



Foreword

American homebuyers are increasingly demanding higher quality, more durable homes. In response to this growing demand, in 1998 HUD and the NAHB Research Center co-hosted a Technology Roundtable for builders and manufacturers on how housing quality could be improved. Participants voiced a need for practical and effective tools to improve the quality of work performed by the various trade contractors involved in home building, e.g., framing, electrical, plumbing, and roofing. Assuring that these critical contractors provide high quality work is an essential ingredient for improving the overall quality of home construction.

Improving trade quality is one of the most challenging yet potentially most rewarding areas for improving tomorrow's homes. In response to this challenge, HUD, through our Partnership for Advancing Technology (PATH) program, commissioned the NAHB Research Center to develop a program of quality assurance for contractors that provide the wood framing for the majority of America's homes. The initial result of this effort was a publication entitled *Quality Assurance System for Wood Framing Contractors*. It was envisioned that, if successful, this approach could be applied to additional trades in homebuilding. The project involved government, industry associations, builders, and trade contractors all working together to develop the quality system and the tools to implement this system in construction operations.

This publication, *Implementing a Quality Assurance System: A Trade Contractor Case Study* reports on the second phase of this effort. It documents the experiences of builders and contractors that have tested this assurance system in the real world. The Report documents the experiences, methods, and results of contractors that implemented the system.

Hopefully, the results of this study will stimulate further efforts to improve housing quality throughout the housing industry.

Lawrence L. Thompson
General Deputy Assistant Secretary for
Policy Development and Research



Case Study Framing Contractors

All-tech Carpentry Contractors, Jamesburg, New Jersey
Del Webb's Contracting Services, Surprise, Arizona
Schuck and Sons Construction Company, Inc., Glendale, Arizona

Innovations

Three wood framing contractors developed and applied a model quality assurance system based on quality methods used by manufacturing industries.

Results

First-year results include defect rates reduced by more than 50 percent, productivity improvements offset regional labor rate increases of over 7 percent, and builder satisfaction improved to top ratings.

Study Period

August 1999 through June 2001



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In a 1998 Technology Roundtable conducted by the NAHB Research Center, builders expressed frustration with the quality of trade contractors available in the marketplace. They noted that skilled labor is increasingly hard to find and retain. The resulting errors and construction defects have severe ramifications, both in the home building process and the quality of the finished house. Builders reported that existing quality assurance strategies do not reliably solve the problem.

In cooperation with the Partnership for Advancing Technology in Housing (PATH), the Research Center has adapted, demonstrated, and evaluated a quality system based on principles successfully used in the manufacturing environment.

Although these principles have been widely adopted in other sectors of the economy, they are relatively new to the home building industry. The result is an important new quality system that can help builders and framers satisfy homebuyer quality demands while increasing profits. The system represents a significant milestone in integrating quality management where it is most needed—the trade contractors that build the nation's homes.

"We have seen improved quality and consumer satisfaction. There has also been an increase in quality awareness, in the field and in management. This program simply formalizes the standards and inspection processes that exist in most companies." Frank Serpa, vice-president, Schuck and Sons Construction Company, Inc. (framing contractor)

The quality system requires trade contractors to accept responsibility for their own quality assurance without builder intervention. While inspections come to mind, they constitute only a small part of the total quality assurance system. Instead, the quality system actually focuses on prevention of errors by systematic control of the construction process. Furthermore, given that inspections may detect problems that need to be fixed, the quality assurance system also ensures that those problems are prevented by improving the construction process.

After three framing contractors implemented the trade contractor quality assurance system, each company

- reduced quality defects by more than 50 percent;
- reduced operating costs and improved productivity resulted in 7%-12% carpentry labor savings; and
- improved builder satisfaction ratings to top levels.

Encouraged by these results, PATH and private sector partners are establishing a national program to expand the quality initiative to all essential trades. Companies that operate their quality systems in compliance with the NAHB Research Center requirements are eligible for certification.



