



Construction Testing and Special Inspections

It's important to get it right...

Topics to be covered:

- What are CoMET and Special Inspections?
- What to look for in a CoMET firm
- How do CoMET firms add value to your project?

Background -

The evolution of modern CoMET and SI

July 17, 1981, Kansas City, MO:

Two 32-ton skywalks at the Hyatt Regency collapsed into the hotel lobby, killing 114 people.



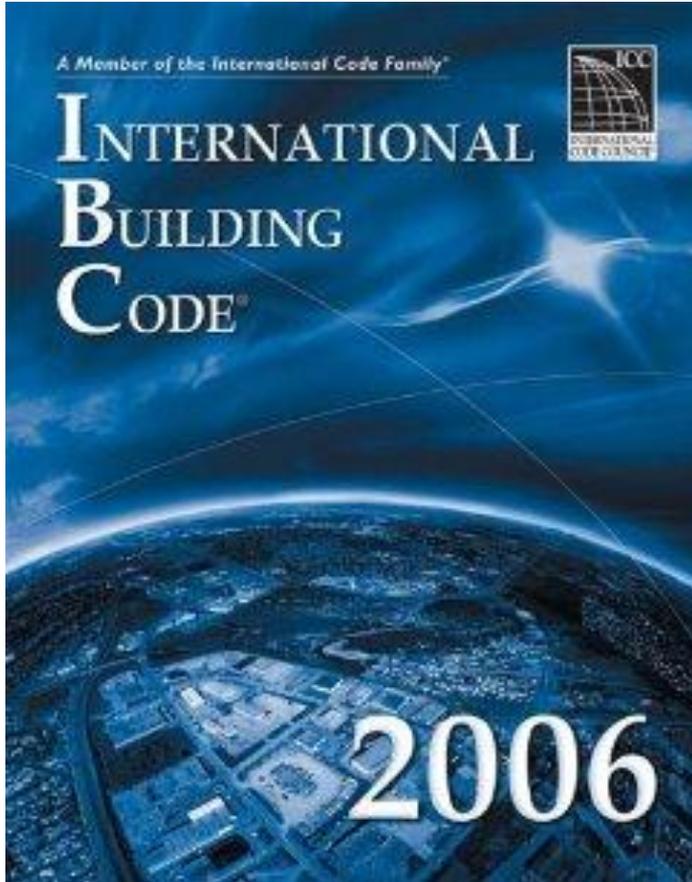
1984:

The U.S. House of Representatives *Subcommittee on Investigations and Oversight*, held hearings to examine the causes of structural failures.



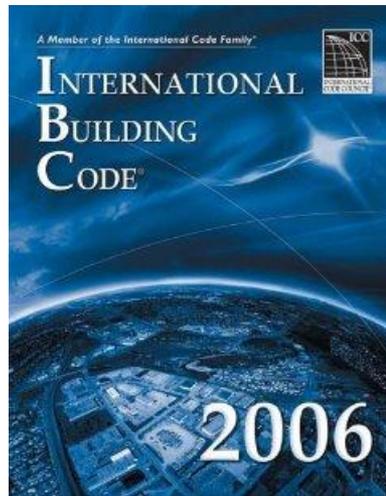
Over 20 contributing factors, with 2 of the most critical being:

- The need for improved organization and better communication
- The need for construction inspection



The Subcommittee suggested building code officials “*should make every effort to ensure that provisions are written into building codes*” that make inspection of structural components during construction “*mandatory*”.

What do CoMET firms do and what is Special Inspections?



Special Inspections are defined by IBC as:

"Inspection as herein required of the materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with approved construction documents and referenced standards."

Typical items from the IBC code that require testing or inspection

- Structural steel fabrication and erection
- Concrete construction
- Structural wood framing construction
- Prepared fill / Foundations
- Sprayed fire-resistant materials
- Exterior Insulation Finishing System (EIFS)
- Structural Masonry
- Other:
 - Tower cranes
 - Earth retention system



Structural Steel

- Fabrication inspection
- Materials
- Welder certifications
- Steel joists
- Metal decking
- Anchor bolts & baseplates
- Shear studs
- Light gauge framing
- Column/Beam erection
- Welded and bolted connections



