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Special Inspections

Art Dahlberg
Commissioner
City of Milwaukee
Department of Neighborhood Services

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Structural Failures

1970 Commonwealth Avenue Building 4 killed, 20 injured

1971 Brockport Ice Arena No casualties

1973 Bailey's Crossroads Building 14 killed

1976 Teton Dam 11 killed

1978 Hartford Coliseum No casualties

1979 Kemper Arena No casualties

1981 Cocoa Beach Building 11 killed, 23 injured

1981 Hyatt Regency Walkways 113 killed, 188 injured

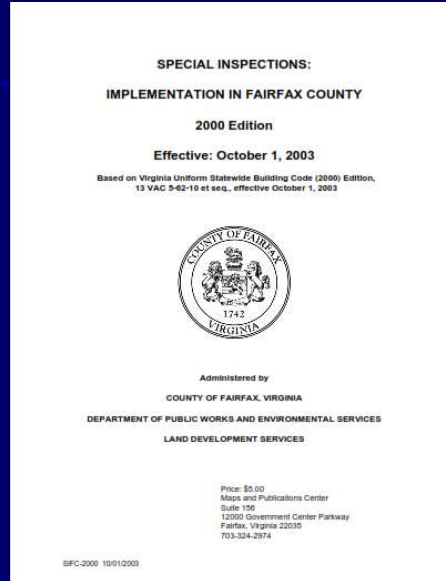
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1973 - Baileys Crossroads Fairfax, Virginia



4

Fairfax County, Virginia



5

1978 - Hartford Coliseum Hartford, Connecticut



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1979 - Kemper Arena Kansas City, Missouri



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1981 - Harbour Cay Condominium Cocoa Beach, Florida



5-8a: Harbour Cay Condominium collapse (NBS/NIST)

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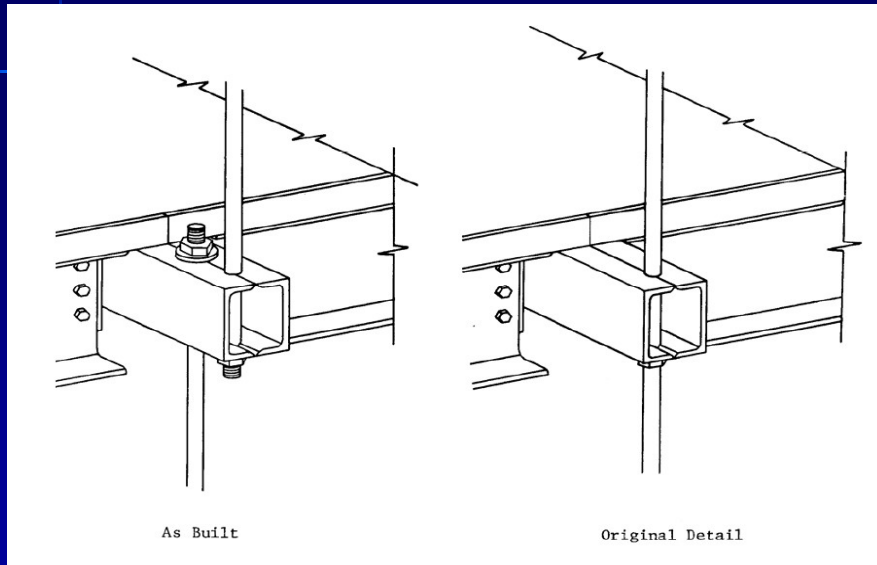
1981 - Hyatt Regency Kansas City, Missouri



2-2: The Kansas City Hyatt Regency atrium walkways (photo from NBS/NIST)

