Expert Commentary

Defining and Fixing Construction Defects

Probably the most famous "construction defect" of them all is the Leaning Tower of Pisa in Italy. More than 700 years after completion, it still stands, albeit a bit crooked and seemingly defying gravity.

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Construction Defect Coverage

The construction of this bell tower for a church began in 1173 A.D. and continued in several phases over a very long period of time. There were lengthy interruptions that delayed the project's completion over 200 years later.

The project is unique in its design, construction, and aesthetics. The engineer, Bonanno Pisano, designed a 16,000-ton tower that is 179 feet in height on a stone base that is approximately 10 feet thick. Unfortunately, or fortunately depending on one's perspective, it was constructed on top of a "crumbly state of the ground." Apparently, the tower started to tilt sometime in 1185 A.D. and today has an inclination measured at about 15 feet.[1] Subterranean water is present, and it is apparent that the soil, composed of clay and other deposits, is subsiding.

> In the last century, the increasingly accurate measurements of the building and the surveys of the subsurface conducted with a wide range of devices, combined with historical and archival surveys, have shed some light on the matter. The Tower was presumably initially designed as a straight building; however, it must have begun to subside right from the first stages of the building work. The subsidence was due to the special morphological features of the ground, composed of several layers of clayey materials and silt, run through by groundwater levels at about 1 meter deep. These conclusions can be drawn from an observation of the soil, and the corrections made to every floor of the building. What is certain, based on the scarce information we have, is that over the centuries the oscillation of the building was minimal, since it must have eventually settled on the ground.[2]

Construction Failure

At the outset, it is important to realize that structures can fail for reasons other than construction and design defects.

> All buildings have an expected lifespan and even the structures of the ancient world will erode into a mound of sand given enough time. The eventual failure of a structure is an expected result rather than a manifestation of a construction defect.[3]

While design and construction professionals can fail to meet standards of care resulting in construction defects and damages, structures are simply not built to last forever, and neither are they required to be perfect in design and construction. The question, then, is whether the failure is due to normal wear and tear, the result of the expiration of the useful life of the structure, a maintenance problem, or one actually due to a construction and/or design defect.[4]

Construction Material

Construction material varies with types of construction, geographical location, amenities desired, and other factors. Materials typically include concrete, wood, steel, stone, glass, drywall, brick, landscaping, etc.

Building Components and Life Expectancy

In February 2007, the National Association of Home Builders/Bank of America Home Equity issued a report, *Study of Life Expectancy of Home Components.*[5] The following describes the US housing stock in 2005.

> The 2005 American Housing Survey by the U.S. Census Bureau shows that there are more than 124 million homes in the housing stock, with a median age of 32 years. About one-third of the housing stock was built in 1960 or earlier. About 10 percent was built in the 1960s, and another 20 percent was built in the 1970s. Of the remainder, 13 percent was built in the 1980s, another 13 percent was built in the 1990s, and 8 percent in the first years of the 21st century.
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> Of the total stock of 124.3 million housing units, about 109 million are occupied housing units, 11.6 million are vacant and about 4 million are seasonal. Two-thirds of all units in the nation's housing stock are single-family detached or attached, 8 percent are in buildings with 2 to 4 units, and about 17 percent are in buildings with 5 or more units. The remaining 7 percent of the stock is in HUD-code homes.
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> About 18 percent of the occupied housing stock is in the Northeast, 23 percent is in the Midwest, 37 percent is in the South, and 21 percent is in the West.

Here are just a few of the study's findings.

- **Concrete and masonry.** Masonry is one of the most durable components of a home. Chimneys, fireplaces, and brick veneers can last a lifetime, and brick walls have an average life expectancy of more than 100 years.
- **Engineered lumber.** Floor and roof trusses and laminated strand lumber are expected to last a lifetime, and engineered trim is expected to last 30 years.
- **Footings and foundations.** Poured as well as concrete block footings and foundations last a lifetime, assuming they were properly built. Termite proofing of foundations will last about 12 years if the chemical barriers put in place during construction are left intact. Waterproofing and bituminous coating lasts 10 years, but if it cracks, it is immediately damaged. Concrete or cast-iron waste pipes are expected to last 100 years or more.
- **Framing and other structural systems.** Framing and structural systems have extended longevities: poured-concrete systems, timber frame houses, and structural insulated panels will all last a lifetime. Wall panels and roof and floor trusses will similarly last a lifetime. Softwood, hardboard, and plywood last an average of 30 years, while oriented strand board (OSB) and particleboard are expected to function properly for 60 years.

- **Insulation and infiltration barriers.** As long as they are not punctured, cut, or burned and are kept dry and away from ultraviolet rays, the cellulose, fiberglass, and foam used in insulation materials will last a lifetime. This is true whether the insulation was applied as loose fill, house wrap, or batts/rolls.
- **Roofing.** The life of a roof depends on local weather conditions, proper building and design, material quality, and adequate maintenance. Slate, copper, and clay/concrete roofs have the longest life expectancy—over 50 years. Roofs made of asphalt shingles last for about 20 years, while roofs made of fiber cement shingles have a life expectancy of about 25 years, and roofs made of wood shakes can be expected to last for about 30 years.

