



# Fire Protection Training

Procedures Handbook 4300

BUILDING CONSTRUCTION

**TOPIC:** Indications of Potential Building Collapse

**TIME FRAME:** 1 Hour

**LEVEL OF INSTRUCTION:**

**BEHAVIORAL OBJECTIVE:**

*Condition:* A written quiz

*Behavior:* The student will list and describe indications of potential building collapse.

*Standard:* With a minimum of 70% accuracy

**MATERIALS NEEDED:**

- Appropriate visual aids
- Audio visual equipment

**REFERENCES:**

- Building Construction for Fire Suppression Forces, National Fire Academy
- Fire Protection Handbook, NFPA, 16th Edition, Section 7, Chapters 8, 17
- Basic Urban Search and Rescue, USAR 1990, Structural Hazard Identification at the Urban Search and Rescue Site, D.J. Hammond

**PREPARATION:**

During emergency incidents, be it fire, flood, earthquake, or any other major disaster, the strength of the construction materials used in the involved buildings can be greatly compromised. It is imperative that firefighters have a basic understanding of the indicators of a potential building collapse if they are to safely conduct the requisite operations.





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INDICATIONS OF POTENTIAL  
BUILDING COLLAPSE

PRESENTATION	APPLICATION
<ul style="list-style-type: none"><li>a. Unreinforced (pre 1933)<ul style="list-style-type: none"><li>(1) Rafter tie plates and bars protruding from wall</li><li>(2) Rafter tie plates and bars pulled back into wall</li><li>(3) Cracks running full wall height</li><li>(4) Numerous individual bricks fragmenting or breaking in a highly localized area</li><li>(5) Separation of sections of plaster overcoat</li></ul></li><li>b. Reinforced masonry<ul style="list-style-type: none"><li>(1) Cracks running full wall height generally along mortar lines</li><li>(2) Reinforcing rods or bars are visible</li><li>(3) Separation of sections of plaster overcoat from underlying wall</li></ul></li><li>2. Unprotected steel construction<ul style="list-style-type: none"><li>a. Warping, sagging, or distortion of steel support members<ul style="list-style-type: none"><li>(1) Begins to weaken at 500° F</li><li>(2) Fails at 1000° F</li></ul></li><li>b. Roughened appearance of steel support members</li></ul></li></ul>	<p>Damage occurs after prolonged exposure of 450° F</p>



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<ul style="list-style-type: none"><li>c. Cracking of columns, corbels and beams particularly in precast structures</li><li>d. Cracking of welds</li></ul> <p><b>II. INDICATORS OF COLLAPSE DUE TO EARTHQUAKE, TORNADO OR EXPLOSION</b></p> <p>A. General Indicators for all Building Construction Types</p> <ul style="list-style-type: none"><li>1. Out of plumb, bulging or leaning walls</li><li>2. Sagging floors or roofs</li><li>3. Abnormally tight doors and or windows</li><li>4. Windows periodically breaking without apparent cause</li><li>5. Cracking, groaning or creaking noises</li><li>6. Collapsed, broken, cracked or separated chimney</li><li>7. House sliding off foundation</li></ul> <p>B. Specific Indicators for various Building Construction Types</p> <ul style="list-style-type: none"><li>1. Masonry Construction<ul style="list-style-type: none"><li>a. Unreinforced (pre 1933)<ul style="list-style-type: none"><li>(1) Rafter tie plates protruding from wall</li><li>(2) Rafter tie plates pulled back into wall</li><li>(3) Cracks running full wall height</li></ul></li></ul></li></ul>	<p>Information sheet #3</p>



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<ul style="list-style-type: none"><li>(4) Numerous individual bricks fragmenting or breaking in a highly localized area</li><li>(5) Separation of large sections of plaster from underlying masonry wall</li><li>b. Reinforced<ul style="list-style-type: none"><li>(1) Cracks running full wall height</li><li>(2) Reinforcing rods or bars exposed</li><li>(3) Separation of large sections of plaster overcoat from underlying wall</li><li>(4) Separation of one course or layer of bricks or blocks from underlying courses or layers</li><li>(5) Parapets and or cornices separated, cracked or fallen from building</li><li>(6) Cracked corners</li></ul></li><li>2. Steel Construction<ul style="list-style-type: none"><li>a. Cracking in slabs adjacent to columns</li><li>b. Broken or damaged connection between wall and floor</li><li>c. Loose or broken connection between beams and columns</li><li>d. Badly cracked walls, columns or corbels</li><li>e. Broken welds at beam to column connections</li></ul></li></ul>	



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PRESENTATION	APPLICATION
<p><b>III. INDICATORS OF COLLAPSE DUE TO WATER (FLOOD, FIRE STEAMS, ETC.)</b></p> <p>A. General Indicators for all Building Construction Types</p> <ol style="list-style-type: none"><li>1. Sagging floors or roofs, or ceilings</li><li>2. Out of plumb, bulging, or leaning walls</li><li>3. Cracking, groaning or creaking noises</li><li>4. Water confined to some depth within structure</li><li>5. Volume of water entering building exceeds amount exiting the building</li><li>6. Washed out foundation<ol style="list-style-type: none"><li>a. Clearly exposed</li><li>b. Undermined</li></ol></li><li>7. Building sliding off foundation</li></ol>	



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## ***SUMMARY:***

All structural materials, whether classified combustible or noncombustible, are adversely affected when exposed to elevated temperatures during a fire. In many cases, damage may be compounded by excessive expansion and instability in unit design. During explosions and earthquakes, the structural stability of a building is compromised in numerous ways. Flooding from whatever source can also cause structural collapse. For safety reasons, firefighters must recognize the indicators of potential building collapse prior to collapse.

## ***EVALUATION:***

A written quiz.

## ***ASSIGNMENT:***

To be determined by instructor(s).