Code Shock

Prepare to face the strictest building codes in history

BY FERNANDO PAGÉS RUIZ

You know the drill: You apply for a construction permit, submitting a set of drawings detailing what you intend to build and how. After some back and forth with the plans examiner and after your plans appear to meet the legal building code, your jurisdiction issues a building permit. Inspectors come to your job site at specific stages of construction to verify that the workmanship and materials follow the approved plans and meet local building standards. You complete construction, your inspector judges the building to be in compliance, and then your local authorities issue a certificate of occupancy. Usually, everything runs smoothly; sometimes, though, it feels like a struggle.

How did we arrive at this system? Why do code standards seem to keep getting harder and more expensive to comply with? Who writes these codes anyway, and who represents your interests in the process?

It began with safety

Code historians—yes, there are such people—tell us that building codes date back to the earliest times we had written laws. American building codes derived from English common-law standards and then evolved in response to local conditions. More often than not, they were responses to local catastrophes, such as the Great Chicago Fire of 1871, the San Francisco earthquake of 1906, and Hurricane Andrew in 1992—all of which resulted in the development of ever more stringent construction standards, crafted to prevent a devastating loss of life and property from happening again. At the same time,

Drawing this page: Gary Waters. Photo facing page: Rodney Diaz.

How model codes become local law

Since 2000, the International Code Council (ICC) has authored the majority of model codes adopted throughout the United States. A "model" building code is one developed and maintained by a private organization independent of the jurisdiction responsible for enacting that code. The ICC's I-Codes represent a suite of 15 interrelated and complementary codes grouped into five broad categories. The I-Codes are designed to work together so that jurisdictions can adopt all the code books that fit their respective environment. As such, a small rural community may want the IBC (commercial), IRC (residential), and other codes, but not need the International Wildland-Urban Interface Code (fire) or the International Existing Building Code.

In the United States, model codes are adopted by state governments, counties, fire districts, and/or municipalities. Depending on where you live, you may have the good fortune of having one code preside from state border to state border (17 states have established statewide building codes that prohibit local amendments without state approval), but for the rest of us, local jurisdictions adopt building codes, often resulting in adjacent cities or even towns operating under different building codes. This can create code confusion for builders working across jurisdictional boundaries.

When a jurisdiction adopts a model building code, it adopts a specific edition (for example, the 2006 or the 2009 IRC), which then becomes law in that jurisdiction only. Adopted codes are not automatically updated. When a new edition of the model code is released by the model-code developer, the adopting authority may choose to ignore it and continue using the older version. Complicating things further, model codes may either be adopted outright as the building codes for a jurisdiction, or they may be adopted with amendments or additional rules. As such, two cities working under the 2009 IRC, for example, may still have slightly different code requirements.

widespread public-health concerns led to sanitary-plumbing standards, light and ventilation requirements, minimum room dimensions, and fire escapes, among other health-and-safety requirements we take for granted in today's building codes.

How did codes become so complicated?

Because our unique system of government preserves certain powers for state and local authorities, almost every village in the United States crafted its own set of codes, which led to a complex tapestry of local building practices that were sometimes inconsistent and contradictory. To establish some uniformity, code writers began trying to develop a national building code at the turn of the 19th century, but all efforts failed to reach a national consensus until 2000, when the International Building Code emerged. Prior to 2000, three regional model codes had become preeminent: the International Conference of Building Officials' (ICBO) Uniform Building Code (UBC), used primarily on the West Coast; the BOCA National Building Code, issued by the Building Officials and Code Administrators International (BOCA) and used primarily in the Northeast and Midwest; and the Southern Building Code Congress International's (SBCCI) Standard Building Code (SBC), used primarily in the South and Southeast. Each model code focused heavily on regional hazards, such as seismic issues in the UBC and wind loads in the SBC.

The intent behind model codes was to help local authorities avoid having to develop their own construction laws from scratch (sidebar above). Until 2000, most states adopted one of the three model codes and made some adjustments to satisfy local interests, but a few states, such as Wisconsin and New York, wrote proprietary codes. Confusing things further, large cities sometimes adopted different model codes than their state, such as Houston, which used the UBC while the rest of Texas used the SBC. If you're old enough to have worked under this feudal code system, you know how confusing and arbitrary it sometimes appeared.

