



Buying a Home - Structural Considerations (Part 1)

Buying a home is probably the most expensive purchase a person or a couple will make in their lifetime. If one buys wisely, the home will not only provide shelter, comfort, and sanctuary from the rest of the world for years, but may provide a good investment for retirement or wealth to be passed down to one's heirs. If one buys poorly, the home will probably provide shelter, but may become a money pit and/or a great aggravation. This article is intended to provide some helpful information to educate the home buyer with their purchase. It is an article that discusses some general principles that may or may not apply to a specific home. This article is not an exhaustive discussion of building components, but intended to discuss issues that we have observed in our examination of hundreds of single-family dwellings since 1983. We no longer perform home inspections for sellers or buyers, but have gathered our experience evaluating distress, damage, and deterioration of residential buildings.

Finally, since we do not know anything regarding your specific situation, we are not providing advice for your situation. If you are reading this, you are probably a prudent person: therefore, act prudently. If you do not understand an issue, contact a professional, educated and

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experienced in the issue you are concerned about. We neither state nor imply any guarantees or warranties in this article. With these warnings in mind, let us begin.

Since we are structural engineers, our information will be focused on the building structure and the exterior finishes. However, there are so many structural issues to review when buying a home, we cannot possibly provide information for all of them in one a short article. We have limited ourselves in this article to structural issues that we have deemed appropriate. We plan to have a series of articles discussing additional issues. Please read the other articles in this series for information regarding electrical, mechanical, and architectural components.

Roof - Composite Asphalt Shingles

Starting at the top of a dwelling, the service life of a 20 year asphalt composite shingle in the Northeast Ohio area is commonly 15 to 20 years. The service life of the shingles may be reduced by poor ventilation of the attic, which causes the shingles to be cooked by heat from the attic in the summer and in the winter dampened by airborne moisture escaping through the roof deck. Service life may also be reduced by heavy shading under trees. Shading slows the drying of the shingles after a rain. Excessive and prolonged wetness can promote biological growth and accelerate aging of the asphalt. Excessive scuffing from repeated foot traffic or mechanical damage from dropped tools can also reduce the service life of shingles.

The accumulation of debris especially at valleys or roof transitions (changes of slope or direction) can pond water from roof runoff and promote leakage. It can also promote plant growth in which roots penetrate the shingles. Roof valleys, that is, the diagonal trough where two different roof slopes meet must be clear to discharge into the gutter or onto a lower roof surface where the roof runoff can flow freely. Roof valleys should not terminate into the side of a wall or at a corner of a wall: this configuration is almost sure to promote leakage and requires a special application of roofing membrane or ice guard under the shingles. A simple hip or gable shaped roof are the least likely to develop leakage because these have fewer flashings.

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Roof leakage often occurs at roof penetrations, such as soil stack, chimneys, roof vents, or skylights. Thus, the fewer of these the better. The history of leakage at penetrations may be reviewed from inside the attic or on the ceilings or walls directly below or down slope from these. Look for moisture stains, multiple rings of moisture stains, discoloration of the wood, obvious repair to the ceiling or wall finish, a different surface appearance (patching or re-painting) of the ceiling or wall finishes. See our article [Assessing the History of a Water Source](#).

While on the roof look for dark streaking that extends down the slope of a roof slope. This is commonly due to algae growth on the granules and is usually only a cosmetic issue. From about the mid-1980s to the mid-1990s the shingle manufacturers were using a material for the granules that promoted algae growth. They have since added algaecides to reduce algae growth.

Evidence of a different color or shade of shingles may indicate repair work for previous damage or leakage. The application of caulking, roof cement, or other goop is also indicative of repair work. Multiple layers of these may be indicative of a repeated problem with leakage. A concentration of small gouges or linear scratches in the shingles, on the flashing (especially valley flashings), and in gutters may indicate the manual removal/chopping of ice and snow due to ice damming.

Other information about shingles may be obtained from our article [Shingle Damage Evaluations](#).

Gutters, Downspouts, and Overhangs

Roof shingles provide weather proofing by shedding the roof runoff down slope to the gutters or off the edge of the roof. The gutters carry the runoff away. The gutters should pitch and drain down to the downspouts. If they don't drain properly, water and debris will accumulate and/or freeze, increasing the risk of gutter damage and ice damming. Downspouts should discharge into underground drain lines - plastic or clay tile. If a downspout discharges onto the

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ground, it should discharge more than 4 feet away and the grade should be pitched to drain the surface water away from the basement or foundation wall. If roof runoff is not handled properly, it will increase the inward pressures on the basement walls when it soaks into the soil behind the basement walls and may infiltrate through the wall into the basement. See our article [A Primer on Basement Wall Distress](#) for further discussion about the effects of groundwater on basement walls.

