

Building Wall Insp. & Testing

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and Testing

Pete Fowler Construction Services, Inc.
July 2008

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Outline

1. Introduction
2. Inspection and Testing Standards
3. Visual Inspection
4. Testing
5. Performance Analysis
6. Reporting
7. Conclusion

Building Wall Insp. & Testing

1. INTRODUCTION

1. Introduction to Building Wall Insp. & Testing

Introduction (1 of 3)

The built environment has changed. It used to be that Owners would hire experienced, hard working Architects and Engineers who developed plans and specifications that were not perfect, but good enough that experienced, hard working General Contractors could hire experienced, hard working Trade Contractors to do the work of making a project happen. The construction was relatively simple, our expectations were less than perfection, so most projects were considered acceptable.

1. Introduction to Building Wall Insp. & Testing

Introduction (2 of 3)

Now we have consumers who expect increasing quality and decreasing prices in all products, a building industry that is not keeping pace with the quality and price advances many industries are making, consumers who are more litigious than ever, the built-environment has been altered in the last 20 years, including increased complexity, less fault-tolerant materials, and tighter, slower drying buildings, and consumers are more conscious of building-related health issues than ever.

Although solving building problems is hard, it is not impossible. Through case studies, horror stories, standards review and open discussion we will review the fundamentals of professionalism in building inspection and testing.

1. Introduction to Building Wall Insp. & Testing

Introduction (3 of 3)

We will describe a framework for ensuring conformance with consensus standards like the American Society for Testing and Materials (ASTM) E2018 Standard Guide for Property Condition Assessments: Baseline Property Condition Assessment Process, ASTM E2128 Standard Guide for Evaluating Water Leakage of Building Walls, and ASTM E 1105 Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.

Visual inspection, testing, performance analysis and reporting take experience, training and hard work, but there are standards that set the bar for excellence in professional practice, and we will review them in this program.

Building Wall Insp. & Testing

1. Introduction

- A. Case Study
- B. Who We Are
- C. Learning Objectives
- D. Elements of Inspection & Testing
- E. Issues & Locations
- F. Terminology

A. Case Study (1 of 4)

Construction Defect: Single Family Residence



A. Case Study (2 of 4)

Construction Defect: Single Family Residence

- Second owners of a high-end, semi-custom, 6,000 square foot single family residence in S-CA. Original owners sold after 1 year making a significant profit.
- Slab-on-grade, wood siding, masonry veneer wainscot, vinyl windows, composition shingle roof, French doors, wood and carpet floors, poor quality cabinets with fine finish doors.
- Constructed by a partnership between an architect and a contractor in a 6 home subdivision.
- Many irregularities during the planning period regarding investigation into the capacity of the soil to accommodate the septic system requirements of homes this large.

A. Case Study (3 of 4)

Construction Defect: Single Family Residence

- Second owners had immediate trouble with the plumbing/sewer system.
- As time went on, the owners had many other problems with the residence. We reviewed complaints and information delivered.
- Conducted visual investigation and concluded there were significant problems that were worth pursuit.
- Created an Issues List and a Room Schedule to identify where the issues occurred. Some issues included: site drainage, fencing deterioration, vapor emission through the concrete slab damaging the wood floor, retaining wall with inadequate drainage, masonry wainscot improperly installed at building walls, minor roofing problems, siding improperly installed, weather resistive barrier improperly installed, cabinet damage, improper flashing, inadequate rain gutters, door leaks, window leaks, plumbing problems and leaks, HVAC problems and electrical problems.

A. Case Study (4 of 4)

Construction Defect: Single Family Residence

- Conducted invasive investigation.
- Composed a Repair Estimate and issue by issue Report.
- Presented our findings at a meeting of all parties including defendants and cross defendants.
- Attended mediation process. Minor parties settled out of the litigation.
- Builder and their insurance company agreed to make repairs consistent with our findings.

