Failures: Inspection and Testing

Proper Selection of Investigative Procedures and Their Benefits

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As there ever been a contractor so blessed that has never experienced a job failure? Sooner or later every contractor is subject to the frustration of product failure. Failures occur when least expected, or predictably, when a job starts badly, gets progressively worse, and ends the way it began. Job problems come in a variety of shapes and forms but for this discussion, let’s consider cement plaster (stucco). The most frequently encountered failure in this system has to be cracking, perhaps followed by color variations.

When cement plaster cracks and the contractor is confronted by the owner and/or the architect, he is generally asked one or both of the following questions:

1. Was the work performed in a satisfactory manner or was the failure the result of other factors?
2. How should the cracks be repaired?

The answer to the second question may not be difficult and in fact the repair may be performed quickly and satisfactorily. However, if the cracking recurs or if reimbursement is a factor it may be necessary to respond to the first question. The next step is often to seek assistance. That assistance may be from a testing laboratory, engineer and/or an attorney. The scope, cost of repairs plus numerous other factors will generally determine who is approached first.

If the decision is to engage a testing laboratory the next question is whom. A matter of indecision is often solved by an acquaintance. If you are not familiar with testing organizations ask someone who has had problems similar to yours. Find out who they hired, what action was taken and whether all the contractors’ needs were fulfilled. This is important information to have before investing in laboratory testing. If you cannot find a source to recommend a testing facility, then start searching.

Consider only those organizations that are experienced in cement and plastering technology. Ask for references from similar work that has been conducted for others. Too often a contractor engages a reputable testing lab and receives a report that contains meaningless data unrelated to the pro-

A one-inch core is taken from a section of cement plaster that has been removed from failed installation. The one-inch core will be sawed in half and attached to a glass plate. The plaster is ground to create a thin section slide which will be examined in a microscope.
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problems encountered, or several pages of numbers and text that he cannot interpret. Its contents could be favorable, unfavorable or of no consequence. The report is useless unless the contractor now engages someone to interpret its contents and apply them to the problem failure. A comprehensive testing program may require substantial investment. Be as sure as you can that your investment of time and money will be fruitful.

The most desirable course of action is to engage an investigator who understands the plastering trade, understands cement technology and/or has a working relationship with a good testing facility. When this type of professional service is required, the selection and involvement of an investigator should be completed as soon as possible in order to provide maximum working time. Do not expect to hire a research professional one week or one month before a trial date and to then obtain a detailed, in depth study.

Investigation of failures and the ensuing testing require time. Each failure is in a sense unique and there are no routine answers or solutions. In fact, one should be suspicious of on-the-spot solutions. Construction failures are rarely caused by a single error or deficiency. Hasty conclusions are generally not worth the investment.

A reliable investigator will examine construction blueprints, specifications, change orders, code documents, construction sequence, will discuss installation procedures with company personnel, will consider materials of construction, their functions and compatibility, will consider environmental factors, weather, etc. before suggesting testing procedures. Before approval, learn what tests will be performed and why. Determine what will

Using the thin section slide prepared for petrographic examination of cement plaster as a negative, a section print can be produced. This photo covers an area approximately 25mm x 25mm (1 in. x 1 in.) and is approximately 25 microns thick.

This cross section of cement plaster clearly shows the wire lath in the upper center of the photo as diagonal black line and three smaller black rectangles. The scratch coat protrudes some considerable distance beyond the back of the lath (to the right). The brown coat is distinguishable as are two finish coats, obviously an area of lap.
constitute a representative test specimen, and what number of tests are required. Most important, determine what questions will be answered by the tests. The removal of specimens should be supervised by the investigator. Specimens should be packaged so as to avoid damage in transit to the lab.

Obtain an estimate of costs for all recommended tests and any potential additional tests that might be considered. Have these questions defined and answered before a commitment is made. After making a decision, your full and prompt cooperation with the investigator and laboratory is essential. Be frank and honest with all inquiries. If the investigator is to be helpful and successful, he needs your input.

What type of test might the investigator suggest? To understand how the lath was applied and tied, the depth of plaster penetration, etc., several portions of plaster may be removed from the building. Information obtained can determine compliance with the job specification and may be used in lab testing. The approximate composition of the plaster may be determined using several chemical and microscopic techniques.

An excellent research procedure is ASTM Designation C 856 “Petrographic Examination of Hardened Concrete.” This type of examination can yield some excellent data on water-cement ratio of the plaster, extent of cement hydration, carbonation, micro-cracking, bond between cement paste and aggregate, hardness of the paste, bond between plaster coats, and presence of contaminants in the plaster.

After careful examination of available and generated data, the investigator can provide possible reasons for failure. Don’t expect his answers to always be hard and fast. His conclusions will state what appears to be the most logical reasons for the failure based on observation, testing, and analysis of the particular project. Do not expect miracles.

The least expensive manner of coping with a plaster failure is give the problem immediate attention. Procrastination is usually followed by frustration, particularly if court action is eminent.

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