While examining the gutters and downspouts examine the overhang and the soffit of the overhang. White powdery coating or brown stains on the trim of the overhang may be indicative of the condensation of excessive airborne moisture along the eaves or repeated ice damming. See our article [There is Mold in My Attic](#) for further discussion.

Exterior – Vinyl Siding, Aluminum Siding, Wood Siding, and Brick

Vinyl siding is a common, relatively inexpensive finish for the exterior of a home. However, it is prone to discoloration from the accumulation of airborne dirt and algae growth from the accumulation of dirt. Dirt accumulation on vinyl siding needs to be washed annually to prevent algae growth. The washing may consist of only spraying with a properly set garden hose. Heavy accumulation of dirt or algae may require power washing. Review the manufacturer's recommendations for the proper method of washing.

Aluminum sided exteriors also require an occasional washing from dirt accumulation, but much less often than vinyl siding. Aluminum siding has become less popular due to its tendency to bend or dent when impacted by toys, tools, furniture, elbows, etc. It also can be scratched or discolored by fading or dusting of the finish. In some neighborhoods, it has been reported that aluminum siding is being removed by vandals and sold as scrap metal.

Wood siding, which had been popular many years ago, is also a tried and true exterior finish. Wood siding requires regular painting (about every 5 to 10 years, depending on many factors). If it is dented, scratched, or discolored, it is relatively easily cleaned, repaired, replaced, painted

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etc. Excessive peeling of the paint on wood siding is usually indicative of excessive airborne moisture migrating out through the siding. The source or cause of the excessive moisture must be determined to resolve this condition. Covering the exterior with vinyl or aluminum siding is not a good long term solution. See our article [There is Mold in My Attic](#) for further information about excessive interior airborne moisture. Sometimes the peeling of paint is due to misapplication or interaction of latex and oil based paints.

No matter which finish is used, vinyl or aluminum or wood, these finishes require proper flashing above and around window and door openings, where the siding abuts the roof line, and at the corners. The edges and ends of the siding should exhibit a straight, clean cut where they abut the flashing, the J-channels (vinyl and aluminum), and corners. Siding on a second floor against a roof should be held ½ to 1 inches above the roof shingles to allow the flow of water and debris. There should also be short bent metal tins called step flashing at each shingle that abuts the wall, which flashes each shingle to the wall. The bottom most flashing should extend out onto the top of the shingle surface to direct roof runoff away from the wall, not terminate behind the siding.

Siding that bulges out or is loose at the second floor framing level is probably due to the shrinkage of the wood framing at the second floor. The shrinking of the depth of the floor joists from moisture loss shortens the height of the wall at the second floor line. The shortening of the wall causes the lip of the overlapping siding to uncouple from the siding below it. This may be fixed with careful re-nailing and/or dabs of caulking.

A brick exterior is a more expensive exterior finish, but it more durable and trouble free for most of its service life. It requires little cleaning. It does not dent or scratch easily. However, the mortar in the joints wears from wind and rain and cracking may appear from foundation movement or shrinkage. When the joints are worn enough, the brick wall is more easily penetrated by water from rain. Worn or cracked mortar joints require scraping and repointing on a regular basis, about every 20 to 40 years depending on the quality of the mortar and the

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brick units and/or the quality of the original workmanship. A good mason can match the mortar color fairly well.

The Attic

Examination in the attic may reveal many things:

1. Fractured or severely split framing may need to be sistered, that is, a new second member placed alongside the original member.
2. Moisture staining around chimneys, vents, soil stacks or other roof penetrations may indicate roof leakage. Examine the roof for potential causes, such as, nail holes, exposed nail heads, missing shingle tabs/strips, loose or dislodged or missing flashings, a split boot on a soil stack, a loosened or dislodged boot, a loose or lifted vent, etc.
3. Spotty dark dots of moisture staining or biological growth (mold) are usually indicative of inadequate attic ventilation, but may also indicate excessive humidification in the winter, excessive use of vaporizers, or other source of excessive airborne moisture generation. Moisture spots on the floor of the attic or on the top of the insulation indicates the dripping of condensation from of excessive airborne moisture from the underside of the roof deck. See our article [There is Mold in My Attic](#) for further information.
4. Sagging rafters or a sagging ridge (usually viewed from the outside) may indicate a structural deficiency in the roof framing. A structural engineer may be required to evaluate the framing for compliance with acceptable construction practices or the local building code and to recommend repair. See our article [My Roof is Sagging!](#)

