

Quality Assurance Protocol Test Drive by CMHC and Polygon Construction Management Ltd.

INTRODUCTION

Canada Mortgage and Housing Corporation (CMHC) commissioned this manual—*Quality by Design*—to establish a management system for assuring the quality of the exterior of multi-storey wood-frame buildings located in the coastal climate of British Columbia. It is part of the initiatives undertaken by the Building Envelope Research Consortium to address the “leaky condo” issue as it pertains to new construction.

The protocol it details is based on a recognized international standard, ISO 9001:1994—a quality system standard likely to become prevalent in Canada in the next few years. Companies and individuals that adopt this protocol will find it eases their future adoption of ISO 9001.

The protocol is generic and can be customized by each company or individual that uses it, depending on their needs, the products and services they supply and the processes and practices they employ.

The procedures it provides complement the requirements specified in traditional design and construction documents. Its purpose is not to enforce uniformity of quality systems.

DESCRIPTION OF THE PUBLICATION

Quality by Design consists of five chapters, each of which incorporates the 20 sections adapted from the ISO 9001: 1994 standard:

- Chapter 1: Organizing for Quality
- Chapter 2: Designing for Quality
- Chapter 3: Buying Quality
- Chapter 4: Building Quality
- Chapter 5: Completing and Servicing Quality.

Together they comprise the Quality Assurance Pyramid shown on the next page, which is the organizing framework for the manual.

Chapter 1: Organizing for Quality

Chapter 1 provides general guidance on establishing, maintaining and monitoring a Quality System. These guidelines cover establishing a company-wide quality policy, appointing Quality Management Representatives (QMRs), defining responsibility for quality on a project-by-project basis and reviewing the quality system.

It suggests creating a *Quality Manual* to cover the detailed requirements of the protocol as well as a Company Quality Plan and Project Quality Plans. The Company Quality Plan defines the organization’s approach to quality assurance, while Project Quality Plans refine the general approach for each new project.

