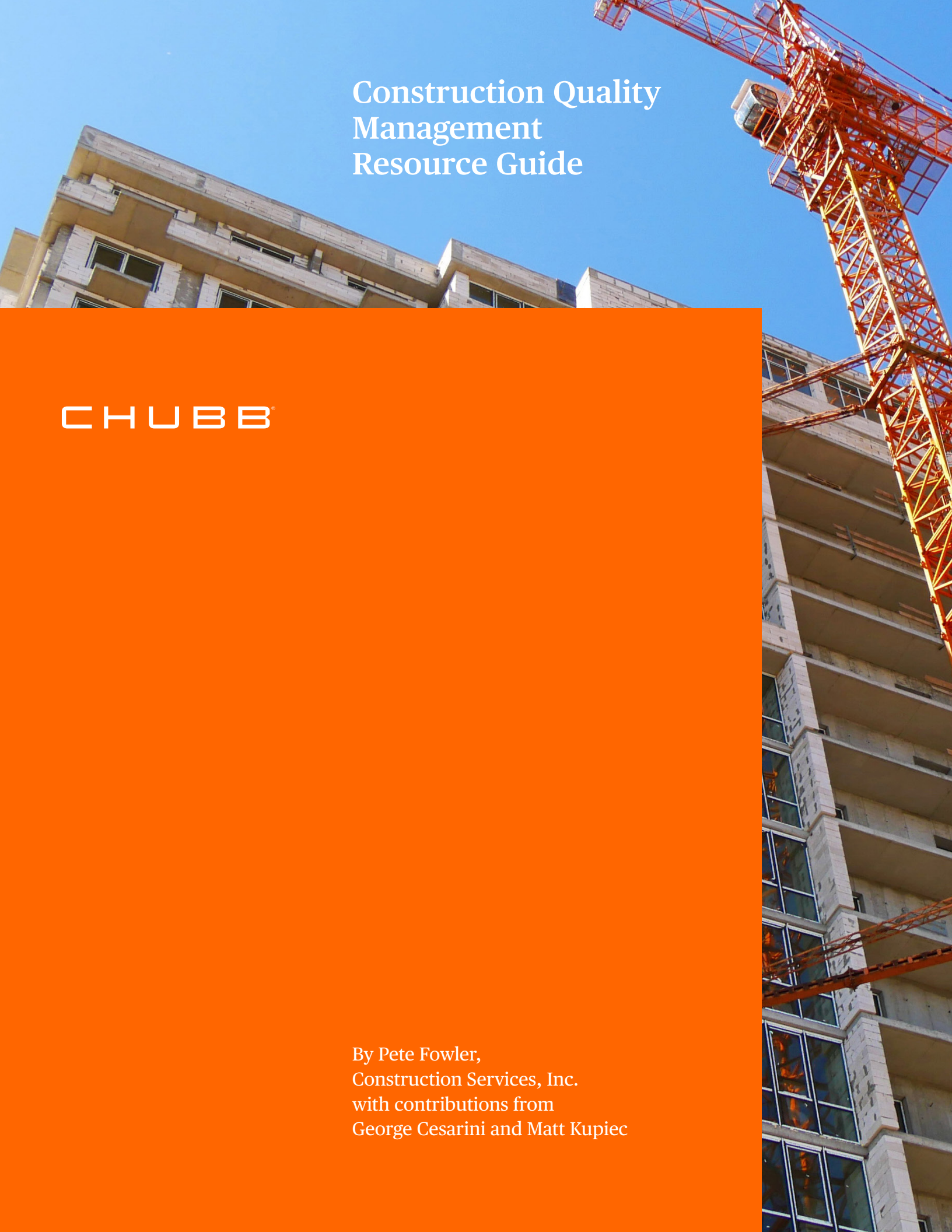




Construction Quality Management Resource Guide

CHUBB®

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Table of Contents

Introduction

1. Why We Are Here	3
2. The New World	3
3. Common Construction Defects	3
4. The Definition of Quality	6
5. Managing Project Quality	6

Managing Construction Project Quality

1. Introduction	7
2. Definitions	7
3. Project Definition	8
4. Roles & Responsibilities	8
5. The Project Quality Management Plan – Summary	11
6. Before Construction	12
7. During Construction	16
8. After Construction	17

Quality-Focused Organizational Maturity

1. Introduction	17
2. Levels of Maturity	18
3. Aspects of Maturity	19
4. Maturity Audit	21

Introduction

1. Why We Are Here

This guide is intended to serve people and organizations that work on building projects and those who intend to improve the quality of the projects and their organizations. It outlines a quality management process for all players in the building lifecycle: owners, developers, investors, insurers, designers, general contractors, material manufacturers, prime trade contractors (roofers, painters, electricians, etc.), subcontractors, and more.

A high quality or mature organization is required to reliably deliver quality projects. Most people in the building business know that project problems often lead to claims and litigation. Organizations like developers, insurers, and general contractors can attempt to influence or even mandate that trades and suppliers use quality management systems on their projects. Regardless of where your organization is in this process, it will benefit from improving project quality and organizational maturity.

2. The New World

Construction professionals are living in a new world. Consumers expect quality increases and price decreases in all products, they are more conscious of building-related health issues than ever before, they are more litigious, and there is a proliferation of attorneys.

Hiring good, experienced people and expecting them to get it all right is no longer enough. The world of business generally, and building projects specifically, are far too complex. We need a system of checks and balances, to “inspect what we expect.” For anything resembling a guarantee of success we need to use defined processes to ensure defects don’t run downstream.

3. Common Construction Defects

Historically, builders and occupants were most concerned with structural stability, so soils and structural systems were the prime focus of the problems we faced. Over the last 30+ years, we have seen fewer of these claims, and those we see are less catastrophic.

More stringent energy requirements in the 1970s resulted in buildings becoming tighter and less fault tolerant. The most common defects have been related to building enclosures like roofs, walls, and waterproofing. High-risk failure points including elements like showers and plumbing systems began to emerge. As building envelopes continued to tighten, less fault-tolerant materials came into use, and the decline of training in the construction trades began to take effect. Now, as buildings have become more complex due to green building, “smart building” features, and other dynamics, the plumbing, mechanical, and electrical systems are emerging as defective conditions more frequently.