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Interior Cracking

Interior cracking can be a symptom of an underlying structural condition. If a structural condition is suspected, a structural engineer may be needed to evaluate the condition. A few interior conditions are discussed here:

1. Cracking at the tops of the walls where the walls meet the ceiling on the top floor of a home may be due to truss lift. If the roof framing above is comprised of trusses, and if the separation is greater near the mid-span of the trusses (the center of most homes), and if the separation opens and closes seasonally, it is probably related to the seasonal lifting of the trusses. Roof trusses lift and drop as the wood members shrink and swell from moisture variation and/or expand and contract from thermal variations. Excessive movement results in the trusses lifting the ceiling off the tops of the interior walls. The effects of excessive truss lift may be reduced with proper ventilation. Sometimes truss lift cannot be reduced enough to prevent recurring damage. In those situations, the interior finishes may be fit with expansion joints or a free floating crown trim to permit the up and down movement without recurring damage.
2. Shrinkage cracking often occurs above door openings or above and/or below window openings. It is due to the shrinkage of the building materials. It usually occurs at a joint in the drywall or at the corner of an opening in plaster. These can be patched and repaired, but they may return.
3. Interior diagonal or stairstep cracking accompanied by out-of-square doors and adjusted latches indicate that the floor is sagged. Sagging maybe due to shallow depth floor joists: the depth of the floor joists should be approximately the span in inches divided by 20. Sagging may be due to the lack of a double joist at a floor opening for a chimney, stairway, etc. Sagging may be due to the removal, notching, or cutting of a structural member such as a joist, a beam, or a post. A structural engineer may be required to

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evaluate the framing for compliance with acceptable construction practices or the local building code.

Basements

Basements are an important place to inspect for potential problems. Any repairs done in a basement are expensive and almost always require a professional with big equipment or a shovel and a strong back.

Small amounts of settlement in an older home are generally not a serious issue. However, if the settlement begins to progress, it can require an expensive solution. Settlement in a home is usually evidenced by stairstep and/or vertical cracking that exhibits a vertical offset across the crack separation. If settlement is observed in a home that is near a steep hillside, the settlement may be related to earth movements called a landslide. Landslides are usually very expensive to restrain. The evaluation of a landslide often requires an analysis and recommendations by a professional called a soils or geotechnical engineer.

An inward bowing of a basement wall from excessive earth or excessive groundwater pressures will be expensive to repair, many times \$150 to \$300 per linear foot of wall length (in 2009 USD). See our article [A Primer on Basement Wall Distress](#) to learn about the more common basement wall problems.

General

Moisture staining, peeling paint, blistered paint, bubbled wallpaper, discoloration or fading, decay or deterioration anywhere in a home may be indicative of an ongoing moisture or water related issue. See our article [Assessing the History of a Water Source](#).

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Exterior Grade

The exterior of a home can speak volumes. For example, a home situated at the dip in the road or the neighborhood may be susceptible to flooding in the basement. Or at least in heavy rainfall the yard may become a retention pond. As mentioned previously, a home on or at the top of a steep hillside may be susceptible to earth movement from a landslide: proper handling of surface and roof runoff are important to reduce the risk of a landslide, that is, collect the water and keep it off and out of the hillside. Uneven, pitched, and sunken pavements (driveway and walkways) around the home indicate that the pavements were set on a poorly placed backfill or that the soil is moving, that is, consolidating, heaving, or seasonally swelling and shrinking with moisture variation. Movement of the pavements should prompt a buyer to re-examine the portions of the home on shallow foundations, such as, porches, garages, patios, additions, chimneys, etc. for dropping and/or separating from the dwelling. These movements may just be a nuisance or may eventually require substantial repair depending on the cause, the amount of movement, or the tolerance of the movement by future home buyers. Chimneys create a special hazard as they are constructed to contain heated exhaust gases. If separations or cracking allow the exhaust gases to escape, it may result in a fire or carbon monoxide poisoning.

Well, we have literally taken you from the top to the bottom of a home, and even outside. All this information may seem overwhelming for the first time home buyer, and it is. But having some of this information may help answer some questions or generate the right questions to be asked of a registered or certified home inspector, seller, or realtor. You don't need to have all this information memorized, but just know where to find the information for your particular issue when it arises.

Good house hunting.

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