1.0 Introduction

For decades, the manufacturing industry has pursued productivity improvements through a variety of quality management approaches. With the decrease in available skilled labor, the home building industry has also taken notice of quality management techniques as a means to decrease defects, improve efficiency, and increase margins.

"Builders want to put together the best possible product. The quality assurance system makes the entire process go smoothly. The builders have less to monitor, the framers automatically produce a high-quality product, there are no callbacks, and everyone is doing it right the first time."
Hank Zolkiewicz, Del Webb's Contracting Services

This case study documents the experience of three framing contractors in establishing a quality management program and integrating it into their production process.

"My opinion is that what we do as carpentry contractors is no different from any other manufacturing except that we're exposed to the elements. It is still the same issue of inventory, supplies, and material. It is essentially the same. It is still assembly line, even though we're moving. The houses don't move down the line, we move down the line." Jalsa Urubshurow, All-tech Carpentry Contractors

The objectives of this project were to document the steps necessary for a contractor to adopt a quality management system, to provide technical assistance with the development of training tools and other aids, and to document the results of the system through follow-on audits.

Sections 2 and 3 of this report describe the collective experience of the project participants. Section 4 discusses future plans. Sections 5 through 7 discuss each framing contractor's quality system implementation, operation, and the resulting benefits.

In addition to this case study, a model for establishing a quality management plan for framing contractors was developed as part of this program. *Quality Assurance System for Wood Framing Contractors*¹, available through HUD or the NAHB Research Center can be used by contractors to assist in developing a quality management plan and quality manual for their companies.

¹ NAHB Research Center, Inc., *Quality Assurance System for Wood Framing Contractors* (NAHBRC, 2000), Upper Marlboro, MD; 800-638-8556.

2.0 Quality System Benefits and Results



“There are benefits to quality...reduced rework, reduced cycle time, fewer callbacks, improved customer satisfaction, better relations with the other trades in the field, and increased profits.”
Craig Steele, President
Schuck and Sons Construction Company, Inc.

The NAHB Research Center, Inc., measured and analyzed the business performance of three framing contractors before and then one year after adoption of the quality assurance system.

This section discusses the collective benefits accruing to the participating contractors. Other sections discuss the specific benefits accruing to the individual contractors.

Reduced Construction Defects

The NAHB Research Center, Inc., measured more than a 50 percent reduction in construction defects at each of the participating companies.

Before implementing the quality system, each company considered itself to be among the nation’s highest-quality framing companies. The results indicate that the quality system helped them improve further.

“The quality system provides the necessary means to capture and address ongoing problems and to create a system that provides for preventive actions. Over time, a company should be able to measure the direct impact from the implementation of such a system.” Jalsa Urubshurow, All-tech Carpentry Contractors

Project participants reported three reasons for the improvements.

First, employees are held responsible for quality. Quality plans clearly specify the right way to do the work. There is no confusion when the quality assurance plan spells out construction details for each activity, specifies workmanship tolerances, and details the use of materials and equipment with prescribed work procedures. Field personnel are qualified to perform specific types of work. They are assigned work for which they are qualified and held responsible and accountable for their quality performance. They respond by taking pride in their work.

“More than trying to focus on any specific aspect of the initiative, I think the overall issue is to establish accountability along the way...every step of the way. The initiative increases our ability to correct the problem.” Jalsa Urubshurow, All-tech Carpentry Contractors

Second, employees see constant reinforcement of the company’s commitment to quality. A variety of sources contribute to delivering the message: frequent discussions about company quality strategies, regular management quality reviews, formal inspection processes, and regular training in quality topics.

Third, a regular process of continuous improvement prevents quality hotspots. Hotspot is the term coined by the contractors to indicate a recurring quality problem. Contractors take it upon themselves to analyze hotspot quality issues to uncover root causes. A solution to any particular problem may require changes in materials, construction details, work procedures, or simply ensuring conformance with a quality process. Regardless of the solution, regular hotspot training of field personnel communicates the right way to do the job. One by one, recurring defects are effectively prevented. The longer the quality system remains in operation, the fewer the quality defects that will occur. Participants expect progressively fewer and fewer quality defects over the coming years.