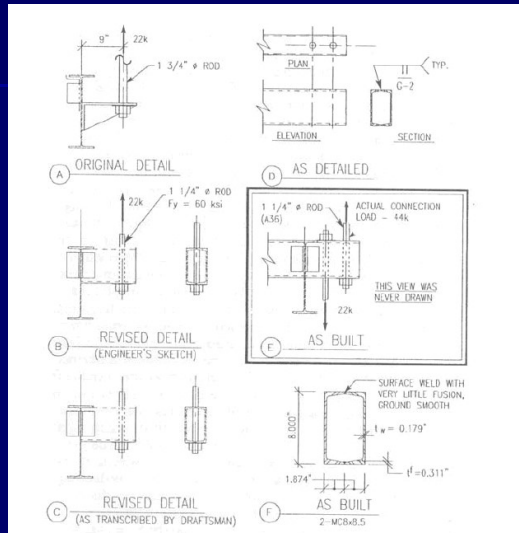
9

As Built and Original Detail



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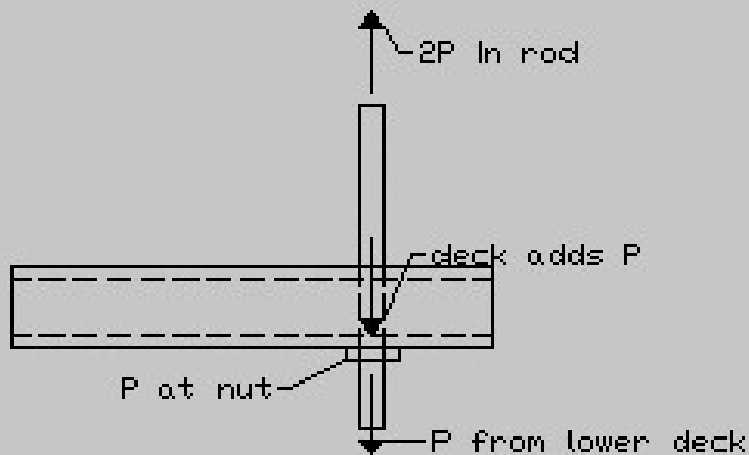
Hyatt Regency – Kansas City



2-8: The evolution of the failed connection (Luth, 2000, p. 55)