B. Who We Are (1 of 2)

Pete Fowler Construction Services, Inc. is a team of consultants with expertise in all phases of building construction including design, estimating, construction management, inspection, testing, repair, construction defect forensics, and training. We specialize in delivering professional solutions for building projects in distress, dispute, or litigation, and in expert witness testimony. We listen to our client's individual needs, evaluate their situation, and use our unique systems to deliver comprehensive solutions with excellence, value, and integrity. Our methods are designed to guide clients through their situation in the fastest, most cost effective way, creating actionable information everyone can use to make informed decisions.

B. Who We Are (2 of 2)

**Pete Fowler
CONSTRUCTION
Services, Inc.**

Building Performance Analysis by PFCS

Managing quality in construction is hard. We can help. PFCS has been focused on issues of construction quality for the past decade, working on all types of construction projects by analyzing building failures and construction defects, performing inspections and testing, delivering total quality management (TQM) and construction training, writing articles and whitepapers, delivering technical presentations and offering sworn testimony. We have developed a modularized method for managing construction quality that is customizable to fit almost any project, budget and risk tolerance level.

Company Services

- Independent Quality Review (CA SB800)
- Building Envelope Consulting (WA EHB 1848)
- Building Inspection and Reporting
- Plan and Specification Review
- Testing and Leak Detection
- Installation and Repair Specification
- Mold and Moisture Assessment
- Property Maintenance Programs (OR SB 955)
- Expert Witness Testimony



To learn more, download our whitepaper entitled *Managing Construction Quality* from the Publications and Seminars page at www.petefowler.com.

C. Learning Objectives

- Introduction to building inspection & testing.
- Introduction to visual inspections.
- Show what are the activities included in good visual inspections
- Discussion of applicable standards that establish the highest professionalism.
- Review case studies in building wall inspections.
- Introduction to testing preparation and methods.
- Overview of building performance analysis
- Show examples of various inspection & testing reports and formats.

D. Elements of Inspection & Testing (1 of 3)

Before

- Working from Big Picture to Details
- Reason / Why Important?
- Reason / Why Test?
- When Not To Test
- Scientific Method
- PFCS Property Analysis Method
- PFCS Investigation & Testing Method

D. Elements of Inspection & Testing (2 of 3)

During

- Working from Big Picture to Details
- Problems / Sources
- Data Collection
- Documentation ("Just the facts, Ma'am")

D. Elements of Inspection & Testing (3 of 3)

After

- Working from Big Picture to Details
- Systematic Method
- Format
- Data Processing
- Deliverables
- Data: Qualitative vs. Quantitative

F. Terminology (2 of 3)

Vocabulary

- Building Performance
- Building Performance Problems (Sometimes hard to diagnose)
- Expectations
- Perfection vs. Practicality
- Suitability of Purpose
- Comfort
- Damage
- Mold
- Construction Defect Life Cycle
- Construction Defect
- Life Cycle

F. Terminology (3 of 3)

Vocabulary

- Life Cycle Cost
- Life Expectancy / Service Life
- Design
- Building Wall Types: Barrier, Membrane-Drainage, Hybrid
- Building Materials
- Energy Standards (CA Title 24)
- Durability
- Fault Tolerance
- Maintenance
- Codes & Standards Compliance
- Disclosure

General Discussion

The following is intended to cover general site inspection procedures. The particular items to be observed regarding special circumstances or particular inspection types will NOT be considered by this document.

The prime objective of collecting data in the field is DOCUMENTING OBSERVATIONS AND CONDITIONS. Our task is to collect data that can be analyzed to become the basis for a well documented and well substantiated Expert Opinion.

Ideally, the field investigation documentation will tell a story of a complete and professional investigation and observation. A qualified individual, who was not in attendance of this observation, should be able to develop a complete understanding of the documented situation and be able to render an Expert Opinion based on the photographs and field notes, **without ever having to speak with the original observer.**

Forensic – of, characteristic of, or suitable for a law court, public debate or formal argumentation (Webster’s New World Dictionary). What we are creating during each site inspection is a FORENSIC RECORD of the construction assemblies and their current condition. (Think of the OJ Simpson trial: a fellow named Matt Fong took a legal beating, and some say that OJ went free partially based on sloppy forensic protocol).

Keep in mind that the final form of the field notes will vary significantly based on the amount of pre-inspection information

available or generated by Pete Fowler Construction Services, Inc. including defect lists, floor plans, inspection checklists, trade checklists, etc...