Prevention of quality defects is fundamental to each of the benefits and results that follow.



Improved Productivity

Seven percent increases regional carpenter wage rates were offset by productivity improvements. Contract pricing on renewed bids was not increased during the one-year study. In comparison, the most recent U.S. Department of Labor cost data² for carpentry labor increased by between 7 and 12 percent.

All of the contractors participating in the study believe that the benefits from the quality system were instrumental in offsetting regional labor rate increases.

Productivity improvements have successfully offset rising labor costs as well as any additional costs of operating the quality system.

The contractors report other cost benefits, including a reduced average hourly wage rate for field labor, lower overhead costs, and reduced postclosing warranty costs. Details are provided in the case study for each contractor.

“After the initial information-gathering process, a company can expect to invest less than an hour per house. That time is more than offset by reduced callbacks.” Frank Serpa, Schuck and Sons Construction Company, Inc.

Participants report that they spend less time correcting errors and more time building homes. Employees are trained to perform a job right the first time, to correct problems at the time of detection, and, most important, to prevent recurrences. Problem avoidance from the outset lowers the cost of repairs made at preclosing inspections and during the warranty period.

Both builders and other contractors benefit from accurate and precise framing. Carefully prescribed workmanship tolerances, appropriate training, and quantitative inspection procedures ensure the definition and maintenance of installation tolerances such that window/door openings are correctly sized, floors are level, walls are straight, trusses are vertical, and so forth. Precision at one point in the process expedites the installation of other products down the line (e.g., doors, windows, tile, cabinets, and so forth) and reduces waste.

Improved Workforce Development

Each contractor has significantly increased its training for field personnel. Just-in-time training provides field personnel with a regular stream of training on hotspot quality issues both when and where it is most needed—on the jobsite.

Because training results in immediate quality improvements, most field supervisors view hotspot training as a tool that makes their job easier. It prevents recurring problems, thereby removing a major source of frustration among supervisors. Turnover of the contractors' field supervisors has been less than 5 percent.

Crew foremen and aspiring foremen have a clear development path that encourages personal growth. With clearly defined qualification requirements for each type of crew, the contractor helps employees evaluate their current capabilities and determine the skills they need to acquire for moving to the next level. Crew members respond by developing the skills required to become a foreman, and foremen develop the skills needed to lead a wider variety of crew types.

² U.S. Department of Labor, *National Occupational Employment and Wage Statistics*. Carpenter mean hourly wage rate for New Jersey and Arizona (1998 and 1999).



Increased Builder Satisfaction

Each contractor made significant gains in builder satisfaction ratings as determined by survey results. At completion of the study, each of the framing contractors was consistently achieving high builder satisfaction ratings.

Builder field personnel report benefits from framers who take responsibility for quality. To the extent that quality defects are reduced, the builder's field personnel can monitor quality rather than provide inspection services at their time and expense. When quality issues arise, the contractor has the means to prevent recurrences. Builder superintendents appreciate that quality issues are addressed in a meaningful way.

Improved Durability Expected

Reduced defect rates as described above are expected to lead to improved durability and to extend the service life of the home.

The quality system improves conformance to building codes, product installation instructions, and good construction practices. For framing, conformance relates to the proper use and installation of roof sheathing, connectors, and fastening systems and of floor, wall, and roof components. Each of these elements is critically important for improving building system integrity and avoiding premature product failure.

While improved quality can be observed and measured at time of construction, it will be a number of years before statistical data can measure improved durability.

Reduced Natural Disaster Losses Expected

The ability of a home to withstand natural disasters such as hurricanes and earthquakes is largely determined by the characteristics of the foundation and framing. For example, NAHB Research Center, Inc., studies show that consistent and correct connection of roof sheathing to roof trusses and trusses to walls is an essential factor in hurricane resistance. Installers must use the appropriate nails and connectors, in the right locations, to the required penetration depth and spaced in accordance with the connector type. Unfortunately, a natural disaster must occur before the impact of a quality system on these results can be evaluated.