Construction defects often are initially latent, with a later manifestation of symptoms of the defect. They can also be patent; that is, they are readily apparent.[6] Timing is important for a number of reasons, including the impact on statutes of limitations and repose and the "trigger of coverage."

Statutes

Construction defects can be defined by statute. For example, in Nevada, NRS 40.615 defines a constructional defect as the following.

> A defect in the design, construction, manufacture, repair or landscaping of a new residence, of an alteration of or addition to an existing residence, or of an appurtenance and includes, without limitation, the design, construction, manufacture, repair or landscaping of a new residence, of an alteration of or addition to an existing residence, or of an appurtenance:
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> 1. Which presents an unreasonable risk of injury to a person or property; or
> 2. Which is not completed in a good and workmanlike manner and proximately causes physical damage to the residence, an appurtenance or the real property to which the residence or appurtenance is affixed.[7]

Florida's Chapter 558.002, defines a construction defect in this way.

> A deficiency in, or a deficiency arising out of, the design, specifications, surveying, planning, supervision, observation of construction, or construction, repair, alteration, or remodeling of a dwelling, any appurtenance to the dwelling, or the real property to which the dwelling or appurtenance is affixed resulting from:
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> a. Defective material, products, or components used in the construction or remodeling;
> b. A violation of the applicable codes in effect at the time of construction or remodeling which gives rise to a cause of action pursuant to s.553.84;
> c. A failure of the design of a dwelling to meet the applicable professional standards of care at the time of governmental approval; or
> d. A failure to construct or remodel a dwelling in accordance with accepted trade standards for good and workmanlike construction at the time of construction.[8]

A Working Definition

A "construction defect" can be defined as a failure of the construction to perform in an intended or expected way. This failure to perform can, but not necessarily, cause physical injury to the work itself and/or other property or work. "Construction defects" include defects in design, faulty work, defective building products/material, and various types of soil failure.

Design defects include the following.

- Improper site selection
- The building/system does not work as designed
- Defective plans, specifications, selection of improper materials

Defective (physical) construction includes the following.

- Faulty workmanship
- Poor quality
- Noncompliance with codes, specifications, plans, product manufacturer instructions, buyer's expectations, or industry standards

Material or products used in a project may be defective, inferior, or inadequate.

Soil defects can be categorized separately and include expansive and saturated soils and improper grading, fill, compaction, and defective testing.

Some "usual suspects" in construction defect claims include the following.

- Saturated, expansive, and poorly compacted soil
- Improper reinforcement of foundation systems, failure to properly prepare for utilities, failure to properly install anchor bolts, crawlspace moisture, and improper foundation waterproofing

- Defects in civil engineering and site drainage
- Framing defects encompassing shear panels, absence of fire stopping, out-of-plumb and out-of-plane walls, and balcony deck framing
- Plumbing defects that include the failure to ream ends of copper pipes that are cut and failure to isolate pipes from framing[9]

Construction defects can be grouped into the following defect categories: site, building envelope, structural, heating/ventilation/air conditioning, electrical, plumbing, and fire/life safety systems.[10]

Increase in Frequency

Why do construction defects seem to be occurring more frequently? A number of reasons have been offered: an abandonment of "the traditional design approach where the architect would utilize established ... standards and details ... that were similar and consistent, i.e. 'tried and true'"; untested new business materials that are limited in application; inadequate design detail; a change in the contractor's role from "Master Builder" to "master broker" with the latter's emphasis on "low initial cost and higher profits" overriding the goal of a product free of defects; the priorities of getting the project done as quickly as possible and maximizing profit; the overall "lack of quality assurance and quality control"; and the lack of effective coordination "resulting in scheduling and sequencing problems."[11]

Back to the Tower

Movement of the Leaning Tower of Pisa continues, as do restoration efforts to stabilize it. Incredibly, despite the design and construction defects, the tower still stands. Aside from the antiquity and beauty of the structure giving it historical value, the leaning caused by a defect in construction or design certainly enhances its value.

But if it wasn't leaning, would the tower be the tourist attraction that it is today? There's no substitute for seeing it in person. It is breathtaking.

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[1] G. Barsali, U. Castelli, R. Gagetti, and O. Parra, *Pisa: History and Masterpieces* (Sesto Fiorentino, IT: Casa Editrice Perseus), pp. 8, 18.

[2] http://www.opapisa.it/en/miracles-square/leaning-tower.html.

[3] Frank Gatlin, *Identifying & Managing Design and Construction Defects* (Construction/Insight from Hindsight: Issue 5, Winter 2013).

[4] Gatlin.

[5] National Association of Home Builders/Bank of America Home Equity, *Study of Life Expectancy of Home Components*, Prepared by the Economics Group of NAHB, February 2007.

[6] Gatlin.

[7] https://www.leg.state.nv.us/NRS/NRS-040.html#NRS040Sec615, retrieved January 23, 2020.

[8] http://www.leg.state.fl.us/statutes/index.cfm?App_mode=Display_Statute&Search_String=&URL=0500-0599/0558/Sections/0558.002.html, retrieved January 23, 2020.

[9] Robert S. Mann, *Defect-Free Buildings: A Construction Manual for Quality Control and Conflict Resolution* (New York, NY: McGraw-Hill Companies, 2007), p. 92.

[10] Gatlin.

[11] Gatlin.