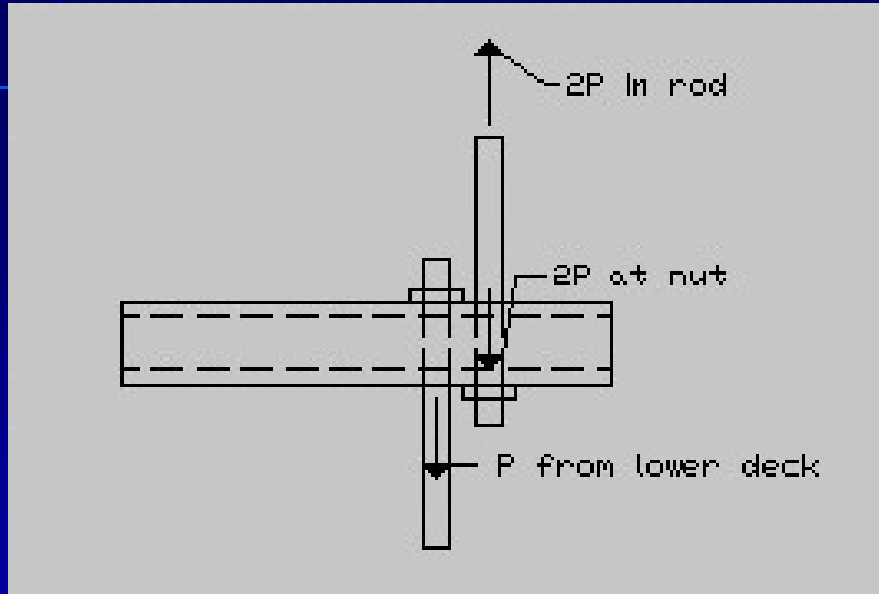
11

As Designed



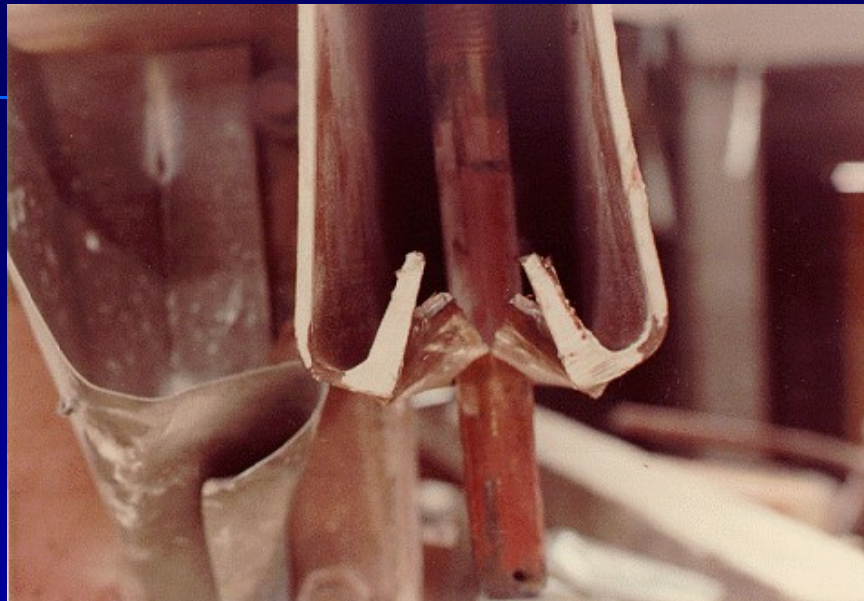
12

As Built



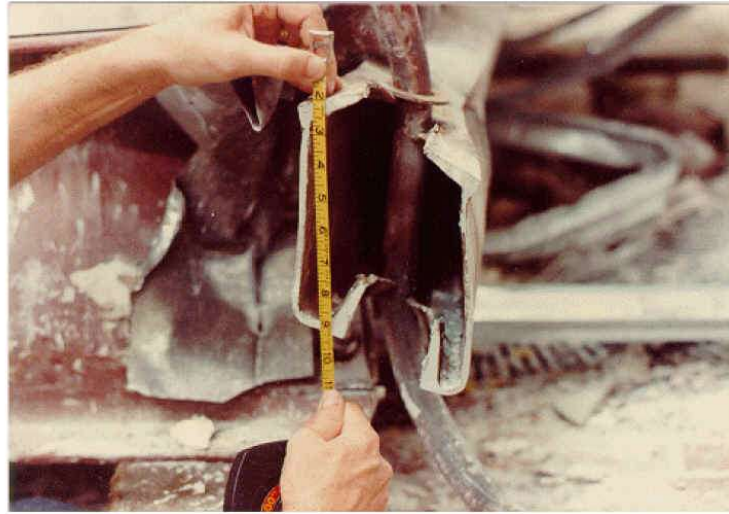
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Hyatt Regency – Kansas City



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Hyatt Regency – Kansas City



2-5: Failed 4th floor beam, photo courtesy Lee Lowery, Texas A&M University (5th.gif)

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Hyatt Regency – Kansas City



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Hyatt Regency – Kansas City



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Hyatt Regency – Kansas City



2-3: Scene of the Kansas City Hyatt Regency collapse, photo courtesy WJE

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U.S. Congressional House Report No. 98-621

"Report on Structural Failures in Public Facilities", released in 1984,

1. A need for better communication / organization within the design and construction team.

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U.S. Congressional House Report No. 98-621

"Report on Structural Failures in Public Facilities", released in 1984,

2. More involvement in the construction phase, by the SER. The report urged that code organizations, "should make every effort to ensure that provisions are written into building codes...which make the on-site presence of the structural engineer mandatory during the construction of structural components...".

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IBC CHAPTER 17

Structural Test and Special Inspections

SECTION 1701 GENERAL 1701.1 Scope. The provisions of this chapter shall govern the quality, workmanship and requirements for materials covered. Materials of construction and tests shall conform to the applicable standards listed in this code.

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Special Inspection Survey of the 35 Largest US Cities

- 31 Cities adopt the Chapter 17 - Structural Test and Special Inspection requirements of the IBC
- 1 City does not adopt Chapter 17 (El Paso, Texas)
- 2 Cities are regulated by a statewide code which relies on the design professional and supervision (Indianapolis, Indiana and Milwaukee, Wisconsin)
- 1 City regulated by a statewide code having a modified statewide special inspection program (Jacksonville, Florida)

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MODEL PROGRAM FOR SPECIAL INSPECTION

BASED ON IBC - CHAPTER 17



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Definition Special Inspection

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 (see Section 1704).