High-Risk Building Elements

- **Foundations:** Although building foundations are failing less frequently than ever, vigilance must be maintained in executing construction which conforms with the design requirements. And although “non-structural” concrete cracking rarely drives a project into litigation, it’s often added to the list of complaints when it’s even slightly more pronounced than “normal.”
- **Sub-grade Waterproofing:** The tolerance for imperfection is low and moisture intrusion into basement level interiors, including parking garages, is one of the most commonly litigated issues.
- **Exterior Enclosure elements** including stucco/plaster, masonry, and siding & trim: Large areas like exterior building walls are rarely defective, unless there is excessive stucco cracking, because these areas are simple and uniform. The devil is in the details. Exterior walls usually fail at interface conditions like roof to wall, fenestration openings, product transitions, or penetrations. See the “SAMPLE CHECKLIST FOR EXTERIOR BUILDING WALL COMPONENTS AND DETAILS” and use it as a checklist in making sure you are ready to build and coordinate trades.
- **Exterior Glazing, Curtain Walls, and Fenestration** including windows, storefronts, and exterior doors: These elements are uniquely susceptible to problems because “the devil is in the details,” and these elements add complexity to the exterior building walls, which are intended to durably separate the interior from the exterior elements. Regardless of whether water is coming through or around these elements, the people involved in manufacturing, coordinating, and installing them are going to get the call. As discussed later in this article, some building elements have mock-ups built and tested even before being brought to the project site. Another option to build one element, or a set of representative elements, on-site and test before moving into full-blown production. The former is generally “safer” but more expensive; the latter is often more costeffective. Both are good practices for high-exposure elements like curtain walls, windows, storefronts, and exterior doors. Some municipalities, owners, and insurance companies require third-party peer review and/or quality control consultants for these elements, which is also, often, a worthwhile practice. See the “SAMPLE CHECKLIST FOR EXTERIOR BUILDING WALL COMPONENTS AND DETAILS” and use it as a checklist to ensure that you are ready to build and coordinate trades.
- **Exterior Coatings (Paint):** Similar to joint sealants, but even more so, exterior coatings have changed a lot in the last 40 years; but some in construction seem to think it’s an unskilled trade and that paying close attention to the manufacturer’s application instructions are not worth the time and money. Coating failures are common. More common are coatings that could have lasted for more than double their lifespan, if they were applied properly, on properly prepared surfaces. It’s wise to build in quality control hold-points, where third party coatings professionals or the manufacturer inspect and verify the quality of the preparation and application.
- **Roofing:** Roofs have traditionally been a focus for claims and for quality management because the risk is high due to the exposure to the elements and the cost of failures, including damage to interiors that require relocation of occupants.
- **Green Roofs/Rooftop Gardens:** What could go wrong!? Of course there are advantages to green roofs. But if you take all of the potential costs and problems associated with roofs, and add them to all of the potential costs and problems associated with waterproof decks, you will have approximated the costs and risks associated with green roofs. There is so much water, and there are so many interface conditions, and many of those interface conditions end up covered with living matter and walking surfaces, that we create a level of complexity and maintenance burden that will inevitably lead to problems on a significant number of projects, over time. As with all of the high-risk elements described here, success is possible through disciplined application of the principles laid out in this guide.
- **Waterproof Decks (Horizontal Waterproofing):** From simple and inexpensive liquid applied membranes, to complex and expensive pedestal systems, decks are tough to get right. Most decks have a large number of complex intersections and interactions with numerous adjacent trades, including the structure (concrete or framing), guard walls and rails, sheet metal, cladding, doors, sealants, plumbing, walking surface, penetrations, and more. The highest level of care and planning needs to be applied to design, drainage, and quality of construction.

- **Joint Sealants** are, by definition, an interface condition; and interface conditions are where problems most often begin. The science of joint sealant design and the craft of installation are well documented. There remain segments of the industry, especially low-rise residential construction, that are completely ignorant of this knowledge. On some projects the sealant work is contracted to an unrelated trade, as if the knowledge and skill required for success were that of a clean-up crew. We recommend against this strategy.
- **Tile & Stone Assemblies (Including Showers):** Tile assemblies in showers and baths are often subjected to more water than roofs, and have been the subject of many multi-million dollar lawsuits from leaks and damage. Even if it's not a wet assembly, integration of rigid tile into more flexible building assemblies, including wood or light gauge steel framing, often leads to failures like excessive cracking. These assemblies require attention to proper specification, quality of installation, and verification that they will remain water tight over time.
- **Plumbing Supplies & Drains; Sprinklers & Standpipes:** Accidentally introducing large volumes of water via plumbing leaks into a modern, tightly constructed building with modern "engineered" materials like OSB, paper faced gypsum, or fiberboard trim, leads to disasters and insurance claims every day. These new materials deteriorate and grow mold remarkably fast. We rarely get a leak mid-run in a pipe of any type, unless someone physically damages it; it's the field installed "interface conditions" that are the most common culprits as failure points. We often see failures at fittings like couplings, elbows, tees, plugs, caps, bushings, reducers, etc., or at transitions into fixtures or equipment. The quality of these connections is critical. Unfortunately, we often don't have the level of discipline that we need to "inspect what we expect". Therefore, proper specification, hiring of contractors with skilled workers, and inspecting for quality, is, arguably, more critical for these building elements than for any others. Plumbing systems should have a generic checklist, similar to our "SAMPLE CHECKLIST FOR EXTERIOR BUILDING WALL COMPONENTS AND DETAILS," so that project and element specific checklists can be composed to ensure that you are ready to build and coordinate trades. Some municipalities, owners, and insurance companies require testing of a representative number of randomly selected components after installation, to verify quality. Even if it's not imposed, consider building in hold points to "inspect what we expect". Destructive testing can be used to examine and test the quality of these connections, to ensure poor workmanship is not going to lead to catastrophe.
- **Heating, Ventilating & Air-conditioning (HVAC):** We believe we are seeing more HVAC claims because buildings are now tighter and more complex. In some cases, "Green Buildings" are built so tight, and their materials so lacking in fault-tolerance (like OSB that deteriorates rapidly when there is moisture and little drying potential), the HVAC system designers, installers, and operators are being blamed for allowing warm interior air to get too humid, which can then migrate toward colder exterior surfaces and condense into water inside wall cavities. This creates a difficult quality management situation for non-expert contractors, who need to create quality checks during the construction process; this sometimes requires third-party specialty experts.
- **Building Automation:** Increased complexity is being introduced into the built environment through building automation or "smart building" systems and technologies, including the rise of "the internet of things" where individual components are connected to and managed via the internet in real time without human intervention. And this complexity creates far greater potential for error. These are systems that occupants interact with daily and have been promised significant benefit, including energy cost savings, from their use. So ensuring quality by proper design and execution is time well spent.
- **Fountains & Swimming Pools:** Fundamentally, these are not complex assemblies. Humans have been building them for hundreds of years. Unfortunately, that much water often causes problems; especially in expensive projects with high profile water features and above-grade pools. Peer review of the designs are recommended due to the geotechnical and structural work supporting these incredibly heavy structures and the interface conditions where water might escape. Quality management hold points to verify conformance with the design are also advised.
- **Fine Grading & Drainage:** As discussed above, it's hard to get subgrade waterproofing perfect. The first line of defense is to keep the water away from the building. It's surprising how many times we have found a roof drain connected to a perforated pipe in a "French Drain" style system, thereby injecting water into a subgrade adjacent a foundation. We have to ensure all "bulk water" is moved away from the building by design, and that the construction conforms with that smart design.

