



MONTHLY

News and Views from the Connecticut Association of Home Inspectors, Inc.

June 2007

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Meeting Dates

Jun 27	Foundations – Michel Beaudoin from Techno Metal-Posts
Jul 25	Mold & Indoor Air Quality - Douglas Auvine from IAQ Plus
August	Vacation Month - No Meeting Scheduled
Sep 26	Electrical issues – Tim Mikloche from Electrical Training Services, LLC
Oct 24	Neutocrete Systems
Nov 28	Brackets & Hangers – Lou Daviau from Simpson Strong Tie

Holiday Inn
201 Washington Ave
North Haven
(203) 239-6700

Foundation Inspection Methods - Part One

By Daniel Friedman

I. SITE FACTORS - in Foundation Damage Diagnosis: How to Observe Site Factors Which May Damage a Building Foundation

- Area History** in Foundation Damage Diagnosis: Is there evidence of a history of earthquakes, landslides, mud slides, soil settlement, sink holes, construction on fill, or buried debris on or at sites in the area?
 - Constructed on fill, or on organic/site debris used as fill or buried for disposal, risks future settlement. In some cases, burying site debris or trees, or construction over an old landfill, can result in dangerous settlement or even sudden ground openings occurring years or even decades later.
 - Constructed over or close to a ravine: Ravines, ditches, filled areas, or underground streams can result in later earth movement, slides, and foundation damage.
 - Neighborhood history; cracks in other houses in the area. If other homes in an area are observed to have settlement, leaning, or foundation damage, watch for those conditions on the property being inspected. In an area of one Northeastern U.S. city, all of the homes in a hilly neighborhood lean consistently to the right and have suffered major settlement damage.
- Area geology** in Foundation Damage Diagnosis:
 - Sink holes:** sink holes can appear suddenly and be a catastrophe; they are more prevalent in certain areas of the country. Sink holes, collapsing soils, voids open suddenly after heavy rains identify by history of area; insurance is available and limited "free" Geotechnical analysis may be available from local state or county government in problem areas. A homeowner should tell the insurance company if there is a sinkhole, evidence of one, or suspicion of one. For detecting evidence of sink holes in an area by visual inspection see www.inspect-ny.com/vision/sinkholes.htm (Sink Holes: Can X-Ray Vision [Advanced Building & Building Site Inspection Techniques] Warn of Sink Holes in Florida or elsewhere?).
 - Lakes and Streams:** surface drainage, water and earth loading: observe nearby lakes for evidence of the probable level of the high water table in the soils on which a building has been constructed. Is the basement below lake or stream level? In areas of Long Island, NY, some homes are constructed with a basement floor below the level of nearby waterways, and survive only by having continuously operating sump pumps. One such home collapsed during an inspection by the author.
 - Solid rock or rocky construction sites:** may mean that foundation construction required blasting. Unusual cracking in a poured concrete foundation of a modular home in New York State was traced to a combination of inadequate footing preparation and blasting at an adjoining site as a second house was being built.

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President's Corner

Bernie Caliendo

First of all I'd like to thank all of you who have or are in the process of renewing your membership. Your dedication to CAHI is greatly appreciated and will be rewarded with another year of top quality seminars, newsletters and benefits.

CAHI is not the association it use to be with 15 to 20 members attending monthly meetings while waiters passed in front of a speaker trying to give a presentation. As licensing changed a lot of that, CAHI changed and grew to meet the challenges and brought the organization to the premier level it is today.

As we grew, more responsibilities were placed on the Board of Directors to make sure those challenges were met. Some of those tasks are behind the scenes and are a thankless responsibility placed on Board members. As we grew, there were purchases made by the Board that made us a professional association presenting quality monthly and yearly seminars.

The purchase of a sound system has greatly enhanced the quality of our seminars along with the purchase of a projector that gives us the capabilities of power point presentations and other forms of presentations on disc. The purchase of a storage trailer has had a two-fold benefit. Board members no longer have to bring this equipment home and store it in their garage, basement, pick-up truck or dining room. Believe me, these are places the equipment has been stored. The library was a compilation of boxes with tapes and books sitting in another director's home. The trailer has also created a new form of advertising for the association as it travels from place to place.