Things have improved. In 1994, the three predominant, regional model code groups merged to become the International Code Council, and the ICC began producing a single family of codes: the International Codes, or I-Codes. The first complete set of I-Codes was published six years later. Since then, the ICC model codes have been adopted by 49 states (Wisconsin being the exception), albeit with a surfeit of local amendments. "The ICC would like to see codes and standards with such a strong consensus that local authorities find little need to do any tweaking," says Dominic Sims, executive vice president and director of operations at the ICC.

Who writes this stuff?

If you ask Sims who writes the codes, he'll tell you, "A team of 50,000 members of the ICC, with only about a third of those members as regulators. The rest are builders, designers, manufacturers, and industry representatives." The ICC uses what it describes as a democratic process to create and change codes. Anyone can propose a new




VOICES FROM THE INDUSTRY

With so many players involved in the code-development process, it's not always easy for individual voices to be heard. Therefore, we've asked a few industry professionals for their perspective on current and future building codes and the impact they have, or don't have, on the home-building industry.

The future of home building in the United States looks bright

"The biggest challenge remains in education, both for builders and inspectors."

Dominic Sims

In the early 1980s, the construction industry began to ask for a lot more flexibility. They were using new materials, they were using new systems, and codes were restrictive and traditional. Codes had to change, and they did. The codes moved from prescriptive to performance-based, and this provided flexibility, but it also added complexity. It created more demanding criteria on designers and contractors. Now we realize that we need not only codes that are highly flexible and performance-based, but also prescriptive models for those in the field who don't want to take on so much engineering.

There are those who complain about our energy policies—some say we're not up to standards set in other countries—but the United States still has the safest built environment in the world. When you see a disaster anywhere else, the failure rate is magnitudes higher. Our buildings are safe for a reason: Our industry has taken the time to ensure good construction. The public should feel pretty good about the present state of building in America, and it's getting better.

The biggest challenge remains in education, both for builders and inspectors. Without craftsmen in the field who understand the how and why, especially with modern materials that are much more sensitive to application than the traditional products we used to use, we can't reach the highest standards we aspire to. We need a workforce trained to put things together right, and we need trained building inspectors to help those in the field become better at their craft.

Dominic Sims, an ICC executive vice president and director of operations, is a former builder and building inspector.

code or modifications to an existing code by using a simple form available at the ICC's website, ICCsafe.org. (For a detailed look at the process, see "How It Works" on pp. 18-19.)

In brief, the ICC code-writing and revision process occurs in a three-year cycle. The last code iteration occurred this year, so the next will take place in 2015. If you want to submit a proposal, you'll have to do it before January 3, 2013, for consideration in the 2015 code update.

"Hundreds of code changes have been submitted by builders over the years and have found their way into code," says Tom Frost, senior vice president of technical services at the ICC. "Just about everything in the residential code has been subject to this process with builders involved." According to Frost, the bulk of the International Residential Code (IRC) is a product of the building industry.

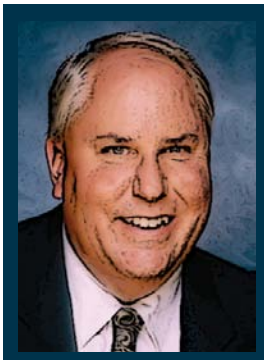
If this reminds you of political lobbying, you're right. While engineering has come to play a greater role in code development, a major part of the process still involves effective advocacy and the dogged persistence of those with a stake in the industry. According to Frost, the virtue of this advocacy process is that for every special interest in support, there are those in opposition. Nevertheless, the heavyweights in code development are those with the time and money to follow the process—namely, the insurance industry, building-product manufacturers, and the federal government through the Department of Housing and Urban Development (HUD), the Federal Emergency Management Agency (FEMA), the Environmental Protection Agency (EPA), and the Department of Energy (DOE).

Your dog in the race, the National Association of Home Builders (NAHB), which represents rank-and-file homebuilders, often argues against codes that adversely impact housing affordability. Larry Brown, NAHB's vice president of construction, codes, and standards, is troubled by the financial implications of ever more rigorous code provisions. "It's arguable whether all the latest additions to the codes have made for safer or better homes, but there's no disagreement about codes making construction a lot more expensive," he says. "We have picked off all the low-hanging fruit," he adds, expressing concern that the next round of energy-related code developments is going to make home building more complicated and more expensive.