4. The Definition of Quality

In our search for a definitive definition of “quality,” we found that a single definition is impossible. Even the dictionary has 14 definitions! The definition depends on who you are and what you’re talking about.

Our Working Definitions of Quality, a Quality Project, and a Quality System

Quality is fitness for use (Juran 1974), including meeting or exceeding needs, now and in the future, reliably, durably, with limited variation, and virtually defect free; and it helps if joy is sparked in those who recognize excellence.

A Quality Product meets or exceeds the customers needs, now and in the future. Aspects of a Quality Product include it being: (1.) fit for its intended use, (2.) cost effective, (3.) delivered on time, (4.) reliable, (5.) durable, (6.) with limited variation, (7.) virtually defect free; and (8.) it helps if joy is sparked in people who are able to recognize excellence.

To deliver a Quality Product, a **Quality System**, with the objective of delivering a Quality Product, must be employed. Components of the system should include definition of: (A.) the customer needs, (B.) the product itself and acceptable variation, (C.) the budget/costs, (D.) the time of delivery, (E.) the process for creating the product, (F.) the process for verifying the parties are capable of doing the right things right, every time (i.e. “Organizational Maturity”), (G.) the process for verifying the parties involved are actually doing the right things right, every time, during creation of the product, (H.) and the process for verifying that the right things were done right, at the time of delivery.

5. Managing Project Quality

As we will elaborate below, to manage project quality there are activities that need to be undertaken **before and during construction**. In order to document the good work, to ease that transition from construction to the building operations team, to capture lessons learned, and to ensure future projects benefit from those lessons because we have all learned that feedback is the breakfast of champions, there are activities **after construction** that should take place.

Planning backward from a successful end requires we define clearly what good performance (high quality work) looks like. This definition can be shared with the project players, and then we “inspect what we expect.” Sometimes the inspecting is by third parties like the building official or deputy inspectors working on behalf of the governing authority. Sometimes this quality inspection is by specialty consultants with deep expertise in systems like waterproofing, building walls, roofs, etc. However, the first line of quality inspection should always be by trained workers themselves and their immediate supervisors. Then, the company doing the work should have a verification mechanism internally to make sure that defects don’t run downstream.

Managing Construction Project Quality

1. Introduction

The major objectives of quality management are to (1.) minimize the defects on asset delivery or handover, and (2.) identify and solve defects and issues before your customers do – safeguarding your reputation. The additional benefits of a well-planned and executed quality management process include increases in speed of activity through the system, professionalism, and predictability. Decreases in confusion, friction, re-work, costs, and drama.

As Albert Einstein said: “Everything should be made as simple as possible, but no simpler.” Therefore, we recommend a simple, written Before-During-After (B-D-A) Plan:

- Before: **Define** what good performance looks like.
- During: **Verify** by inspecting what we expect.
- After: **Memorialize** and learn.

See the details below, but in short: During the pre-construction (“Before”) phase, we will make sure our design hypothesis (project definition) is reasonable by having someone with experience in building performance issues review, comment, and recommend improvements. We make sure the plans, specifications, standards, and contracts are all consistent in describing to the contractors, those who will actually install the specified materials, “what good performance looks like.” We will establish a procedure to “verify” at specified hold points during construction; we will “inspect what we expect” to verify conformance with the project definition (plans, specifications, standards, and contracts). After the initial assemblies are installed, we might even test them to verify performance, or build a separate mock-up and test it (whichever is more cost effective).

2. Definitions

- **Plans and Details:** Graphic representations of construction.
- **Specifications:** Specs are the written representation of construction, which usually include a greater level of detail regarding products and materials, installation or application process, quality management, and performance.
- **Construction Contract:** Agreement between two or more parties for the delivery of construction; plans and specifications are used as the definition of what is being bought and sold.
- **Standards:** Documents, with graphic and written information, referenced by plans, specifications and construction contracts, which specify performance criteria and/or methods in greater detail than typical plans or specifications. Standards are created by standards-setting bodies like ASTM, product manufacturers, and industry trade groups.
- **Scope of Work:** The written definition of what is being bought and sold. Usually articulated in writing by making a list or description of responsibilities and specific exclusions (work that is NOT included), with references to plans, specifications (prescriptive or performance based), and industry standards. We strongly prefer when the scope can be summarized in a 5-15 point list, or conform to the fundamentals of a 2 or 3 level “Work Breakdown Structure,” collectively representing 100% of the project scope.

- **Hold Point:** Critical time in the construction process where construction should stop for verification of conformance with plans, specifications, standards and contracts. Verification can include inspection, testing, recording, and reporting.

3. Project Definition

We need to make sure the “project definition” is crystal clear. Many projects that have “gone bad” stem from the following issues:

- Unclear designs, where the plans say one thing (or are silent) and details conflict with one another
- Specifications in conflict with details
- Contracts that make vague reference to the “plans & specs”
- Sparse and confusing RFIs
- Change orders that are unclear
- Project players that agreed verbally to do work in a way that no one ever bothered to write down
- Lack of communication with the architect or engineers about said work

In today’s complex world, we need to avoid anyone onsite thinking “That’s how we always do it” as an acceptable mode of operating. It’s not. If we ever hear “Don’t tell me how to do my job! I’ve been doing this for 30 years!!” then we should know then that we have not laid the proper foundation for managing construction quality. Everyone’s scope of work should be well known and written in adequate detail to verify conformance in a way that everyone can agree when the work is done acceptably. Getting a clear, specific and detailed project scope of work is a critical step in the construction project management process, and it is where a project’s “quality” should be established.

Plans and specifications are a hypothesis that if the builders construct in conformance, then the result will be a quality project. Therefore, we need to make sure we understand the plans and specifications, and we need to take action to validate the hypothesis at various points in the process. We should consider peer review and constructability analysis prior to planning for the construction. Then we need to plan the construction by breaking the work into sensible work packages by trade, and identify quality control hold points where we will stop and evaluate the work in process. Either before or during the initial stages of construction, we can test the building assemblies to ensure they are performing to the level of expectation.

4. Roles & Responsibilities

Third-Party Quality Management Consultants and the Cost of Quality

The old adage “We offer three kinds of service: Good, cheap, and fast. But you can only pick two.” is no longer true in most aspects of the modern economy; Good, cheap, and fast have actually become a consumer expectation. That’s because application of modern quality tools like organizational maturity, Lean, Six Sigma, and others, genuinely make products (including construction) better – cheaper – faster.