Common Structural Steel Deficiencies

- Anchor bolts improperly located
- Columns out of plumb
- Bolts too short
- Nuts insufficiently tightened
- Bolt holes don't align
- Torch-cut holes
- Mixing of components
- Bolting clips in wrong place
- Defective welds
- Epoxy anchors not properly installed



THE CONSEQUENCES CAN BE FATAL



August, 2011, Indiana State Fair – 7 people died, Over 40 injured

Cast-in-place Concrete Construction

- Material tests
- Reinforcing
- Mix design
- Batch plant
- Formwork
- Placement/Curing
- Post-tensioning
- “Stripping” letters



Common Cast-in-place Concrete Deficiencies

- Improper mix design
- Batch-to-placement time
- Out of slump/water added
- Inadequate consolidation
- Lack of curing
- Field cylinders disturbed
- Low lab cylinders strength
- Imbeds missing
- Improper connections
- Lack of approved, remedial details
- Reinforcing steel improperly placed



THE CONSEQUENCES CAN BE FATAL



AP / Brian Branch-Price

October 2003, Atlantic City, NJ Garage collapses – 3 people died, Over 20 injured

Prepared Soil Fill and Foundations



- Site preparation
- Soil placement and compaction
- Bearing capacity
- Pile/Pier foundations
- Reinforcing steel
- Verify Soil Type

Common Soil Fill And Foundation Deficiencies

- Unsuitable material
- Inadequate/excessive moisture
- Lack of compaction
- Insufficient bearing capacity
- Water in excavation
- Unanticipated subsurface conditions
- Improper reinforcing placement



THE CONSEQUENCES CAN BE FATAL



June 2009, Shanghai, China – Apartment building topples over – 1 worker died

More areas covered by CoMET firms:

- Sprayed Fire-Resistive Material (SFRM)
- Structural Masonry
- Exterior Insulation Finishing Systems (EIFS)
- Tower Cranes
- Retaining Walls
- Structural Wood

All of which can have fatal consequences if done poorly...



Fatalities are an extreme consequence of inadequate construction...

... The more common consequence is increased project costs.

Most Common Causes of Contractor Claims (1)

- Defects in plans and specifications
- Differing site conditions
- Inadequate construction observation, testing and management

**Appropriate CoMET firm involvement
can significantly reduce the risk for each
of these types of claims**

(1) First three items in a list of ten common causes, from *Prevention and Resolution of Contractor Claims, EPA Construction Grant Program Guidance for Municipal Grants, USEPA, March 1985.*

Owners only get *one chance* to get the project right...

... *A LOT* depends on wise CoMET firm selection.

Who Provides CoMET and Special Inspections?



Who are Construction Materials Engineering and Testing (CoMET) Consultants?

CoMET firms provide expertise related to testing of construction materials testing typically required by project specifications and building codes.

CoMET Firm Selection Criteria

The basics...

- Qualifications (ASTM E329)
 - Laboratory Accreditations
 - Technician Certifications
- Experience
- Area of expertise (geographic, jurisdiction and technical knowledge)



Designation: E329 – 09

Standard Specification for Agencies Engaged in Construction Inspection and/or Testing¹

This standard is issued under the fixed designation E329; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last approval. A superscripted epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope²

- 1.1 This specification defines the minimum requirements for inspection agency personnel or testing agency laboratory personnel, or both, and the minimum technical requirements for equipment and procedures utilized in the testing and inspection of construction and materials used in construction.
- 1.2 Criteria is provided for evaluating the capability of the agency to properly perform designated tests on construction materials, and establishes essential characteristics pertaining to the organization, personnel, facilities, and quality systems of the agency. This specification may be supplemented by more specific criteria and requirements for particular projects.
- 1.3 This specification can be used as a basis to evaluate an agency and is intended for use in qualifying and/or accrediting agencies, public or private, engaged in the testing and inspection of construction and materials. Building officials can use Specification E329 as a tool in the qualification and inspection of competency of inspection and testing agencies in the fields covered by Specification E329.
- 1.4 A certificate of accreditation, including the scope of accreditation, is required to comply with this standard.
- 1.5 The users of an accredited agency must review the agency's scope of accreditation to ensure the agency has been accredited for its technical competence to perform the specific tests or inspections requested by the user.