Codes and their economic impact

While it may feel as if codes are constantly squeezing builders' wallets, this is not necessarily so. Frost points out that recent provisions simplify codes and, in some instances, even help to save builders money. The very first ICC code, promulgated in 2000, brought into national profile many cost-saving construction methods, including frost-protected shallow foundations and 24-in.-on-center framing, which helped to reduce construction costs while improving building performance. The code introduced new building methods as well, such as the continuous sheathed-bracing method, which simplified wall bracing, and a now-popular prescriptive approach to insulated concrete forms (ICFs). More recent code updates include a prescriptive method for an unvented attic assembly, simplified prescriptive

Illustrations this page, facing page: Jacqueline Rogers



"It is more important than ever for us to keep abreast with building science, and to make sure we get it right."

Matt Belcher

Tread carefully with new and emerging building technologies

Codes have advanced quickly over the past six years, pushed in part by the green-building movement. Rapid progress can be a double-edged sword, however; if we get the code wrong, it can take a long time to fix. That makes it more important than ever for us to keep abreast with building science, and to make sure we get it right. When energy came into focus back in the 1970s, we made a lot of mistakes, such as putting impervious vapor barriers on interior walls. This may have saved energy, but it resulted in mold and rot. We are focused on energy again, and over the last three code cycles, energy requirements have grown tremendously. There's a lot more to building than just saving energy, though, and we have to keep the whole system in focus when tweaking any one part, because every part affects the rest. I believe that emerging technology should be promoted rather than mandated. The volunteer rating systems do this very well. Deploying new technology, however, requires a knowledge base many builders and even building inspectors lack. Building technology has gotten too complicated to mandate. If we could focus entirely on promoting all we already know about best practices, the benefits would accrue exponentially, and the builders installing these advanced systems would know what they are doing. We need to change the attitude from building to code minimum to building to code maximum. I urge builders to get involved in the code-development process, to learn, and to become better builders. If you do, when the market comes back, you'll be able to jump right in. Those that don't keep up are in for a big surprise.

Matt Belcher of Belcher Homes is a member of the ICC Residential Energy and NAHB Building Codes committees.

requirements for structural-insulated-panel (SIP) construction, and even provisions for installing photovoltaic roof shingles. "This happens because a lot of the changes are submitted by builders, and they are very active in submitting fixes to what they see as problematic," says Frost.

Engineering associations help to streamline compliance through their work developing consensus standards, such as those from ASTM International, formerly the American Society for Testing and Materials. Codes make use of these voluntary standards through extensive references. For example, if you're building a garage fire-separation wall, the prescribed assembly will include a reference to ASTM E 119 or UL 263. If your wall complies with either of these standards, your wall complies with code.

Energy takes center stage

Another important influence on today's codes comes with the voluntary green-building and energy-efficiency rating systems, including Energy Star, LEED, and the National Green Building Standard. The newest code, the International Green Construction Code, or igCC, was published in 2012 with extensive participation from all the major green-building rating programs. Perhaps the biggest influences were the energy-efficiency initiatives pioneered by Energy Star, such as the Energy Star Version 2 Thermal Bypass Checklist that was incorporated substantially into the 2009 IECC (International Energy Conservation Code). "The voluntary programs are highly effective, moving the bar so that codes can continue to increase in rigor," says Sam Rashkin, who founded the EPA's Energy Star for Homes program and now runs the DOE's Builders Challenge.

"Strict code enforcement is a hindrance to innovation in an industry that needs to change dramatically to keep up with the advances in building science."

Bill Eich

Building codes are holding back an industry in need

The city of Spirit Lake scrapped the idea of enforcing building codes in our area and nowadays enforces only zoning ordinances. It certainly tried. However, after a few years of frustration, expense, and a lot of dissatisfied citizens and contractors, the city decided that it could not afford to enforce a building code effectively.