So in the end “Quality” should be free; and maybe even increase profitability. But realistically, in the beginning, quality improvement is an investment. So far, we have only touched briefly on third party consultants versus project players self-managing quality. The use of third parties, in addition to those mandated by the governing authorities like building departments, varies greatly. This guide recognizes that at the pinnacle of organizational maturity, most of the quality management is by the company performing the work itself. But the building business is a long way from universal self-policing for quality. Also, the business is inherently risky, and use of third-party inspectors is an often employed risk management activity. Most of the players in the process have a profit motive to get the project completed as quickly and inexpensively as possible, so it sometimes takes an outsider, who’s job it is, to have the courage to ring a bell that slows (or even stops) progress if quality standards are not being met.

Therefore, third party quality consultants should be hired and managed the same way we are describing the use of any contractor. That is, the work should be defined and specified clearly, and there should be built-in mechanisms to “inspect what we expect” at specified intervals. This entire guide should be consistent in communicating this process, regardless of whether it’s a third party consultant reporting to an Owner’s Representative, a subcontractor reporting to a general contractor, or an employee reporting to a manager; the discipline must be exercised to “inspect what we expect” and deliver consequences. The consequences for excellent performance should be praise and payment.

If parties in the process can not or will not conform with the required standards, then we must be willing to administer consequences. You will get resistance. If a contractor has signed a contract to perform consistent with a specified standard, it will sometimes take a strong will to make some of them perform. Always be fair; but also be firm.

Key Project Players

- **Owner/Developer:** Homeowners, custom/spec builders, home builders, private or public companies or developers, state or federal governments, municipalities, school districts, etc.
- **Owner’s Representative/Construction Manager:** A company that specializes in construction management that is responsible to advocate for the owner’s best interests by overseeing the construction process, including scheduling, change management, and progress payment application processing.
- **Designers:** Architect, engineers, and specialty designers like waterproofing, roofing, and interiors.
- **General Contractor:** A contractor with a prime contract with the owner who performs and/or supervises the work of multiple trades.
- **Subcontractors:** A contractor that contracts with a general contractor, not directly with the owner.
- **Prime Trade Contractors:** Trade contractors who contract directly with the owner.

Quality Professionals

- **Company Quality Executive (Champion):** This is the corporate executive who promotes quality throughout the company.
- **Project Quality Team:** This is the team responsible for preparing and executing the quality plan for a specific project.
- **Project Quality Executive:** This is a management-level leader, with supervisory responsibility, who fosters the culture of trust and accountability. The most important accountability function is to ensure that the Project Quality Team has a written Project Quality Management Plan, and executes that plan conforming with the company's high standards or with the third-party consultant contract.
- **Project Quality Expert/Technical Consultant:** This is the person who knows the details of the Project Quality Management Plan and whether or not the construction work is conforming with the project definition. This individual may not self-perform all of the work of the Plan, but is responsible for the completeness and excellence of the work. This role reports to the Project Quality Executive.
- **Project Quality Manager:** This role is responsible for the supervision and/or execution of all the activity of the Project Quality Management Plan. Generally, the majority of the coordination work is performed by the Project Quality Coordinator, but the Manager is ultimately responsible for the project's success from an administrative and managerial perspective. This role reports to the Project Quality Executive.
- **Other (Possible) Team Members:**
 - **Quality Inspector:** This is a skilled building professional capable of understanding the project definition, comparing the work in place to that definition, documenting conformance or lack of, and reporting clearly and professionally. This role reports to the Project Quality Expert/Technical Consultant.
 - **Specialty Experts:** Structural, waterproofing, windows, roofs, mechanical systems, etc.
 - **Project Quality Coordinator:** This is a role that may do most of the day to day work of making sure the details of the quality plan are performed, including scheduling, meeting and task management, organization and analysis of the project documents, etc. This role reports to the Project Quality Manager.
 - **Project Quality Assistant:** This role reports to the Project Quality Manager and assists the Manager and Coordinator in accomplishing the day-to-day work of the quality plan execution. In a third party quality consultancy, the client would expect to pay less for this individual's time than the Manager or Coordinator.

5. The Project Quality Management Plan – Summary

Quality Assurance Sample Checklist:

Before Construction/Pre-Construction Phase

- ☐ 1. Initial Quality Team Project Planning Meeting with executive (or client).
- ☐ 2. Detailed Scope of Work, Budget, and Schedule for Project Quality Management Plan.
- ☐ 3. Quality Team Project Status Meeting.
- ☐ 4. Plan Constructability Review and Report(s) (to create Inspection Checklists).
 - ☐ A. Decide on building elements and interface conditions that will be the subject of the plan.
 - ☐ B. Plan Review: architectural, structural, and specialty designs.
 - ☐ C. Specification review.
 - ☐ D. Referenced standards review.
- ☐ 5. Inspection Checklists.
- ☐ 6. Testing Plan: Mock-up of assemblies and testing (Optional).
- ☐ 7. Hold Point Inspection & Testing Schedule. Be prepared to stop the project if acceptable performance cannot be achieved.
- ☐ 8. Quality Team Project Status Meeting(s).
- ☐ 9. Project Status Meeting(s) with Executive (Client).
- ☐ 10. Requests for Information (RFIs).
- ☐ 11. Project Budget Review against Design and Scopes of Work. Project Budget and Quality Management Plan Budget updates as necessary throughout the process. Make active decisions about “how much insurance to buy.”
- ☐ 12. Trade Contract Scope of Work Reviews and Updates (including performance standards and tolerances). Trade/Subcontracts: connect the Plans, Specifications, and Standards, Quality Management Plan, including Hold Points, to the Contract and Scope of Work documents so that Quality does not “cost extra” (in change orders) during construction.
- ☐ 13. Bid Process.
- ☐ 14. Submittals.

During Construction Deliverables/Construction Phase (Quality Control)

- ☐ 15. Project File and Document Management Control Plan
 - A. Plans
 - B. Specifications
 - C. Transmittals
 - D. RFIs
 - E. Daily Logs
 - F. Inspection Documentation (Daily/Weekly)
 - G. Punch List Reports (Daily/Weekly)
 - H. Incident Reports (As Needed/Daily/Weekly)
 - I. Interim Reports (Weekly/Monthly)
 - J. Etc.
- ☐ 16. Project Kickoff Meeting(s). Make sure prime and trade contractors know the standards they will be held to during the construction.
- ☐ 17. Coordinate actions at Hold Points in the construction schedule to verify quality of installations.
- ☐ 18. Inspection and Documentation (Daily or at Hold Points).
Verify conformance with project definition (plans, specs, standards and contract scope of work documents) and to evaluate any onsite changes (Optional).
- ☐ 19. Testing at Hold Points to verify performance (Optional).
- ☐ 20. New Punch List Items (Non-Conforming Work) Report(s) (Daily/Weekly).
- ☐ 21. Punch List (Non-Conforming Work) Status (Master List).
- ☐ 22. Interim Report(s) (Monthly) to Management/Project Quality Executive/Client
(This is extremely important; similar to a contractor's monthly payment application).

