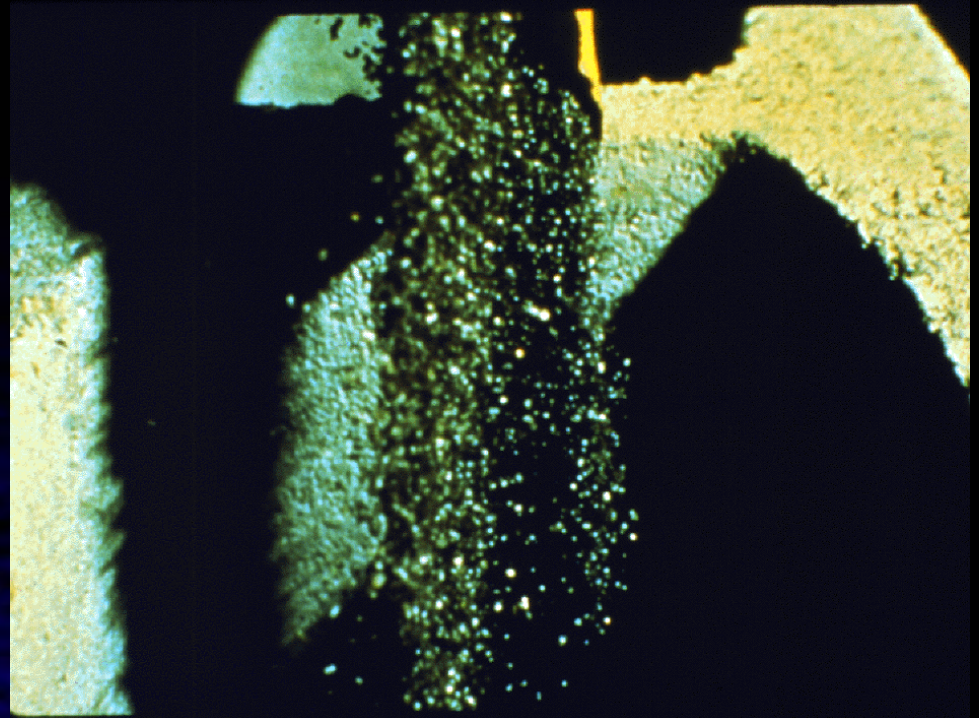
- TEK 7-1C: Fire Resistance Rating of Concrete Masonry Assemblies
- TEK 7-3A Firestopping for Concrete Masonry Walls
- TEK 7-5B: Evaluating Fire Exposed Concrete Masonry Walls
- TEK 7-6: Steel Column Fire Protection

\*All are available free on-line  
through [www.ncma.org](http://www.ncma.org)