Not having to deal with code enforcement has allowed me to experiment with several new building techniques, including the frost-protected shallow-foundation technique, the airtight-drywall approach, and whole-house exhaust-only ventilation. I have used all three techniques without any problems or callbacks since 1982, and I would have encountered a lot of grief had I been dealing with code enforcement during that time. Strict code enforcement is a hindrance to innovation in an industry that needs to change dramatically to keep up with the advances in building science that can significantly improve the quality of homes that are built today. It took more than 15 years for the frost-protected shallow-foundation technique to become approved in the codes, and there are still code officials in some locales who are reluctant to allow it. This is after the technique has been used in Europe for over 35 years.

Bill Eich is a green builder in Spirit Lake, Iowa, and is the owner of Bill Eich Construction Co.

Codes

Where we've been . . .

1600
The first building codes in the United States attempted to prevent the spread of fire. A general requirement for building chimneys in buildings at Jamestown was said to be the first-ever building code in the New World.

1875
In the wake of the Great Chicago Fire of 1871, the National Board of Fire Underwriters pushed to enact building codes, which may have led to the creation of the Building Code and Fire Prevention Ordinance of 1875.

1890
The National Electric Light Association called a meeting to develop rules for the safe use of electricity. Later, the National Board of Fire Underwriters adopted this code and renamed it the National Electrical Code.

1896
Under pressure to create a national standard, the National Board of Fire Underwriters voted to draft the first edition of the National Board's model building law. First published in 1905, it quickly lost support.

1945
By 1945, three model codes had been developed: the BOCA National Building Code, ICBO's Uniform Building Code (UBC), and SBCCI's Standard Building Code (SBC).

1972
BOCA, ICBO, and SBCCI formed the Council of American Building Officials. The purpose of this group was to establish and maintain lines of communication among the three model code organizations.

1994
The International Code Council was formed to develop a single set of codes. BOCA, ICBO, and SBCCI were the founders of what is now known as the ICC.

1997
An ICC/NAHB task force recommended to the ICC board a stand-alone residential code. This code was called the International Residential Code for One- and Two-Family Dwellings. It's now known simply as the IRC.

. . . and where we're going

By 2015, the ICC hopes to reduce the energy use of a code-built home by 50% over 2006 benchmarks. Not all the 2015 code changes have been finalized, but here is a look at how energy-related code provisions have progressed over the years.

	2006	2009	2012	2015 (proposed)
Duct construction	Same as 2003 but requires air handler and filter boxes to be sealed	Code requires all ducts to be sealed, and for ducts and the air handler to be completely inside conditioned space or for a duct-tightness test to be performed on the system.	Duct-tightness requirements have become more stringent: from 12 cfm to 4 cfm per 100 sq. ft. of conditioned floor area (after construction).	Strict and verified quality control (refrigerant charging, duct design, thermostat placement, etc.)
Efficient lighting in dwelling units	No requirement	Code requires at least 50% of the permanently connected lighting in dwelling units to be fitted with high-efficacy lamps.	Code requires at least 75% of the permanently connected lighting in dwelling units to be fitted with high-efficacy lamps.	Code requires occupancy sensors or other automatic controls for lighting in selected areas of the home (closets, bathrooms, garages, outdoor lighting).
Airtightness requirements	No verification requirement	Builders were given two compliance options: either follow an envelope checklist or have the home tested with a blower door. The blower-door threshold requirement was 7 air changes per hour (ACH) at 50 Pascals. No equipment-envelope trade-offs were allowed.	Builders must now comply with checklist requirements and conduct a blower-door test. Air-leakage requirements have increased to no more than 5 ACH50 for climate zones 1 and 2, and 3 ACH50 for homes in all other zones.	To be determined
Whole-house mechanical ventilation	No requirement	No requirement	All homes in zones 3 through 8 and some homes in zones 1 and 2 are required to have a whole-house mechanical ventilation system.	Code requires heat recovery in colder climate zones when mechanical ventilation is required.
Exterior-wall insulation and thermal bridging	Wall insulation required by climate zone	Typical cold-climate (zone 5) ceiling insulation: R-38	Wall-insulation requirements have become more stringent in climate zones 3, 4, 6, 7, and 8. For the first time, builders in climate zones 6, 7, and 8 are now required to install exterior rigid-foam insulation. The minimum ceiling R-value (zone 5) is increased from R-38 to R-49.	To be determined

"The additional 50% improvement the ICC wants to dictate by 2015 is going to be very hard to achieve."