After Construction/Operation & Maintenance Phase

- ☐ 23. Start-up Documentation & Commissioning.
- ☐ 24. Warranty Documentation, Maintenance Plan & Records.
- ☐ 25. Final (Project Close) Report. Quality control process, design summary, evaluation process, inspection summary, testing summary and ongoing maintenance recommendations (Optional).
- ☐ 26. Project Close Meeting [with Executive and/or Client].
- ☐ 27. Project File Compiled and delivered and/or archived.
- ☐ 28. Project Debrief.
- ☐ 29. Follow up Annual Property Condition Assessments.

6. Before Construction

Planning backward from a successful, virtually “zero defect” project is hard.

Early in the process we need to decide the level of energy (time, money, talent, etc.) that we can and will dedicate to the quality management plan. To decide on the level of energy, begin with the Explanation of Service Levels below. Then apply your decision to the Project Quality Management Plan – Summary activities, above. This way you can estimate the time and cost for your Plan. Remember, the quality management activities do not include doing the actual design. At a minimum, this is making sure the project definition is (close to) complete, and verify proper installation and integration of the assemblies that will lead to appropriate performance. Further work can ensure a connection between the plans, specifications, standards and contract scope of work documents.

Explanation of Service Levels

1. No Inspection
2. Limited Visual Inspection
3. Limited Visual, Limited Testing
4. Periodic Inspection, Limited Testing
5. Extensive Inspection, Limited Testing
6. Extensive Inspection, Extensive Testing

Document Review Levels:

- (A.) Plans and Specifications only
- (B.) Plans, Specifications, and Standards
- (C.) Plans, Specifications, Standards and Contracts

Keys to Success in the “BeforeConstruction” Phase

Creating Sensible Lists: One of the necessary skills is making sense of the million moving parts of a construction project. With help from psychologists, the project management profession figured out the best way to make sensible lists that are easy for humans to understand. It’s called a “work breakdown structure” (WBS) where each level of the outline has between 5-9 items. In construction we sometimes get away with as many as 15-25 items, but more than that number and people lose the ability to see the “big picture”. The table of contents of this guide is what we call a 2-level WBS.

Meeting Management: Building projects have lots of people involved. And to get lots of people rowing in the same direction is like cat herding; it’s not easy. Meeting management may be the most studied subject in business. The point is, make a written sensible list of things you need to accomplish before any meeting, and share it. Then make a SMART (Specific, Measurable, Assertive, Realistic, and Timed) set of action steps that people agreed to during the meeting. Then return to the next meeting with the list of action steps from the previous meeting, and use it to hold people accountable.

Knowing how the project is going to be built: Not everyone on the team needs to have deep expertise in knowing how things get built; much of the work requires surprisingly little. But there **MUST** be a deep, nuts and bolts level understanding for real success.

Key Deliverables

- Meeting Minutes & Action Steps
- Detailed Scope of Work, Budget, and Schedule for Project Quality Management Plan
- Building Plan & Specification Constructability Review and Report(s)
- Inspection Checklists
- Testing Plan
- Hold Point Inspection & Testing Schedule
- Trade Contract Scopes of Work

To create Inspection Checklists and a Hold Point Inspection & Testing Schedule, see the list of HIGH-RISK BUILDING ELEMENTS in the introduction, and begin creating and identifying the critical components of each major building element that will need verification of conformance, during construction.

Sample Checklist for Exterior Building Wall Components and Details (Level 2 WBS)

1. Wall Plane/Section

- ☐ Exterior Finish(es)/Cladding
- ☐ Drainage Plane
- ☐ Weather/Air Barrier(s)
- ☐ Attachment Fasteners
- ☐ Substrate
- ☐ Vapor Retarder
- ☐ Insulating Elements
- ☐ Interior Finish(es)

2. Joints/Transitions

- ☐ Similar Materials
- ☐ Dissimilar Materials
- ☐ Sealant (Caulk) Joints
- ☐ Control Joints
(Horizontal and Vertical)
- ☐ Expansion Joints
(Horizontal and Vertical)

3. Wall Base

- ☐ At Soil
- ☐ At Paving
- ☐ At Deck
- ☐ At Roof (see Roof To Wall)
- ☐ At Steps/Stoop
- ☐ At Wall to Below-Grade
(Waterproofing)

4. Corners

- ☐ Inside
- ☐ Outside

5. Roof to Wall

- ☐ Head Wall
- ☐ Confined Rake
- ☐ Kick-Out
- ☐ Wall to Eaves
- ☐ Chimney (Back Side)
- ☐ Incline Wall
(see Protrusions/Incline Walls)
- ☐ Low-Slope Roof to Wall

6. Windows

- ☐ Sill
- ☐ Jamb
- ☐ Head
- ☐ Trim
- ☐ Round/Arch Conditions

7. Doors

- ☐ Sill
- ☐ Jamb
- ☐ Head
- ☐ Trim
- ☐ Round/Arch Conditions

8. Penetrations

- ☐ Beams
- ☐ Electrical/Lighting/Square
- ☐ Plumbing/Electrical/Round
- ☐ Vent/Large
- ☐ Parapet/Wall Intersection
- ☐ Ledger/Shelf Angle
- ☐ Accessory/Decorative/Shades/Awnings/Signage

9. Soffits

- ☐ Intersection at Building (Three Plane)
- ☐ Outside Edge (Weather Exposed)
- ☐ Inside Edge (Not Weather Exposed)
- ☐ Headers/Arches

10. Parapet

- ☐ Cross-Section
- ☐ Outside End
- ☐ Wall Intersection (see Penetrations)

11. Recesses

- ☐ Outside Edge
- ☐ Outside Corner (Three Plane)
- ☐ Corner
- ☐ Inside Edge
- ☐ Inside Corner (Three Plane)

12. Protrusions/Incline Walls

- ☐ Outside Edge
- ☐ Outside Corner (Three Plane)
- ☐ Inside Wall to Slope (Section)
- ☐ Inside Wall to Slope (Three Plane)

13. Protrusions/Incline Walls

- ☐ Base
- ☐ Mid
- ☐ Top

Similar checklists should be considered for all of the HIGH-RISK BUILDING ELEMENTS listed in the introduction. From here, your Inspection Checklists can be composed based on the specifics of the design including plans, specifications, manufacturers instructions, trade standards, etc.