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Table 1704.3 Steel Construction

VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC	REFERENCED STANDARD ^a	IBC REFERENCE
1. Material verification of high-strength bolts, nuts and washers:				
a. Identification markings to conform to ASTM standards specified in the approved construction documents.	-	X	AISC 360, Section A3.3 and applicable ASTM material standards	
b. Manufacturer's certificate of compliance required.	-	X	-	-
2. Inspection of high-strength bolting:				
a. Snug-tight joints.	-	X	AISC 360, Section M2.5	1704.3.3
b. Pretensioned and slip-critical joints using turn-of-nut with matchmarking, twist-off bolt or direct tension indicator methods of installation.	-	X		
c. Pretensioned and slip-critical joints using turn-of-nut without matchmarking or calibrated wrench methods of installation.	X	-		

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Definition

Special Inspection, Continuous

The full-time observation of work requiring *special inspection* by an *approved* special inspector who is present in the area where the work is being performed.

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Definition

Special Inspection, Periodic

The part-time or intermittent observation of work requiring *special inspection* by an *approved* special inspector who is present in the area where the work has been or is being performed and at the completion of the work.

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Table 1704.4 Concrete Construction

**TABLE 1704.4
REQUIRED VERIFICATION AND INSPECTION OF CONCRETE CONSTRUCTION**

VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC	REFERENCED STANDARD*	IBC REFERENCE
1. Inspection of reinforcing steel, including prestressing tendons, and placement.	-	X	ACI 318: 3.5, 7.1-7.7	1913.4
2. Inspection of reinforcing steel welding in accordance with Table 1704.3, Item 5b.	-	-	AWS D1.4 ACI 318: 3.5.2	-
3. Inspection of bolts to be installed in concrete prior to and during placement of concrete where allowable loads have been increased or where strength design is used.	X	-	ACI318: 8.1.3,21.2.8	1911.5, 1912.1
4. Inspection of anchors installed in hardened concrete.	-	X	ACI318: 3.8.6, 8.1.3, 21.2.8	1912.1
5. Verifying use of required design mix.	-	X	ACI 318: Ch. 4, 5.2-5.4	1904.2.2, 1913.2, 1913.3
6. At the time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	X	-	ASTM C 172 ASTM C 31 ACI 318: 5.6, 5.8	1913.10

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Table 1704.5.1 Masonry Construction

**TABLE 1704.5.1
LEVEL 1 REQUIRED VERIFICATION AND INSPECTION OF MASONRY CONSTRUCTION**

VERIFICATION AND INSPECTION	FREQUENCY OF INSPECTION		REFERENCE FOR CRITERIA		
	CONTINUOUS	PERIODIC	IBC SECTION	TMS 402/ACI 530/ASCE 5 ^a	TMS 602/ACI 530.1/ASCE 6 ^b
1. Compliance with required inspection provisions of the construction documents and the approved submittals shall be verified.	-	X	-	-	Art. 1.5
2. Verification of f'_m and f'_{uc} prior to construction except where specifically exempted by this code.	-	X	-	-	Art. 1.4B
3. Verification of slump flow and VSI as delivered to the site for self-consolidating grout.	X	-	-	-	Art. 1.5B.1.b.3
4. As masonry construction begins, the following shall be verified to ensure compliance:					
a. Proportions of site-prepared mortar.	-	X	-	-	Art. 2.6A
b. Construction of mortar joints.	-	X	-	-	Art. 3.3B

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Report Requirement

1704.1.2 Report requirement.

Special inspectors shall keep records of inspections.

The special inspector shall furnish inspection reports to the building official, and to the registered design professional in responsible charge.

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Report Requirement

1704.1.2 Report requirement.

Reports shall indicate that work inspected was or was not completed in conformance to approved construction documents.

Discrepancies shall be brought to the immediate attention of the contractor for correction.

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Report Requirement

1704.1.2 Report requirement.

If they are not corrected, the discrepancies shall be brought to the attention of the building official and to the registered design professional in responsible charge prior to the completion of that phase of the work.

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Report Requirement

1704.1.2 Report requirement.

A final report documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted at a point in time agreed upon prior to the start of work by the applicant and the building official.

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Definition Structural Observation

The visual observation of the structural system by a registered design professional for general conformance to the approved construction documents. Structural observation does not include or waive the responsibility for the inspection required by Section 110, 1704 or other sections of this code.

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