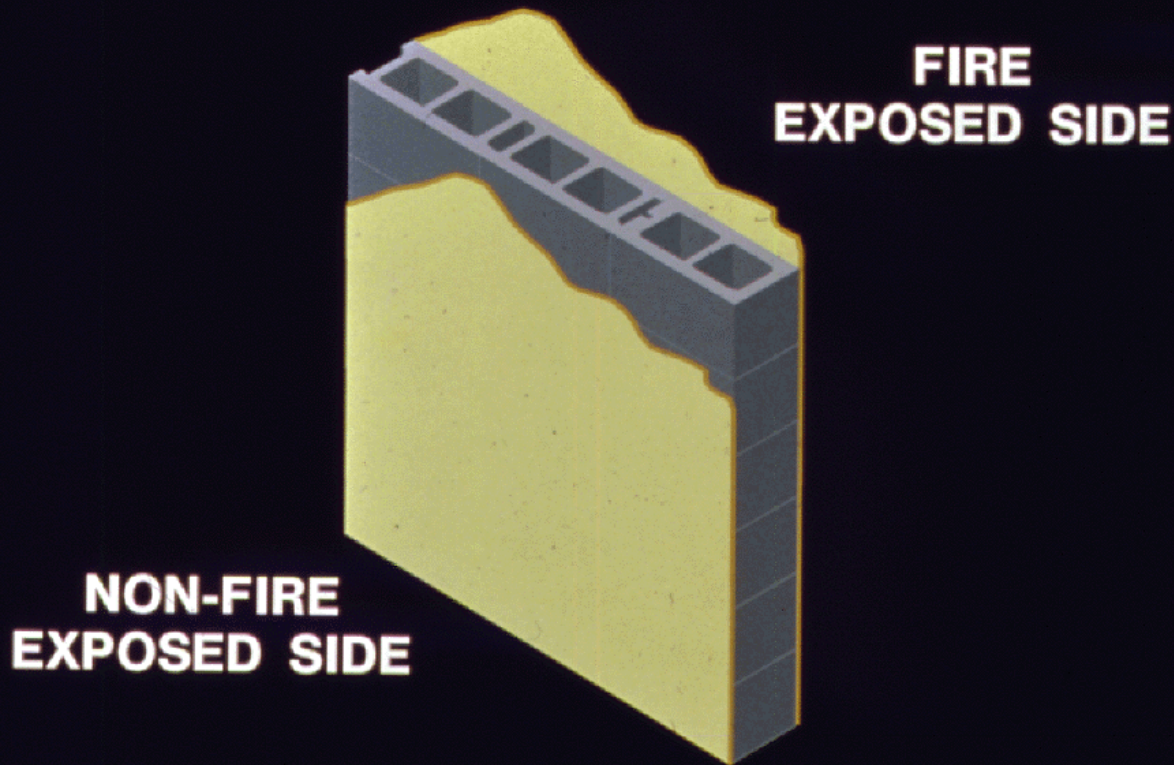
# Filling Cores

When the hollow cores of concrete masonry are filled, the equivalent thickness is considered to be the actual thickness of the concrete masonry unit.

Thus all filled 8-inch and many 6-inch CMU have 4 hour ratings.