7. During Construction

Some important thoughts:

- Obviously, the “During Construction” actions are the most visible part of the system, but we can’t emphasize enough how critical the “Before Construction” actions are to prepare for success in this phase.

- It's critical that the Project Quality Team's Project File be in order. Holding people accountable is much easier, more effective, and less time consuming (therefore less expensive) if all of the building information is readily accessible. Maintaining a "single source of truth" for 100% (not 99; not 101) of the project definition is hard. By the time construction begins this "single source of truth" for 100% of the project definition includes all the current plans, specifications, and referenced standards from all of the designers. It also includes generally applicable standards, contracts, change orders, RFIs, RFI Responses, Change Orders, Construction Change Directives, and more.
- A Project Kickoff Meeting (or meetings) help(s) to ensure that the project players know the standards they will be held to during the construction. It's worth getting human-to-human buy-in.
- Projects that are chaotically run without a schedule are more likely to have quality problems, because as the old saying goes, "how you do anything is how you do everything." At best a construction project is a little chaotic and messy. But the best contractors run the least chaotic projects. We should strive for order. With all of that said, we should try to coordinate quality management inspections at hold points in the construction schedule to verify quality of installations.
- Inspection documentation should tell the story of a professional investigation, and someone who was not present should be able to understand what was accomplished. The photographs and notes should verify conformance with project definition (plans, specifications, standards, and contract scope of work documents) or clearly prove a variation from the project definition. There should be measurements and liberal quantification. Photos should be taken from large to small for orientation. Notes should be clear and complete. Diagrams should be included. Photos of the plans, details, specifications, and standards should be included when applicable. All defects must be re-inspected and additional photographs and reports published to show corrected actions and compliance.
- The old saying that "one test is worth a thousand expert opinions" is often true.
- Maintaining a sensible Punch List of "Non-Conforming Work" is not as easy as it sounds.
- Composing a periodic report (Daily/Weekly) explaining what the list means is also not easy, but taking the time to translate technical information into plain English is important and helpful.
- Composing a thoughtful Interim Report, usually monthly, to the Project Quality Executive or Client is really important; similar to a contractor's monthly payment application.
- If your project is an interior fit out or tenant improvement only, all of this material still applies. And if the property will be occupied during the work, then this planning, communicating the plan to all the applicable players in writing, inspecting what you inspect, and holding players accountable, can be the difference between project success and a protracted litigation. With occupied spaces it's all too easy to cause or contribute to an injury. And a common property damage incident to an on-going business can turn into a legitimate loss of use claim that FAR exceeds the cost to repair the physical damage. So plan backward from success and think about protecting the ongoing building operations carefully.

8. After Construction

The After Construction activities require organizational discipline and dedication. This is where the Project Quality Executive is crucial. People are ready to move on at the end of a project, but this is where the best separate themselves from the rest. Closing the loop is a professional discipline that embeds the lessons learned like nothing else. As the organizational and sports psychologists say: Feedback is the breakfast of champions.

Some of this work is a necessary part of the transition to the owner/operations team, including equipment and other building element start-up documentation, commissioning activities, and warranty documentation. A maintenance plan and preliminary records may be part of the hand off.

If the quality management is by a third party, then a Final (Project Close) Report should be included in the original scope of work for that professional. The quality management process, design review, evaluation process, inspection summary, and testing summary should be covered. In addition, the third-party might have expertise that is worth contracting for, related to ongoing maintenance recommendations. If this quality management is entirely internal, these final activities may be less formal, but they are every bit as important, and maybe even more so. They can be summarized in the agenda and minutes of a Project Close and/or Project Debrief Meeting with the Project Quality Executive and/or Clients.

The Project File should be compiled and delivered or archived permanently. Finally, a smart risk management activity would be to schedule or encourage follow up annual Property Condition Assessments to monitor the performance of the construction over time.

Quality-Focused Organizational Maturity

1. Introduction

An organizational maturity model is a relatively new (1990s) tool to evaluate whether or not a human organization can reliably and predictably accomplish its objectives. Models typically have 3 to 5 levels of maturity. As with humans, age is not closely tied to maturity level.

Level 1 relies mostly on individual, sometimes heroic, effort to accomplish objectives or good results; that is, success is not an integrated, systematic, repeatable, organizational process. This level goes by many names including initial, immature, ad hoc, or chaos. Many small and medium size businesses have aspects in level one, even some surprisingly large and profitable enterprises are run using this “genius with helpers” model. The trouble is when the genius goes missing or the business grows too large for the genius to quality check everything.

Level 5 is a mature, world-class, optimized, self-optimizing, and continuously improving system, capable of accomplishing the organization's objectives every time, virtually defect free. The Level 5 organization has healthy leadership at all levels, and a culture of trust and accountability. They measure, manage, and quality check all key processes and outputs, never letting defects run downstream. Their processes are well -documented and continuously improved, and their tools and technology are advanced, fully-integrated, and accelerate performance. Their training is such that they are often considered "university organizations," a disproportionate number of leaders in their industry once worked in this organization, and their results are superior, often achieving greater than two times the profit or effect per unit of input.

Levels 2 to 4 are the stages on the journey from friction, confusion, and underperformance, to world class.

The assessable and (usually) measurable "aspects of maturity" include (1.) leadership, (2.) a culture of trust and accountability, (3.) measurement, (4.) process orientation (this is where Lean Six Sigma and other Quality tools come in), (5.) tools & technology, (6.) training, and (7.) results. A Maturity Model can be applied to any human organization, at any level including large corporations, business units, departments, charitable or non-profit organizations, governmental organizations, etc.

At some point early in a project quality management endeavor, we will run into an organizational maturity issue. It's pretty straightforward (although not easy) to define what good performance looks like from a physical construction perspective, and then inspect to compare the actual work to that standard. But many of the people in virtually every organization have a natural resistance to change and accountability. It makes most people sad or mad when they receive feedback that their work is not meeting the minimum requirements for quality. Getting anywhere close to zero defects takes tremendous energy and resolve.

2. Levels of Maturity

- **Level 1 – Heroes:** Few processes. Ad hoc. Tribal knowledge. Friction, confusion, and underperformance.
- **Level 2 – Defined:** Key processes are defined but not applied by 100% of the people 100% of the time. Less friction.
- **Level 3 – Managed:** People are enthusiastic and proud. Processes are defined and managed. Performance is good.
- **Level 4 – Quantitatively Managed:** All processes have KPIs (Key Performance Indicators). All units have scoreboards.
- **Level 5 – World Class:** Zero defects. Continuous improvement. Agile. Fewer people, doing more, paid highest in the industry. Greater than 2X industry average performance.