Larry Brown

Strict codes complicate construction with questionable results

We need to focus on the existing housing stock. Some old homes have no insulation; others have inadequate insulation and inadequate air-sealing. The old homes are the energy guzzlers; new homes consume very little energy by comparison. Today's biggest houses use less energy than the small houses of yesteryear.

I'm concerned about the payback and the economic impact that comes with escalating energy codes. When you look at multifamily houses, the payback for energy-efficiency upgrades required in the 2012 IECC may take 100 years or more. Between 2006 and 2009, the energy code achieved a 15% improvement and then another 30% in 2012. The additional 50% improvement the ICC wants to dictate by 2015 is going to be very hard to achieve. We have tightened homes to the point that we have to introduce fresh air artificially, which then has to be preheated and cooled, knocking off some of the energy savings we gained while creating potential air-quality problems. We're now forced to fight new problems we created in trying to solve the old ones. In the end, the customer just won't be able to pay for it. A focus on improving the existing stock of homes would provide an energy benefit, and more significant savings for the consumer, but also badly needed residential construction jobs for beleaguered builders.

Larry Brown is vice president of the NAHB's Construction, Codes and Standards Department.

Even more telling, during a recent presentation on the influence of voluntary rating systems on the energy code, James Scott Brew, AIA, a principal architect working with the Rocky Mountain Institute, showed a graph that dramatizes the increasing rigor of the model energy code. While the 2006 IECC represented a more significant increase in requirements than occurred over the prior 35 years, according to Brew, the 2015 IECC will achieve another 50% reduction in residential energy use over a house built to the 2006 code.

Once cutting edge, high-performance construction practices soon will become code minimum. Builders engaged in Energy Star and other voluntary ratings programs have a leg up, therefore, both in education and in practice. If you want to know what codes will look like tomorrow, join a program like the DOE's Builders Challenge today.

Brace for code shock

For builders who have been out of the home-building industry during the past few years, reentry could entail an element of code shock. "The codes have moved from a prescriptive to a performance base that provides greater flexibility, but also adds complexity," says Sims. "This presents much more demanding criteria on the designers and contractors. Ultimately, we're rediscovering the value of engaging architects and engineers that know how to detail plans and call out appropriate specifications."

"Codes have become more technologically advanced over the last six or seven years due to advances in building-science research," says Matt Belcher, a builder and former code official in St. Louis. "From 2009 to 2012, we have seen more changes in the code than ever before, and the pattern will continue through 2015."

New code concerns that builders have not encountered in past decades include more-stringent water-conservation measures and quickly evolving indoor-air-quality standards. Manufacturers have also continued to develop new products, such as new engineered-wood products and materials with recycled content, and to promote aggressively the inclusion of these products in the codes.

Jay Crandell, P.E., former director of the structures and materials division at the NAHB Research Center and now a consultant, sees several areas where codes have become more challenging, including new wall-bracing requirements, changing lumber design values and span tables, and most significant, integrating new energy codes with the structural code. For example, codes now require a water-resistive barrier behind all cladding, but not all materials work equally well in every combination. "There are so many new products, and their properties are all over the place," says Crandell. "It all depends on the sheathing's permeability, what climate you're in, and what wall assembly or specific materials you're using. Let's say you've added a significant amount of insulation, which changes the properties of your exterior building shell. A typical builder may understand insulation, but not its effect on moisture management, dew points, etc. One approach or product does not necessarily work in every instance, and you can get into trouble with any one of them if not executed properly. When you do the wrong thing on the job, even following the code, it's not the inspector or the code writers that get blamed—it's you."

Fortunately, the technology and knowledge to implement such an assembly correctly is widely available, and a good design consultant can help to evaluate the best trade-offs in material selection, performance, and cost.

We all know that the days when a handy backyard mechanic with a handful of tools could fix the family car have passed. Perhaps the days when an old-line builder, an expert through experience, could competently construct a code-compliant house are also fading. Increasingly, the industry has moved in the direction of trained professionals with at least a basic understanding of building science and engineering. It's no longer a question of when codes will catch up to modern demands; it's now the builder's turn. □

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Illustration this page: Jacqueline Rogers