Other behind the scenes work includes: The [Web Site Committee](#) maintains the web site which is no small feat, keeping member information accurate, updating events, constantly adding continuing education links, providing information that is beneficial to members and the general public alike. CAHI's [E-Mail Site Committee](#) is maintained daily with responses in a timely manner along with e-mailing pertinent information to our members. Our [Education Committee](#) is constantly researching and booking speakers, bus trips and special seminars along with getting everything approved by the Licensing Board. Our [Membership Committee](#) not only takes care of new members but also maintains seminar attendance, certificates and records. The newsletter doesn't just happen, our [Newsletter Editor](#) has to make critical decisions on where to find articles, what articles are appropriate, other content, article storage and getting the copy to our Publisher. The [Treasurer](#) has a job that is endless and, since we are a For-Profit Corporation, record keeping, check and credit card processing, disbursements and tax filings are almost a daily occurrence.

Other disbursements during the year include monthly meeting and seminar room or hall rental fees, speaker or presenter fees, handouts (some handouts at monthly meeting have cost the association \$4 - 5 each), meals (when speakers do not charge a fee, CAHI offers to buy them dinner), Federal & State taxes must be filed and paid, insurance, web site hosting and web master yearly fees, and other daily and yearly expenses. Just to give an example: the Building Science Seminar expenses for the hall, lunch and speaker cost us \$5190.00 and we took in \$375.00 from non-members. Bus trips usually run anywhere from \$1200 to \$1800.

All the Directors on the Board serve at their own expense. There is no pay, although expenses can be reimbursed for such things as printing expenses, postage and toll calls. However, no one has asked to be reimbursed for toll call expenses which over the years has totaled in the hundreds of dollars at the personal expense of some directors.

Next time you see an officer or director, just say thanks. It means a lot!

As stated in our Bylaws, 3 directors are up for re-election every September and are elected by the present board. If you would like to be considered as a nominee for this coming election, please submit your willingness and a brief résumé to the Secretary prior to September 1st in order to be considered.

Thanks and have a great summer!

Bernie

June Keynote Speaker

This month's meeting topic is **Foundations.**

Our meeting will feature [Michel Beaudoin](#) from Techno Metal-Posts. He will explain their techniques and reasons for deep footings, foundation lifting, tie backs and other foundation repair methods. This is a great chance to see first hand how the experts remedy significant foundation problems!

2 hours of Continuing Education Credits

New Web Site Listings

CAHI has added 2 new pages to our web site.

- (1) **Find an Intern** - Anyone who would like to act as a supervisor and take on an intern, login on the "Members Area" box and click on "Find an Intern." Any potential or existing intern who is looking to find someone to act as a supervisor, and has contacted CAHI requesting their name and contact information be posted, will be on this page.
- (2) **Find a Licensed Supervisor** - If you are a Licensed Home Inspector and would like us to list your name as a potential or existing supervisor seeking an intern to supervise, contact CAHI at info@ctinspect.com. We will list your name and contact information under "Helpful Information" on the public section of our web site under "Find a Licensed Supervisor."

These listings do not constitute an endorsement or recommendation by CAHI ! It is the responsibility of the inspector and intern to do their homework when taking on an intern or selecting a supervisor.

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3. **Soils** in Foundation Damage Diagnosis: Are there problem soils such as wet, expansive clay soils, scree, bedrock, boulders, buried debris, evidence of fill? Problems having soil characteristics as their origin can show up years later.

- **Fill:** Is there evidence of construction on fill: Look at the surrounding land, its slope and shape. Look for covered tree boles.
- **Expansive soils** - are more serious extensive and more common in certain areas: e.g. Colorado, North and Central Florida Ocala/Gainesville, and in Canada, Ottawa, Winnipeg, Ontario and Manitoba. Expansive soils shrink and expand significantly as ground water levels vary. In some areas homeowners must install a system to maintain water in the soil below the home to prevent soil shrinkage, settlement, and building damage.
- **Tree bole** is the bottom of a typical deciduous tree where the tree roots begin to leave the trunk and spread underground. Normally the bottom of a tree widens and slopes down away from the tree. If you observe a deciduous tree trunk which is simply vertical, going straight into the ground, you may have found evidence that fill has been added to a site.

4. **Original and Surrounding Slopes:** show the original direction of excavation-sequence used in constructing a building. For example, the foundation

for a home constructed on a steep hillside will normally be constructed by excavating into the hill from the down-hill side of the foundation footprint. The excavation process cuts into the hillside and moves earth from the "uphill" side of the foundation footprint to the "downhill" side where it serves as fill. If the filled-portion of the foundation area is not adequately compacted or stabilized, a result is that building footings are constructed on virgin soils at the "uphill" portion of the home but on filled soils at the "downhill" portion of the home's footprint. It is common to find evidence of footing and foundation settlement cracking occurring over the on-fill portions of the foundation, and perhaps beginning just at the transition point where the footings moved from being poured on virgin soils to being poured on-filled soil. Observing the site shape tips-off the inspector to watch out for evidence of such movement.