General Categories of Inspection

- A. Construction Defect Claims: quality, performance, code and safety problems
 1. Plaintiff Construction Defect Project (Also see Residential and Commercial Property Condition Assessment)
 2. Developer / General Contractor Defense
 3. Subcontractor Defense
 4. Other / Special
- B. General Property Condition Assessment (See ASTM E2018 Standard Guide for Property Condition Assessments)
 1. Residential Property Condition Assessment ("Super" Home Inspection)
 2. Commercial Property Condition Assessment
- C. Catastrophic Events: soil or structural failures, leaks, flooding, earthquakes
- D. Traditional Construction Claims: process, change order and scheduling problems
- E. Personal Injuries: Job site accidents, injuries related to property (usually falls)

Pre-Inspection Checklist

The following questions shall be asked before the inspection (and answered as completely as current information allows):

1. When and where is the inspection?
2. How do I get there and how long will it take?
3. What type of inspection is this (Property Condition Assessment, Plaintiff, Developer, GC, Sub (Which Sub), Other / Special)?
4. What is the Project Name AND Number?
5. Who is the Project Manager or Project Coordinator?
6. What information is available (defect list(s), building plans, reduced floor plans, Inspection Checklists, etc...)? Is there a Site Inspection checklist applicable to this inspection?
7. What tools and equipment will be necessary? See reference to "Tool List" in Addendum Section 1 of this document.
8. Do you have a blank memory card for you camera, and batteries?
9. Number of visits you have made to the property, so the photo numbering can begin with the number of visits you have made (see photo numbering).
10. Are we meeting anyone on the site? Who?

If you have not answered the questions above, you are not fully prepared for a site inspection.

Methodology for Photography

The photographic record should give an over-all feel for the project and the issues that are being observed. In conjunction with the field notes (including matrices,

diagrams, floor plans, checklists, etc.), this record should compose a complete report of observations upon which Expert Opinions can be based.

The first photo in each inspection shall be the PFCS Photo Info Sheet with all applicable information filled in, including Project Name, Project Number, Location, Date, Photographer ID and Photo Number. This first photo should be a close-up and include **ONLY** the Photo Info and the PFCS, Inc. logo.

The Pete Fowler Construction Services, Inc. Photo Info Sheet shall be shot again upon any significant changes or particularly relevant observations during the inspection, especially change of address, building or unit.

In most cases, the photo immediately following the PFCS Photo Info Sheet should be an over-all shot (of the residence, building, unit, room, etc...), so that someone reviewing the photo record will have a feel for the location and project. Include some photographs of the neighborhood or surrounding streets so that a general feel of the locale can be had by simply reviewing the photo record.

A 'detail' photograph should be the end of a sequence that includes an over-all shot, a semi-detailed, and finally a detailed photo. Always shoot from general to detailed ("Work from large to small."). The photo record will be easier to decipher and the reviewer of the record will need to depend on the notes less if there is some perspective in the photo sequence. In some detailed photographs we should include our PFCS arrow business card / measuring gauge.

In taking field photographs during a site investigation, keep in mind that too many photos could make for a photo record that is so voluminous that it creates information

overload, but if we must err let it be on the side of too many photos; but remember, a large number of photographs do not take the place of good notes and diagrams.

Try also to keep in mind who we are working for, and not allow the entire photo record be dominated by shots of problematic locations if that is not the situation on site. If we are representing a developer or sub, and locations similar to those being observed or tested are not exhibiting problems, then be sure to capture some of these locations on film.

Be sure to get photographs of every AREA or LOCATION where ISSUES could occur and a large sample of every CONDITION where issues could occur.

Photograph Numbering

All consultants will have a 2-digit code (Pete Fowler = PF, etc...) that will be part of the field photograph numbering system. This code is typically your initials, though it may be different if your initials are already being used by another consultant. Be sure your code is on the Photo Info Sheet. The code shall be located directly to the left of the current photo number. Only 1 consultant shall take photos on any given photo memory card or make notes on any page of field notes.