3.0 Implementation of the Quality System

The participating framing contractors simultaneously implemented and refined the quality system over a one-year period. Each framing company amended its existing quality assurance procedures to conform to the guidelines outlined in *A Quality Assurance System for Wood Framing Contractors*.³

This section discusses the common implementation process shared by the contractors. Other sections discuss the specific customized implementation details for each participating contractor.

The participating contractors were already performing many of the activities required by the quality system. Implementation, however, focused on formalizing the performance of the activities on a regular basis and then documenting the results.

“Most companies do not realize it but they probably have some type of quality system already implemented. Where many companies fall short is in the documentation of the quality requirements that they are already performing. The quality system provides the necessary means to capture and address ongoing problems and to create a system that provides for preventive actions. Over time, a company should be able to measure the direct impact from the implementation of such a system.” Jalsa Urubshurow, All-tech Carpentry Contractors

Implementing the quality system is a one-time investment to make the quality system operational. Once the system is operating, documentation of the quality system needs updating only as materials or work procedures change.

While the order of activities varied, all contractors followed what can be described as a six-step implementation process as follows:

Step One

A seminar provided an overview of how the quality system works. Participants previewed the implementation process and developed a project plan. The company president named a quality representative.

Step Two

A baseline assessment analyzed quality performance and current quality assurance practices. Each contractor developed a customized quality manual that built on its quality accomplishments. The manuals contain policies, procedures, and forms specific to customer requirements, construction methods, division of labor, and organizational structure.

“Depending on the level of existing policy and procedures, it is not difficult at all. It all comes down to documenting current procedures and measuring those against the standard.” Jalsa Urubshurow, All-tech Carpentry Contractors

Step Three

Each contractor prepared an approved material list of commonly used building products, required equipment, and workmanship tolerances. These items, along with related installation instructions, were added to the quality manual. Foremen and superintendents were formally evaluated and qualified to lead and/or inspect specific types of work crews. At the end of this step, the contractor introduced the quality system to employees.

Step Four

Inspection forms were tailored to the company’s existing field reporting requirements. A single form tracks production status as well as quality data. Field employees were trained in the new inspection procedures, which then took effect.

Step Five

Managers and superintendents began documenting their field review observations. Contractors institutionalized regular training of field employees on quality hotspot improvements. Contractors initiated the administrative procedures for managing the quality system.

³ NAHB Research Center, Inc., *Quality Assurance System for Wood Framing Contractors* (NAHBRC, 2000), Upper Marlboro, MD; 800-638-8556.



Step Six

Monitoring of the system operation led to adjustments and refinements. Contractors tracked the benefits of the quality system for comparisons with the baseline data identified in step two. After six months of operation, audits verified system operation.

"The NAHB Research Center, Inc., was our resource group. They were very good at facilitating the initial formation of this Quality assurance program...they were very knowledgeable...they were very open to suggestions. They didn't go in with blinders on and just go in one direction. They took information from all parts of the country to put this generic quality system together. They have been very helpful and always there to answer any questions that we may have when implementing." Hank Zolkiewicz, Del Webb's Contracting Services

One year after implementation, follow-on audits by the NAHB Research Center, Inc., verified continuing operation of the quality system.

*"Quality is not luck, it is the end result of a specific plan."
Jim Hoffner, K. Hovnanian*



4.0 Plans for the Future

Encouraged by the success of the quality assurance system, several industry initiatives are underway.

4.1 NHQ Certified Trade Contractor Program

Participants in the demonstration project have proposed the creation of the National Housing Quality (NHQ) Certified Trade Contractor Program to

- improve housing quality and customer satisfaction;
- improve productivity and cycle time;
- reduce exposure to construction defect litigation and insurance costs; and
- streamline the code inspection process.

The participants recommended that the program concentrate on

- developing trade contractor quality assurance guidelines based on ISO 9000 quality management principles;
- educating, training, and providing implementation assistance to home builders and their network of trade contractors;
- independently certifying trade contractors;
- promoting program awareness and program participation; and
- campaigning for insurance pricing incentives and regulatory streamlining.