2. Referenced Documents

- 2.1 ASTM Standards:³
 - A880 Practice for Criteria for Use in Evaluation of Testing Laboratories and Organizations for Examination and In-

¹This specification is under the jurisdiction of ASTM Committee E36 on Accreditation & Certification and is the direct responsibility of Subcommittee E36.70 on Construction and Building Testing/Inspection Agencies. Current edition approved Nov. 1, 2009. Published December 2009. Originally approved in 1967. Last previous edition approved in 2008 as E329-08. DOI: 10.1520/E0329-09.

²For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

- specification of Steel, Stainless Steel, and Related Alloys³
- C1077 Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Construction Laboratory Evaluation
- C1093 Practice for Accreditation of Testing Agencies for Masonry
- D5666 Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
- D3740 Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
- E4 Practices for Force Verification of Testing Machines
- E843 Specification for Agencies Performing Nondestructive Testing
- E605 Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
- E736 Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
- E994 Guide for Calibration and Testing Laboratory Accreditation Systems General Requirements for Operation and Recognition⁴
- E1515 Practice for Application of Sprayed Fire-Resistive Materials (SFRMs)
- E2174 Practice for On-Site Inspection of Installed Fire Stops
- E2393 Practice for On-Site Inspection of Installed Fire-Resistive Joint Systems and Perimeter Fire Barriers
- 2.2 AASHTO Standard:
 - R18 Standard Recommended Practice for Establishing and Implementing a Quality System for Construction Materials Testing Laboratories⁵
- 2.3 ANSISO/IEC Standard:
 - 17020 General Criteria for the Operation of Various Types

³Withdrawn. The last approved version of this historical standard is referenced on www.astm.org.

⁴Available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001, http://www.transportation.org.

What to look for *beyond* the basic qualifications:

- Reputation - check references.
- Service - responds promptly and anticipates needs.
- Takes the time to understand your project and get the scope right.
- Profitable and cares about reasonable contract terms - (*so they will be there for you in the future*).
- Participates in professional organizations such as ASFE.
- Invests in new technology.
- Invests in well-educated and trained employees.
- Invests in the community.

How Can CoMET Firms Add Value?

- Reviews related plans and specifications prior to construction.
- Provide timely information regarding construction activities and observed non-compliances.
- Communicates regularly with the design and construction team.
- Documentation, Documentation, Documentation!!...

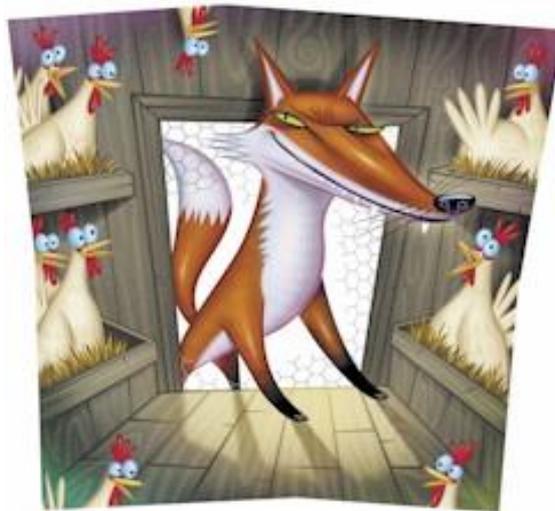
Who Should the CoMET Firm Work For?

The Contractor or The Owner?



Fox Watching the Hen House

- The potential for problems increases when the contractor has the responsibility for choosing a CoMET firm.
- If it is necessary to have CoMET costs paid by the contractor, the owner should negotiate with a qualified CoMET firm and include that cost as an allowance in the bid documents.
- This will keep the engagement of these technical/professional services from becoming part of the price competition of the contractor's bid.



The Owner's Role in Adding Value:

- The CoMET firm's fees are minor compared to overall project costs and other consultants - but their work often impacts overall costs. Here's how the owner can help the engineer add value:
 - Hire based on qualifications, not fee
 - Get the CoMET firm involved early.
 - Be honest - don't withhold important details.
 - Communicate your expectations. Make the CoMET firm a team member and keep them informed (meetings, changes, etc.)
 - Use the CoMET firms knowledge of local codes and requirements to answer questions and help address problems that arise.

The Road to a Successful Project...

- Engage the best qualified firm (get involved early)
- Develop trusted relationship with a CoMET firm
- Let the CoMET firm help you to develop the appropriate scope and budget
- Understand the value of CoMET firms

Questions?