3. Aspects of Maturity

1. Leadership

- **Level 1:** No process orientation. Often the #1 hero making results happen by the force of genius rather than process and effective delegation to a competent team of dedicated team members.
- **Level 2:** Leaders know they need to increase process orientation, but have only taken initial steps in the direction of increased process orientation. Leaders realize that the culture and health of the management team is closely related to a healthy company culture.
- **Level 3:** Top leaders are fully invested and dedicated to increasing process orientation throughout the organization. They are getting their direct reports excited about increasing the effectiveness of the processes, increasing quality, and decreasing drama. These leaders are in sync with and supportive of the other members of the management team.
- **Level 4:** Leaders feel like they work for the people “below” them in the organization. The leaders feel like it’s their job to serve the direct reports and make their ability to do excellent work easier and easier over time.
- **Level 5:** Leaders are evangelists for the organization and how awesome their people are. They give all the credit to the people doing the work and to the managers who support the people doing the great work of the organization.

2. A Culture of Trust and Accountability

- **Level 1:** Drama, blame, finger-pointing; resigned to the idea that they work in a messy place.
- **Level 2:** Less drama; some are excited about the new processes; a divide between process oriented and the “old guard” emerges.
- **Level 3:** Low drama; staff are enthusiastic; teamwork; victories are often celebrated; everyone knows the organizations objectives; unaccountable people leave.
- **Level 4:** Virtually zero drama; the staff love the work and each other; everyone knows exactly why their job is important in accomplishing the organizational objectives; they recommend that their smartest friends join the team.
- **Level 5:** SEAL Team; 100% trust; 100% accountable; fewer people doing more and better work for the highest pay in the industry.

3. Measurement Maturity

- **Level 1:** Feedback only comes from complaints. Financial and other reporting does not exist, is inaccurate, not shared, or so delayed that it does not aid in decision making.
- **Level 2:** Basic financial measures are available after close of periods: P&L, balance sheet, cash flow.
- **Level 3:** KPIs exist for all operational units and aid in decision making. Clients are surveyed periodically.
- **Level 4:** Leading KPIs are connected to organizational success and roll up from bottom to top. All individuals have a dashboard. All units have scoreboards. Clients are surveyed often.

- **Level 5:** Industry leading. Everyone knows how they are contributing every day. Everyone enjoys contributing to the organization's success.

4. Process Orientation Maturity

- **Level 1:** Tribal knowledge.
- **Level 2:** Key processes are documented. Less than 100% adherence. Limited management.
- **Level 3:** All processes are documented and managed.
- **Level 4:** All processes quantitatively managed with measures of quality and quantity. Continuous improvement.
- **Level 5:** Industry leading. Staff are industry leading experts. Were, will be, or could be specialty consultants in process management.

5. Tools and Technology Maturity

- **Level 1:** Ad hoc. Cobbled together.
- **Level 2:** Basic functionality. 5S Method (i.e. Sort, Straighten, Shine, Standardize and Sustain).
- **Level 3:** Lean. Advanced functionality. Good integration.
- **Level 4:** Six Sigma. Fully integrated and continuously improving.
- **Level 5:** Industry leading, proprietary "technology accelerators".

6. Training Maturity

- **Level 1:** Basic on-the-job training (OTJ). Inconsistent.
- **Level 2:** Basic functional training. Inconsistent. Skills verification is limited.
- **Level 3:** Documented, delivered professionally, and skills mastery is verified.
- **Level 4:** Continuously improving.
- **Level 5:** "University Organization".

7. RESULTS ORIENTATION MATURITY

- **Level 1:** Friction, confusion, and under performance.
- **Level 2:** Below average.
- **Level 3:** Good
- **Level 4:** Great
- **Level 5:** Awesome. Greater than 2X industry average.

About the Author

Pete Fowler holds a bachelors in Construction Management, is a construction manager, consultant, contractor, estimator, author, speaker, expert witness, and President of Pete Fowler Construction (petefowler.com), a diverse consultancy with operations in CA, FL, NV, OR/WA, and TX.

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4. Maturity Audit

To evaluate any organization, (A.) begin with the Organizational Maturity Matrix (B.) Use three colored highlighters to fill in all 35 boxes associated with the 7 aspects and 5 Levels of maturity:

- **Green:** Nailed it. No need to work on this, because the organization is past this level of maturity.
- **Yellow:** The organization is in the process of maturing in this aspect, but not yet past this level. Some energy and attention in this aspect is warranted.
- **Red or Orange:** The organization is immature in this aspect, at this level, and for this aspect, will require significant energy and attention to pass this level of maturity.

(C.) Unless you are confident that the organization you're evaluating is world class in every way, you can begin by coloring all 7 boxes under Level 5 red/orange. This should make using the red/orange pen easier. Confronting the facts of the matter as honestly as possible is helpful. The only shame should be in not working to improve.

(D.) Then begin at Leadership Maturity and Level 1 in the upper left corner and evaluate the aspects of maturity of the organization at hand. Unless you're in a one-person organization, then all of the boxes at Level 1 can be colored green. Most organizations in the world will have at least some boxes that are red/orange in Level 2, and most will have most of the boxes in Level 3 colored red/orange. An organization with ANY green boxes in Level 3 or 4 has reason to be proud.

