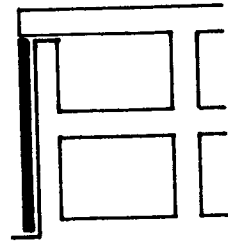


EXTERIOR WALLS

SUMMARY



The primary objective of the exterior wall is to keep out the weather - heat, cold, rain, snow and wind. In the process of achieving this goal, the wall is exposed to the brunt of these elements. The field tests in this area emphasize these primary objectives and are directed at conditions which impair this performance.

Undue movements of the exterior wall often create openings which will either now or in the future, cause problems. Ascribing the cause of these openings (cracks) is difficult and while they are categorized below in terms of the most likely cause, other factors can generate the same condition.

PERFORMANCE OBJECTIVE: PREVENT ELEMENTS FROM ENTERING BUILDING

TEST # 1: Control Undue Movement of Exterior Walls

Test Method: Determine past performance, if possible. Test by visually examining the complete exterior wall (outside and inside) from a distance of five feet with occasional examination from one foot in critical areas such as parapets, intersections and points of juncture with other subsystems. A vernier calipers, spark plug gapper or ruler calibrated to 1/32 inch should be used to measure separations. Depth of openings can be measured by a Depth Gauge employing a rod for probing (1/16 inch diameter and calibrated to 1/64 inch).

Oftentimes, problems not apparent on the exterior surface will be quite obvious inside because of the monolithic nature of interior materials, and their more uniform texture and color which should result in 'telltale' cracking.

A long level (at least 4 feet) and a simple vernier inclinometer (Empire Corporation, Milwaukee, Wis.) reading to 1° is used to determine horizontal and vertical displacement. Data on the location and size of openings is recorded and photographs taken of these conditions.

Measures:

- a. Due to thermal expansion and contraction of wall
 - Cracking at intersection of walls
 - Step cracking and buckling at parapets, especially corners
 - Cracks in center of wall
 - Cracking at intersection of low and high exterior wall
 - Horizontal crack between foundation and exterior wall
- b. Due to thermal expansion and contraction of structure
 - Vertical or step cracks under points of structural support
 - Horizontal crack at wall mid-section; lack of plumbness
 - Horizontal crack or lack of plumbness where parapet meets roofline due to expansion of roofdeck
 - Vertical cracks at parapet or exterior wall between column lines
 - Vertical cracks at wall intersections (due to creep)
- c. Due to structural loads
 - Vertical crack over mid-section of lintel or step crack at upper ends of lintel
 - Vertical cracks at column
- d. Due to settlement
 - Horizontal crack between wall and foundation
 - Random vertical cracks in wall
 - Step cracks at lower part of openings

TEST # 2: Resist Heat and Moisture Penetration At Openings

Test Method: Use test #1 with emphasis on the examination of caulking, gasketing and tolerances around all openings in wall.

Measures: Tolerance and seal of wall openings

- Missing or deteriorated caulking (caulking cracking, wrinkling, slump, adhesion, shrinkage, oil bleeding, brittleness, peeling)
- Gap between door and threshold (to 1/32 inch)
- Infiltration of air around door and windows
- Discoloration of openings around doors and windows

TEST # 3: Resistance to Moisture Penetration

Test Method: Same as test #2

Measures: Stains, discoloration due to moisture penetration

- Measure to 2 inches

TEST # 4: Control Condensation-Causing Heat Loss

Test Method: Same as test #3

Measures: Stains, discoloration

- Same as test #3

PERFORMANCE OBJECTIVE: PROVIDE SATISFACTORY APPEARANCE AND MAINTAINABILITY

TEST # 5: Resistance to Staining, Discoloration and Deterioration

Test Method: Same as test #1. Wall should be viewed from a distance of 5 feet.

Measures:

- Efflorescence from dissolved salts. Measure extent and severity to 1 inch
- Rust and dirt stains on surface. Measure to 6 inches. Spalling of surface (to 6 inches)
- Cracking, checking, blistering (to 1 inch)
- Fading, chalking
- Ink, pencil, marker paint damage

TEST # 6: Control Deterioration of Appearance

Test Method: Determine past performance if possible. Test by using routine maintenance procedures and commercially available cleaning materials to remove stains; discoloration; graffiti; etc., which is easily visible from 5 feet. The removal procedure should not exceed 15 minutes of application, scrubbing, etc.

Measures: Stain removal

- Completely removed (not visible from 2 feet)
- Trace remaining (just visible from 5 feet)
- Most removed (visible from 5 feet)
- Partially or not removed (easily visible from 5 feet)

REFERENCES

The most significant sources for development of these field tests were:

Performance Criteria for Exterior Wall Systems, National Bureau of Standards Report 9817. 4.25.68
This includes test descriptions in some detail and their background. Very comprehensive document on performance characteristics and the results of testing some typical specimens.

The Weathering and Performance of Building Materials, J.W. Simpson and P.J. Horrobin. Wiley, 1970.
Exterior materials emphasized. Excellent background for understanding performance required of various exterior wall materials.

The following were also helpful in test development:

The Contemporary Curtain Wall, W.H. Hunt, Jr., F.W. Dodge, N.Y., 1958

ASTM C509-66T, Cellular elastomeric, Performed Gasket and Sealing Material, Test #2,3

ASTM E283-65T & E331 Test for Air Leakage through Windows, Test for Water Resistance of Windows, Test #2,3

ASTM C67-66. Sampling and Testing Brick, Test #5

Fed. Standard #141a, method 6141. Gardner Washability Test, Test #6

SUMMARY OF EXTERIOR WALLS PERFORMANCE TESTS

PERFORMANCE OBJECTIVE: PREVENT ELEMENTS FROM ENTERING BUILDING

TEST # 1: Control Undue Movement of Exterior Walls

TEST # 2: Resist Heat and Moisture Penetrations at Openings

TEST # 3: Resistance to Moisture Penetration

TEST # 4: Control Condensation-Causing Heat Loss

PERFORMANCE OBJECTIVE: PROVIDE SATISFACTORY APPEARANCE AND MAINTAINABILITY

TEST # 5: Resistance to Staining, Discoloration and Deterioration

TEST # 6: Control Deterioration of Appearance