Each photo will have a number:

- PF 01.001 will be Pete Fowler's 1st day, and the 1st photo taken on that day.
- PK 03.026 will be Paul Kushner's 3rd day, and the 26th photograph taken on that day.

When photographed, the Pete Fowler Construction Services, Inc. Photo Card should always have the current photo number (PF 1.1, PK 3.26, etc...)

If inspections last for more than 1 day, the photo numbering shall continue using the days of inspection as the leading number (the first photo on day 4 is number 04.001). If 6 months after an initial inspection, destructive testing takes place, and Pete Fowler returns to the field for the second time, the first photo is PF 02.001. Note that this numbering is per project; so many different projects may have a photo labeled as PF 01.001.

Detailed Field Notes Recommendations

Remember that the photographs and the field notes should tell the entire story of the project observations. If narrative is most appropriate, then so be it. If photo log, diagrams and sketches best tell the story, good. A checklist/matrix made from the plaintiff defect lists is an excellent resource for observation. Standard observation items for specific types of inspections such as fireplaces, stucco and roofing (see Addendum Section 1 for examples) are very helpful. Of course, pre-drafted floor plans of all plan types including reverse types are a great resource for field documentation.

Use PFCS grid sheets or pre-prepared floor plans and/or defect list matrices in conjunction with the grid pads. The use of the grid sheet is important because we want the observer to always be prepared and encouraged to draw detailed diagrams of conditions that might not be clear from photographs and written descriptions alone. The wide variety of information we collect is not conducive to the use of structured forms alone.

The inspector shall number every sheet of the field inspection record appropriately, with all applicable information, including consultant ID, project name, date, page number, inspection address (if applicable),

etc... This is to make sure no problems are encountered even if the sheets are mixed-up before being compiled in the job file.

Numbering shall begin with 1 and move sequentially through the end of the day. Restart each new day of inspection with page 1. If you find you need to insert a page, simply number it, for example, page 4.1 if it needed to be placed between pages 4 and 5.

The inspector shall make a reference in field notes to each photo taken, or at least every sequence. For example:

- 02.002-004; Right Elevation; DT @ DR WDO, 40-50 SH AL WDO. (Photos 02.002 to 02.004 depict destructive testing at a dining room window on the right (elevation from exterior), the window is 4'0" wide by 5'0" tall and is a single hung type of aluminum window.)

Standard architectural abbreviations are appropriate in field note taking.

If reference materials (such as defect lists, plans, etc...) are used in generating the field analysis, make reference thereto in the field notes. If possible, upon returning to the office, make a copy of the reference materials and attach them as addendum to the field notes before filing.

Attempt to limit subjective descriptions of conditions described in field notes to GOOD, FAIR or POOR. As much as possible, live by Sergeant Friday's mantra "Just the facts, ma'am."

Sometimes it is appropriate to make a note, in the body of what is primarily a photographic log, which is not specifically related to any particular photograph. To make such notation use the format ***Note D# P# N#** (D is the day number, P is the page number, and N is the note number on that page). For example, *Note 2.6.2 is the second on page 6 of the second day of

inspection. The in-office photograph processor will add these notes to the processed photographs.

There are a total of 3 notation or reference types in notes,

- Photo reference numbers
- Note reference numbers
- Diagram numbers (see next section for more information)

With the above notation methods, any photo, photo caption or description, notes or diagrams can easily be traced to their source or referenced in the body of a report or memo and then easily found at a later date.

When inspecting a project that jumps from unit to unit and back again, we must use extra care in describing what is going on and where the notes and photographic record lead.

- For example, a DT is scheduled in Unit A for 8:00-10:00 a.m. At 9:15 Unit B is opened or "before" shots at the window drywall removal for a water test, but the inspection at Unit A is not complete. Depending on the subcontractor we are representing, it is likely that we need before shots.
- In this case the inspector should leave Unit A, and proceed to Unit B for "before" shots. Simply update the photo card with the new location and photo number, shoot the photo card with this information and begin at the new unit / location. Regardless of where you are in your note taking, begin a **new page** for the new unit, numbered sequentially with the rest of the notes.
- Update the photo card with the Unit A location and update the photo number, shoot the photo card alone with this information and begin again at Unit A. In any case the

photo roll number continues to run in sequence, as usual. Be sure to begin a new page of notes for Unit A when you return, even if there are only a few lines of notes at Unit B.