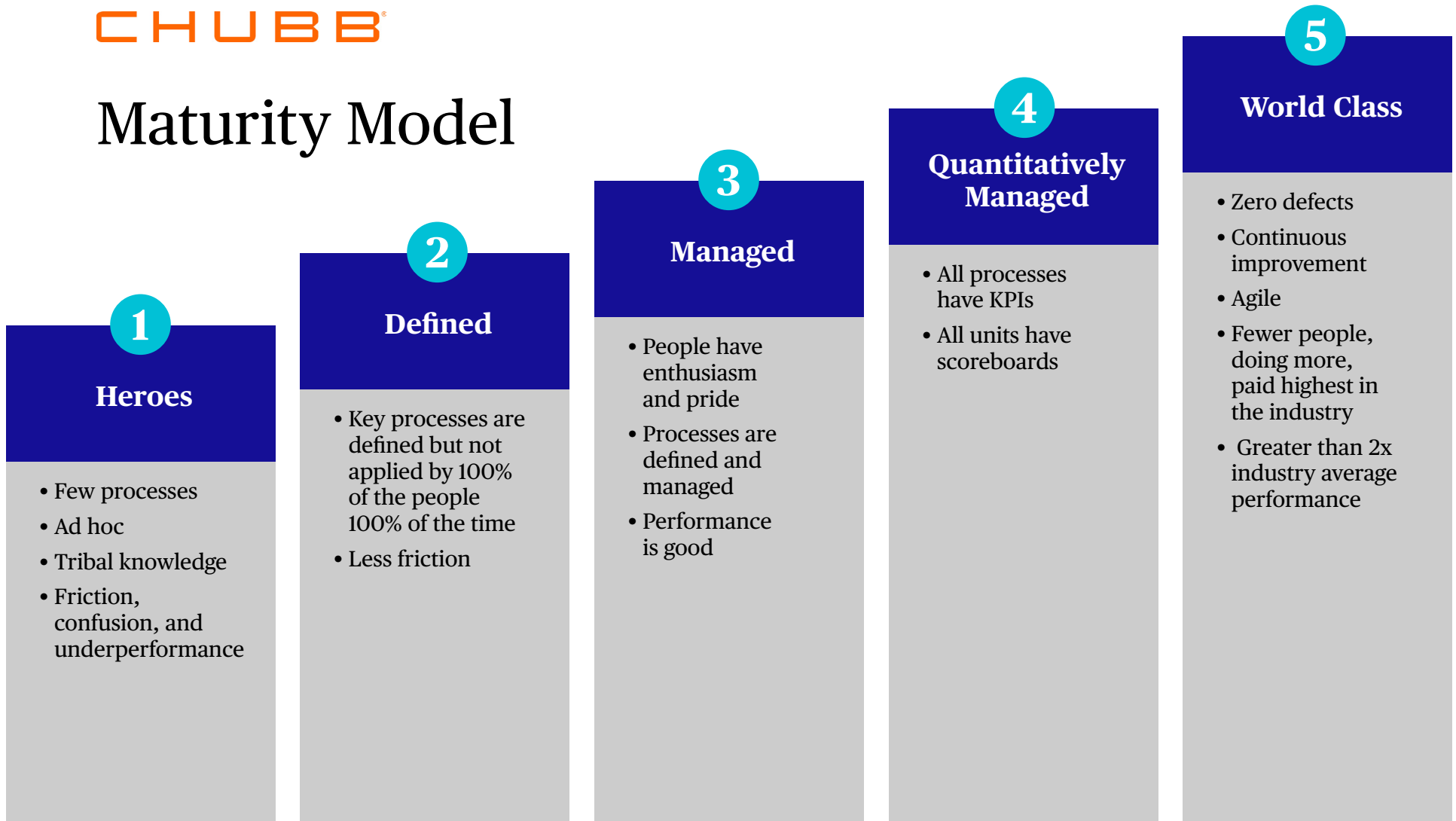
(E.) We believe the book [*The Goal*](#) correctly observes and explains that there is always one bottleneck in any system; when the one bottleneck is removed, automatically some other aspect of the organization becomes the bottleneck, so working on anything other than the one current bottleneck is silly. So, (E.) find the lowest maturity level(s) that are colored yellow or red/orange, and make an improvement plan. There are likely yellow or red/orange in aspects of Level 2. For example, under Process Orientation Level 2 is "Key processes are documented. Less than 100% adherence. Limited management." If you colored this yellow, meaning you are here, but have not moved beyond, then you could easily make a plan to put together a team to make sure you have a 100% list of key processes, that all of these processes have at minimum, rudimentary documentation that everyone agrees is correct.

Attachments

- 10/03/2019 PFCS – Maturity Model, Level 1
- 05/13/2019 Fowler, Peter D. – Maturity Model



Maturity Model



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Maturity Matrix



	1 Heroes Few processes. Ad hoc. Tribal knowledge. Friction, confusion, and underperformance.	2 Defined Key processes are defined but not applied by 100% of the people 100% of the time. Less friction.	3 Managed People are enthusiastic and proud. Processes are defined and managed. Performance is good.	4 Quantitatively Managed All processes have KPIs. All units have scoreboards.	5 World Class Zero defects. Continuous improvement. Agile. Fewer people doing more paid highest in industry. Greater than 2X industry average performance.
Leadership Maturity	No process orientation. Often the #1 hero making results happen by the force of genius rather than process and effective delegation to a competent team of dedicated team members.	Leaders know they need to increase process orientation, but have only taken initial steps in the direction of increased process orientation. Leaders realize that the culture and health of the management team is closely related to a healthy company culture.	Leaders are invested and dedicated to increasing process orientation, getting direct reports excited about increasing the effectiveness of the processes, increasing quality, and decreasing drama. Leaders are in sync with and supportive of the other members of the management team.	Leaders feel like they work for the people “below” them in the organization. The leaders feel like it’s their job to serve the direct reports and make their ability to do excellent work easier and easier over time.	“ Leaders are evangelists for the organization and how awesome their people are. They give all the credit to the people doing the work and to the managers who support the people doing the great work of the organization.”
Culture of Trust and Accountability Maturity	Drama, blame, finger-pointing; resigned to the idea that they work in a messy place.	Less drama; some are excited about the new processes; a divide between process oriented and the “old guard” emerges.	Low drama; staff are enthusiastic; teamwork; victories are often celebrated; everyone knows the organizations objectives; unaccountable people leave.	Virtually zero drama; the staff love the work and each other; everyone knows exactly why their job is important in accomplishing the organizational objectives; they recommend that their smartest friends join the team.	SEAL Team; 100% trust; 100% accountable; fewer people doing more and better work for the highest pay in the industry.
Measurement Maturity	Feedback only comes from complaints. Financial and other reporting does not exist, is inaccurate, not shared, or so delayed that it does not aid in decision making.	Basic financial measures are available after close of periods: P&L, balance sheet, cash flow.	KPIs exist for all operational units and aid in decision making. Clients are surveyed periodically.	Leading KPIs are connected to organizational success and roll up from bottom to top. All individuals have a dashboard. All units have scoreboards. Clients are surveyed often.	Industry leading. Everyone knows how they are contributing every day. Everyone enjoys contributing to the organization’s success.
Process Orientation Maturity	Tribal knowledge.	Key processes are documented. Less than 100% adherence. Limited management.	All processes are documented and managed.	All processes quantitatively managed with measures of quality and quantity. Continuous improvement.	Industry leading. Staff are industry leading experts. Were, will be, or could be specialty consultants in process management.
Tools and Technology Maturity	Ad hoc. Cobbled together.	Basic functionality. 5S Method.	Lean. Advanced functionality. Good integration.	Six Sigma. Fully integrated and continuously improving.	Industry leading, proprietary “technology accelerators.”
Training Maturity	Basic on-the-job training (OTJ). Inconsistent.	Basic functional training. Inconsistent. Skills verification is limited.	Documented, delivered professionally, and skills mastery is verified.	Continuously improving.	“University Organization.”
Results Orientation Maturity	Friction, confusion, and underperformance.	Below average.	Good.	Great.	Awesome. >2X industry average.

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