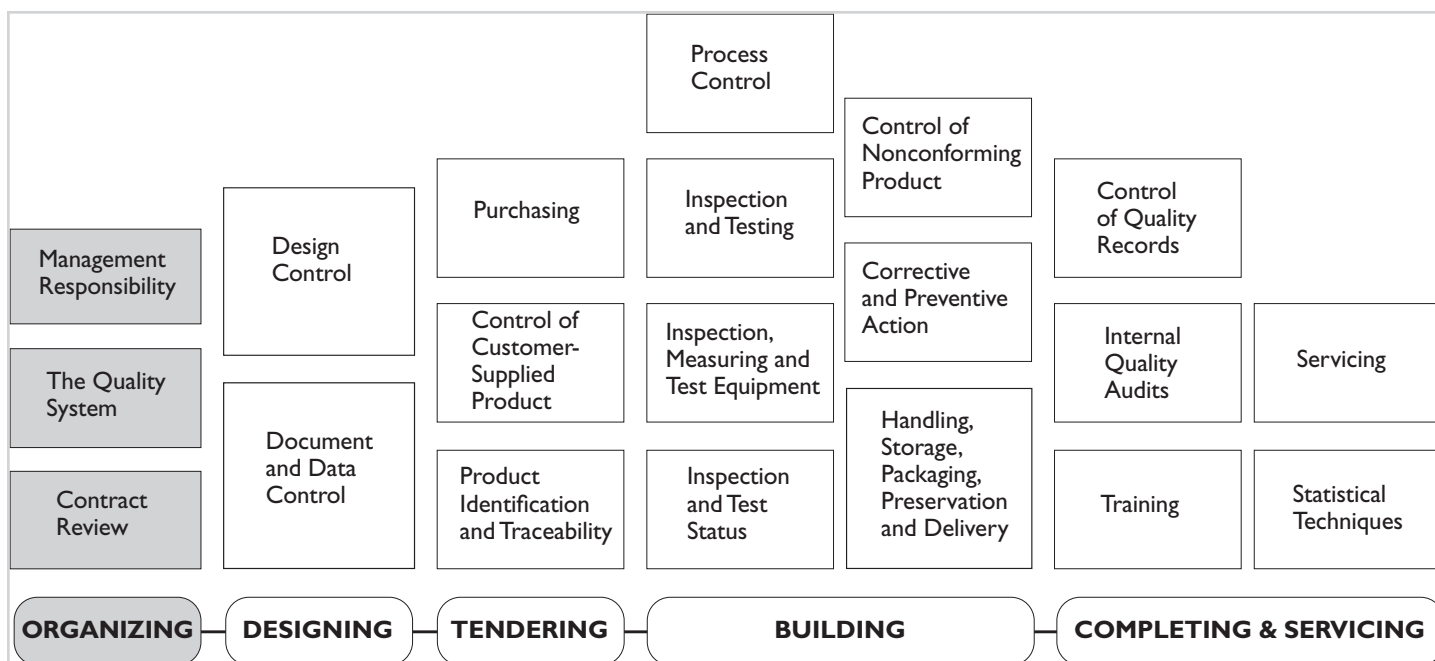


Figure 1 The Quality Assurance Pyramid

Also recommended is the development of Contract Review procedures appropriate for the contractor as a general contractor, design/build contractor, construction manager, project manager or owner. The Contract Review verifies procedures such as identifying the customer's needs and the ability of the supplier to provide the required services on time. It ensures details such as durability and maintenance expectations, documents the building performance criteria and notes all amendments to the contract agreements.

Another important element of the Contract Review is the requirement to ensure all elements of the bid satisfy the balance between quality and cost considerations.

Chapter 2: Designing for Quality

Chapter 2 defines the two essential components of designing for quality: Building Envelope Design Control, and Document and Data Control.

The purpose of Design Control is to ensure that design activities follow documented and maintained procedures in order to meet requirements such as those described in CMHC's *Quality Assurance Protocol for the Exterior of Wood Frame Multi-Residential Buildings* or those of the owners and occupants.

The Document and Data Control system establishes guidelines for controlling documents and data essential to the design, construction,

assembly, inspection, review and commissioning of a building envelope. These guidelines describe the means and methods of identification, collection, indexing, filing, storage, maintenance, retrieval and disposition of documents and records. They also ensure that any changes to the documents are recorded.

The guidelines apply to documents and data such as engineering drawings, specifications, standards, building codes and regulations, municipal assurance letters; purchase orders and design documents.

Chapter 3: Buying Quality

Chapter 3 addresses the need to inject quality considerations into the purchasing of materials, systems and services used in the construction of the building envelope. It also identifies methods for assuring and verifying that customer-supplied products and services are in line with contract requirements and the guidelines provided in the *Quality Manual*. In addition, it suggests procedures for identifying and tracing products and services, both to reduce errors in initial construction and make traceability problems easier. This improves the ability to repair latent defects.

Also provided are guidelines about purchasing procedures, responsibilities, assessing suppliers, purchase order data and other information related to the quality of purchased goods and services.

Chapter 4: Building Quality

Chapter 4 addresses control of the building envelope construction process. It contains seven sections: Process Control; Inspection and Testing; Inspection Measuring and Test Equipment; Inspection and Test Status; Control of Non-conforming Product; Corrective and Preventive Action; and Handling, Storage, Packaging, Preservation and Delivery.

Process Control suggests procedures for controlling the operations involved in building envelope construction. It applies to all activities that affect the quality of the work supervised or performed by the building envelope provider.

Inspection and Testing guidelines deal with verifying the quality of the finished building, its proper functioning and expected durability. These guidelines cover the following activities:

- Receiving Inspection for verifying the quality of materials received on-site, including those supplied by the customer.
- In-process Inspection for assuring the quality of the work performed on-site by builders, suppliers or installers, including mock-up preparation.
- Final Inspection for reviewing the finished product or a specific stage of the finished product, such as concrete work, electrical framing or cladding.

The next section—**Inspection, Measuring and Test Equipment**—describes a set of procedures for controlling, calibrating and maintaining inspection, measuring and test equipment. This is the equipment used to verify the conformance of the elements of the building envelope to specified requirements.

Inspection and Test Status details a method for indicating the conformance or non-conformance of a completed building envelope, building envelope components or related purchased products with regard to inspection and tests performed.

Control of Non-conforming Product outlines a system for identifying, rejecting, reworking or disposing of a building envelope, an element of a building envelope, or purchased material or a service that does not conform to specified requirements. The procedure recommended is the use of a HOLD tag to identify the material and a HOLD tag log for recording pertinent information.