At the time of this writing, the program is in the concept stage of development.

4.2 Expansion to Other Trades

The NAHB Research Center Inc., will be conducting quality system implementation directed at broadening the quality system to include other essential building trades. Sponsoring the effort are the Partnership for Advancing Technology in Housing and the U.S. Department of Housing and Urban Development (HUD).

The quality system will be implemented in several geographic regions. The aim is to create a critical mass of quality trade contractors in each region.

Participation is expected by local home builder associations, leading builders in the various regions, and their network of trade contractors.

Through this process, the NAHB Research Center, Inc., expects to prepare a series of model quality assurance guides for the major building trades, along with a case study report and implementation training materials.

Since the three framing contractors implemented the quality system, the six-step process has undergone refinement and streamlining. The NAHB Research Center, Inc., crafted a series of workshops around the six-step process to aid implementation of the quality system by other trade contractors.

"We've taken a good year and a half for implementation and going through the process. That's not the way it will be for everyone, I think, because we were obviously creating [the quality system] as well."
Jalsa Urubshurow, All-tech Carpentry Contractors

As of October 2001, K. Hovnanian, a national builder, is using the six-step process to implement the quality system with 20 trade contractors in New Jersey. The quality manager at K. Hovnanian has been closely involved in the development and implementation of the quality system for the framing contractors. The quality manager is using the experience to adapt the quality system to other building trades.



4.3 NAHB Research Center, Inc., Trade Contractor Certification

One of the ways that the NAHB Research Center, Inc., is supporting the NHQ Certified Trade Contractor initiative is through the creation of a trade contractor certification program. The program is open to all building trades that meet the requirements of the quality system and abide by the NAHB Research Center, Inc.'s, certification guidelines.



Certification qualification involves a full-day qualification audit of quality records, employee interviews, and jobsite verification of quality policies and procedures. Ongoing certification requires annual audits starting six months after initial qualification.

Additional information is available from the NAHB Research Center, Inc.⁴

*"Nothing is mandatory, but in an ever-increasingly competitive market, builders who expect quality will find value in a certified framer focused on and committed to quality."
Frank Serpa, Schuck and Sons Construction Company, Inc.*

4.4 Resources and Information

There are a number of resources available to builders and trade contractors on the quality system and its implementation, and on new developments.

- Publications, including manuals, guides, case studies, and articles related to the quality system, will be available from the NAHB Research Center, Inc. (www.nahbr.org or 800-638-8556), and from the U.S. Department of Housing and Urban Development.⁵
- Quality and building technology questions are answered at no charge by the NAHB Research Center, Inc.'s, ToolBase Hotline (www.toolbase.org or 800-898-2842).
- Seminars will be presented at the International Builders Show, regional builder shows, and local home builder associations.⁶
- Quality articles relevant to the quality system will continue to be published in the *ToolBase News*,⁷ the *Fieldworks*⁸ newsletter, the *Pathways*⁹ newsletter, and *Professional Builder*¹⁰ magazine.
- ToolBase webpages and free subscriptions to the ToolBase email news will keep interested parties informed (www.toolbase.org).

⁴ Contact the NAHB Research Center, Inc., at bhill@nahbr.org, www.nahbr.org, or 301-430-6237.

⁵ Contact the HUD Department of Policy Development and Research at www.huduser.org or 800-245-2691

⁶ Seminar schedules will appear at www.nahbr.org. Local home builder associations considering a seminar should contact ecaldeira@nahbr.org or 301-430-6310.

⁷ *ToolBase News* is published quarterly by the NAHB Research Center and distributed free to NAHB members by local home builder associations and is available online at www.toolbase.org.

⁸ *Fieldworks* is published by the HUD Department of Policy Development and Research. Contact www.huduser.org or 800-245-2691.

⁹ *Pathways* is published by the Partnership for Advancing Technology in Housing. Contact www.pathnet.org or 202-708-4277.

¹⁰ *Professional Builder* magazine is published monthly. Contact www.housingzone.com or 847-635-8800.