# Finishes

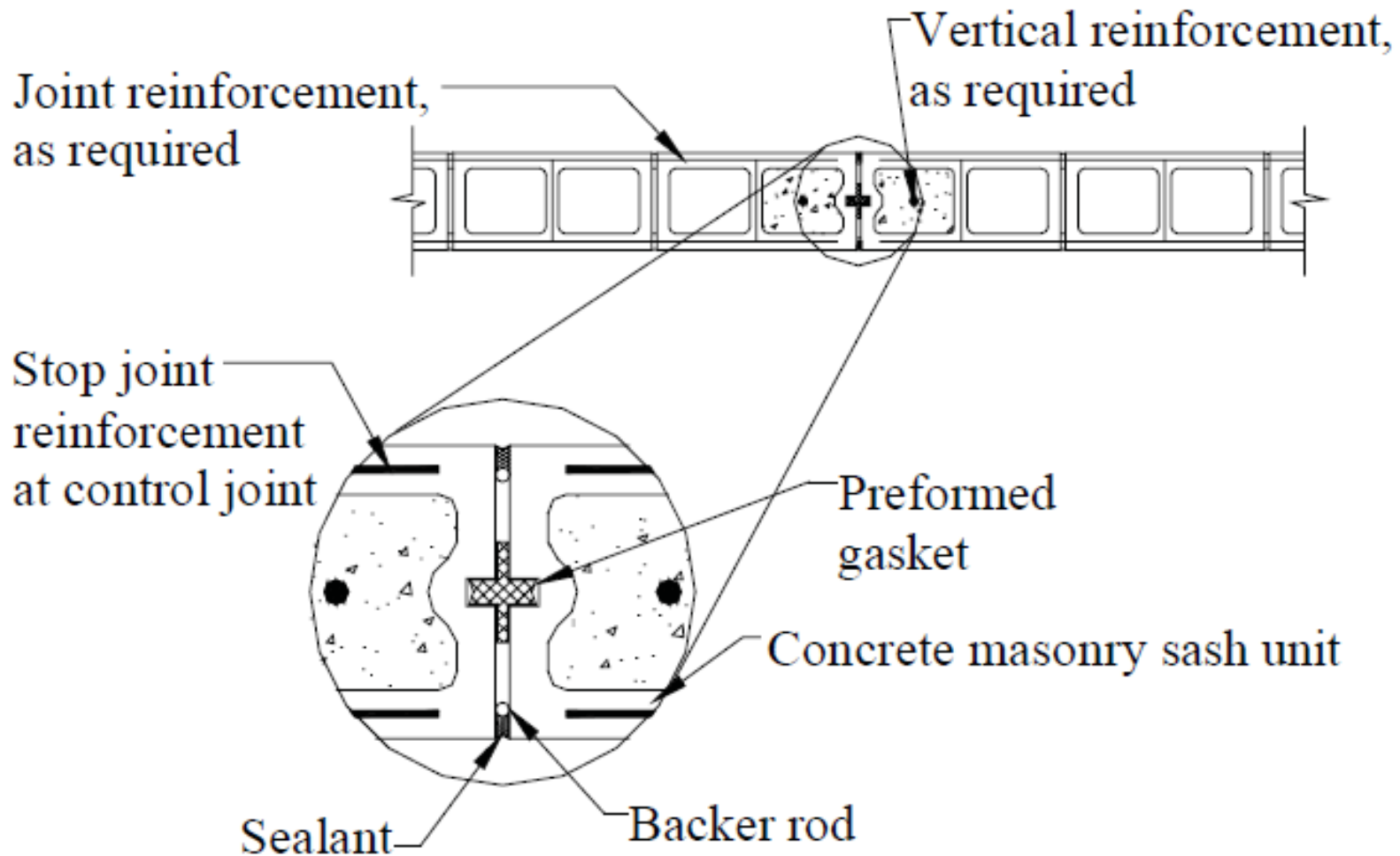


Finishes are an excellent way of increasing the fire resistance rating of existing assemblies

# Repairs to Concrete and Masonry

Concrete, mortar, and grout are generic listed fire resistant materials that can be used for repairs and firestopping within the limitations of the code.

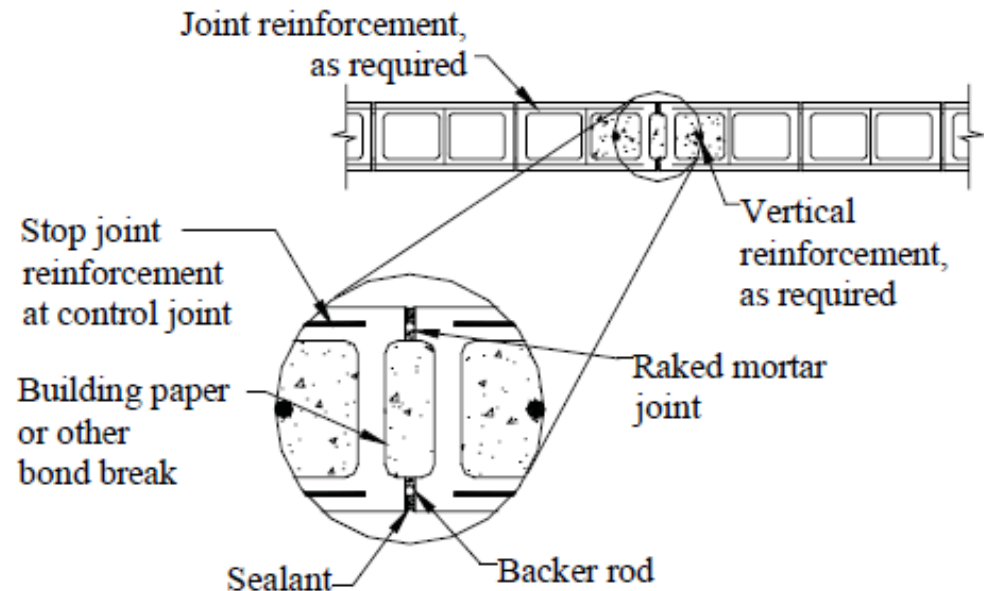
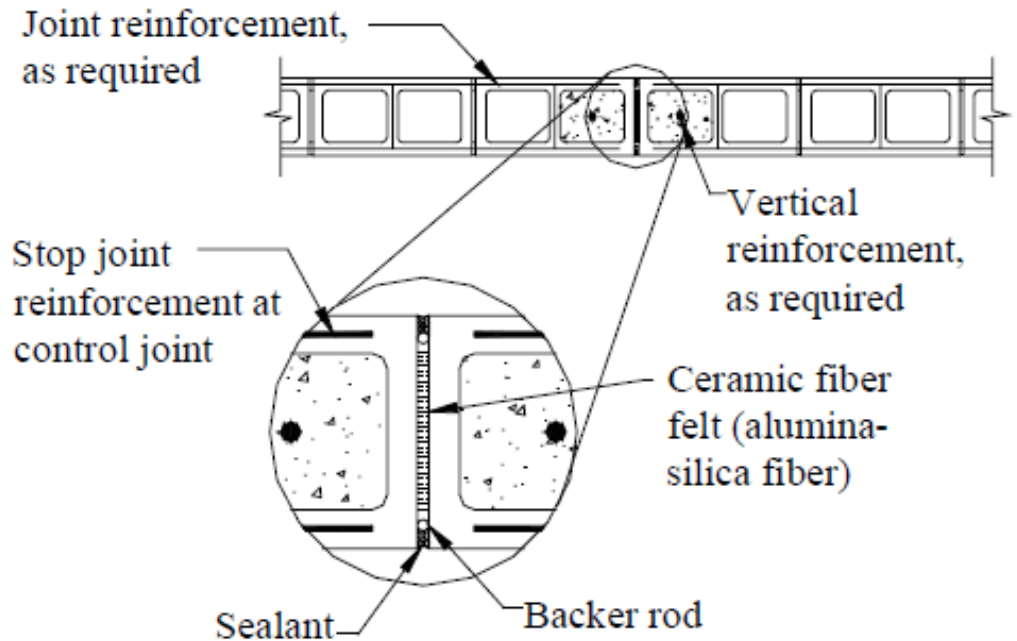
# Control Joints