Corrective and Preventative Action describes a procedure for identifying substandard aspects of the building envelope or related purchased products. The building envelope provider may also apply it to unsatisfactory performance. The guidelines include reporting the

problem, recording it in the Corrective Action Request Log, investigating, implementing corrective and preventive action, and confirming that these actions have taken place.

Handling, Storage, Packaging, Preservation and Delivery

procedures ensure that products used in the construction of the building envelope are transported, stored, packed, preserved and delivered in a way that protects them against damage or deterioration. These procedures apply to building materials, as well as purchased and customer-supplied building envelope components, at various stages of the construction process. As with the other components of the Quality Assurance Pyramid, there should be records such as a Receiving Log and a Building Site Construction Log.

Chapter 5: Completing and Servicing Quality

Completing and Service Quality addresses what the building envelope provider should do in five areas to ensure a quality construction process. These areas are Control of Quality Records; Internal Quality Audits; Training; Servicing; and Statistical Techniques.

Control of Quality Records outlines appropriate methods for collecting, storing, retrieving, retaining and disposing of records, which may be in any type of media. These can include inspection records, test data, commissioning reports, design review and verification reports, material certificates, equipment calibration data and other documents.

Internal Quality Audits allow the building envelope provider to regularly evaluate the effectiveness of the complete Quality System. In addition, they identify discrepancies, which should be reported to the building envelope provider's senior management in a timely manner.

Training defines the building envelope provider's policy for training the personnel who provide the labour and services on a building site. It should ensure all employees understand the Quality System, maximize the use available skills, experience and expertise and improve the availability of people with interchangeable skills. The guidelines recommend assessing training needs, identifying training programs and monitoring results.

Servicing refers to the need (if required by the contract) to establish and maintain documented procedures for performing, verifying and reporting that servicing meets specified requirements. Guidelines in this area include identifying customer needs with respect to servicing, defining these needs in the contract, assigning responsibility, reporting and handling warranty complaints, training service personnel and maintaining service records.

Research Highlight

Quality Assurance Protocol Test Drive by CMHC and Polygon Construction Management Ltd

Statistical Techniques help verify the conformance of the building envelope quality to specified requirements. They assist in monitoring project progress, inspection activities, investigating Corrective Action Requests and monitoring quality performance. Simple check sheets, diagrams such as bar and line graphs, and logbooks are recommended for this purpose.

In addition to the five parts of the Quality System, the manual contains appendices with sample forms, review sheets, reports and schedules. However, each adopter of the protocol will likely customize these samples according to how they are involved in the construction of the building envelope.

IMPLICATIONS FOR THE HOUSING INDUSTRY

This *Quality by Design* manual is intended for use by building envelope designers, builders, suppliers and installers in British Columbia. While it deals specifically with quality system requirements for the exterior of wood-frame multi-residential buildings, most of its contents apply to virtually any building project.

The quality system requirements in this manual will reduce or prevent non-conforming and non-performing building envelopes at all stages—from design, through to occupancy and maintenance. The protocol can also make the building envelope provider more competitive by establishing quality practices that reduce customer complaints and costly recalls, and create a more cost-efficient construction process from beginning to end.

CMHC Project Manager: Jacques Rousseau

Research consultants: Brian Palmquist, Pro Pacific Architecture Ltd.
William A. Gies, Pro Pacific Architecture Ltd.

Housing Research at CMHC

Under Part IX of the *National Housing Act*, the Government of Canada provides funds to CMHC to conduct research into the social, economic and technical aspects of housing and related fields, and to undertake the publishing and distribution of the results of this research.

This fact sheet is one of a series intended to inform you of the nature and scope of CMHC's research.

To find more **Research Highlights** plus a wide variety of information products, visit our website at

www.cmhc.ca

or contact:

Canada Mortgage and Housing Corporation
700 Montreal Road
Ottawa, Ontario
K1A 0P7

Phone: 1-800-668-2642
Fax: 1-800-245-9274

©2001, Canada Mortgage and Housing Corporation
Printed in Canada
Produced by CMHC
Revised: 2007

10-10-07

Although this information product reflects housing experts' current knowledge, it is provided for general information purposes only. Any reliance or action taken based on the information, materials and techniques described are the responsibility of the user. Readers are advised to consult appropriate professional resources to determine what is safe and suitable in their particular case. Canada Mortgage and Housing Corporation assumes no responsibility for any consequence arising from use of the information, materials and techniques described.