- This method will facilitate the common break-up of photos and notes by Unit. Notes for Unit A will not be on the same sheets as those for Unit B.

NEVER USE TWO CAMERAS DURING A PFCS INSPECTION.

NEVER INSPECT WITHOUT TAKING FIELD NOTES AS THE INSPECTION PROGRESSES. THAT IS, NEVER WAIT UNTIL AFTER THE INSPECTION TO TAKE NOTES. THERE WILL BE CIRCUMSTANCES WHERE YOU INITIALLY BELIEVE THERE IS NO ALTERNATIVE - THIS INITIAL THOUGHT IS INCORRECT. ALWAYS TAKE FIELD NOTES AS THE PHOTOGRAPHS ARE BEING TAKEN. ON RARE OCCASIONS, THEY CAN LATER BE UPDATED WITH MORE DETAIL (BUT THIS SHOULD BE A REALLY RARE OCCASION).

Recommendations for Field Sketching / Illustrating

The PFCS grid pads have squares that are ¼" x ¼". This makes approximating the scale of a drawing very simple. (For further assistance on appropriate scales, see the file "Scales with Grid Sheets")

If you draw a detail or diagram on the same page as other notes or in sequence on the same page as the photo log, then the diagram will have a simple designation that corresponds to the page number, such as (A/6). (A/6) would represent the 1st detail on page number 6 ((B/3) would be the 2nd

diagram on page 3 of the notes). Thus, you can easily refer to this same detail later in your notes. Don't forget to give each diagram a TITLE (Section @ MBR WDO or KIT Floor Plan). If the diagram is on a page by itself, number that page sequentially and make it part of the running notes giving the diagram a Detail Number (such as A/6) and Title.

Be sure to note appropriate dimensions on your sketch for reference. Make sure you note clearly if the diagram is a Plan view, Elevation, Section or Detail. And remember with diagrams and notes, paper is VERY inexpensive. A tiny diagram squished in-between a photo log makes little sense when a larger and more easily readable diagram would have only "cost" 1 sheet of paper.

To make sure the diagram is referred to by anyone who reviews the electronic photo record, refer to the diagram in one or more photograph descriptions. For example, field note:

- "1.9 Front ELEV w/ numerous STCO CR – see A/4."

The in-office photograph processor will interpret this note and type into the file:

- "PF 01.009; Front elevation; numerous stucco cracks – see diagram A/4."

If you do not make this reference in the photograph notes, it is possible for the reviewer of the photographic record to never know there was a diagram clarifying the condition being described, since the photos are processed electronically and the in-office processor cannot "Type" a diagram. We must refer to the diagram in a photo note so that we are drawn to the written field notes upon review of the electronically processed photo files; if there is no reference, we may never realize there are clarifying diagrams in the notes at all.

Correlation Between Field And Office Procedures

Upon returning to the office, the field notes should be immediately organized and logged in with the photograph memory card. This includes electronic processing of images, applying written annotations (descriptions) from the field notes to each photo image and adding note and diagram references from the field notes where applicable. The photographs and notes are then published in e-files that are easily deliverable electronically.

General usage and viewing of the photographic record may be done at any computer workstation on the network, e-mailed, or burned to CD-ROM for transport and use off-site. There is also a PFCS Photo Matrix where images can be sorted and viewed by many criteria other than the order they were taken, which is an amazingly powerful tool for use during the analysis phase of our work.

Upon completion of processing, photos will be numbered as they were in the field, for example:

- PK 03.026 will be Paul Kushner's 3rd day, and the 26th photograph taken on that day.

If an alternative form for organization of site inspection documentation is required for some reason (if say, sorted by Building, by Address or by Defect), then it will be so, but this will be the exception rather than the rule. The numbering system will remain the same, even if the photos are arranged differently for presentation. When the photo numbers remain the same, any photograph can easily be referenced back to who took it and the field note that corresponds with that photograph.