**2-Hour Fire Resistance Rating**

# Control Joints

- 4 hour rated joints for masonry
- Concrete similar to top figure
- Chart indicates amount of insulation



# Glazed Units

The calculated fire resistance rating procedure for a glazed unit is the same as for conventional units- Same charts based on equivalent thickness and aggregate type.





# Clay Brick and Tile

The IBC and ACI/TMS 216 standard also address calculated fire resistance rating for clay brick and tile masonry wall assemblies (very similar to the concrete masonry tables and procedures).



# IBC NFPA 285 Requirement

IBC 2603.5.5 Vertical and lateral fire propagation.

The exterior wall assembly shall be tested in accordance with and comply with the acceptance criteria of NFPA 285.

# IBC NFPA 285 Requirement

## Exception:

1. One-story buildings complying with Section 2603.4.1.4.

2. Wall assemblies where the foam plastic insulation is covered on each face by a minimum of 1-inch (25 mm) thickness of **masonry or concrete** and meeting one of the following:

a. there is no air space between the insulation and the concrete or masonry; or

b. the insulation has a flame spread index of not more than 25 as determined in accordance with ASTM E 84 or UL 723 and the maximum air space between the insulation and the concrete or masonry is not more than 1-inch (25 mm).

**TEK 7-4A**

# Exterior Generated Fires



# Monte Carlo Hotel Las Vegas

Jan. 24, 2008



# Cost Comparison Study



## Fire Safe Construction Cost Comparison Study



# Cost Comparison Study

The original study was conducted in MA, PA, MD, NY. However, supplements were issued later for 31 additional cities across the US.

# Cost Comparison Study

## Conclusion

Cost of compartmentalized construction using a concrete based material is generally less than 5 percent of the overall construction cost and in some cases there is no increased cost.

See: <http://www.pafscac.org/>



# Summary

- Concrete products provide robustness and added protection
- Fire ratings are easily determined by the various methods available.
- Compartmentation is effective and it doesn't cost as much as people think.

# Questions

Thank you for your time!



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