5. **Stepped foundation footings:** are a normal practice on steep slopes. But where a site has a combination of intermittent bedrock and steep soils, differential footing settlement and movement often occurs at transition points, such as where a footing steps off of rock and onto soils. Similarly, because a house with a basement and a garage often has footings at two very different depths (8' down for the basement and 3'-4' down for the garage) differential settlement may occur between those structures.

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6. **Exposure of foundation to mechanical or vehicle damage:** A driveway close to the foundation wall, common in older cities, e.g. NYC and Toronto, exposes foundations to damage when heavy trucks such as an oil tank truck or a cement delivery truck pass close to the building to make a delivery. Horizontal earth loading cracks (in a masonry block wall) are likely to appear in a pattern similar to earth loading cracks but higher up than from simple earth loading, perhaps at the center or bottom 1/3 of the wall.
7. **Water, Foundation Leaks, Wet Basements** in Foundation Damage Diagnosis: Trees (their roots) and rocks which are near the foundation define areas to watch out for both root damage to a foundation and, more subtle, water entry from ground water (or roof spillage) which is directed towards the building foundation wall by a combination of these factors:
- Poor site drainage and improper routing of surface runoff, roof runoff, or ground water are very common sources of both basement water entry and foundation damage.
 - Water follows underground passages in soils created by tree roots, digging animals, earth worms, excavations for underground utilities such as water lines and buried electrical lines. If these lead towards a foundation, particularly from an uphill slope, watch for foundation leaks inside such locations.
 - Water follows underground bedrock which slopes towards a building, and is difficult to keep out. Leaks often are observed in a basement or crawl space where bedrock is exposed and one can see the building footing sitting on (and hopefully pinned-to) bedrock or on large boulders.
 - Frost heaving (in freezing climates) - recurrent wet soil freezing, due to poor site drainage or gutter defects, tends to cause horizontal cracks in the upper 1/3 of a foundation wall, always below-grade level, and typically at or just above the natural frost line depth of the soil.
8. **Nearby Roadways:** may expose a building foundation (or other components) to damage from traffic-induced vibration.

II. FOUNDATION CONSTRUCTION - Identify Foundation Construction Type, Materials, Sequence

Foundation Construction Types

- Slab-on-grade
- Monolithic slabs - resist to problems over sink holes/clay
- Supported slabs - on footing/foundation/pins hairline step cracks in block walls above (FL-mc) hairline to 3/16 common at top of slab elevation (FL-mc)
- Floating slabs - not connected to foundation
- Crawl spaces - wall height is a key factor in predicting crawl space failures. Special crawl space wall and knee-wall reinforcement is required in earthquake areas.
- Basement - wall height vs block width/reinforcement
- Additions - connection to original, varying materials, varying footing depths
- Actual footing/foundation type usually not visible

Foundation Construction Materials

- Masonry block for building foundations
- Poured concrete for building foundations
- Brick for building foundations
- Stone for building foundations
- Wood for building foundations
- Pre-cast concrete for building foundations

Foundation Construction Sequence Considerations

- Site preparation, construction on fill
- Excavation-errors
- Forms and footing errors
- Foundation errors
- Backfill errors
- Site drainage errors
- Modular construction concerns
- Site blasting
- Adjacent site blasting

III. DEFECTS OF OCCURRENCE - Identify Foundation Defects of Occurrence

1. COMMON FAILURES - Common Foundation

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Defects of Occurrence - General

- Structural/construction defects and damage
- Concentrated loads
- Excessive backfill height; premature backfill
- Improper materials (soft brick, below grade)
- Shallow/absent/undermined/cut footings, settlement and frost damage
- Improper soil preparation - settling footings and slabs
- Foundation damaged during moved/modular building set
- Equipment damage (backfill, vehicles)
- General signs of movement/damage
- Foundation cracks (see "Diagnosis")
- Leaning or tipping
- Bulging
- Settlement, uniform or differential
- Excessive loading, fractures
- Interior cracks (trace to source)

Note: use of plumb lines, levels, laser levels, & simple measurements of amount by which a wall is out of level or plumb, or of crack widths and patterns are beyond CAHI Scope but are common simple tools and procedures used by masons, carpenters, builders, as well as foundation experts and engineers.

2. FAILURES BY FOUNDATION TYPE - Foundation Defects of Occurrence - by Material

a. Poured Concrete Foundation Defects

- **Cold Pour Joints in concrete foundations** which leave visible lines in the concrete foundation wall are not usually a structural problem but may in some cases form a dry joint which permits water leakage through the foundation wall. Cold pour joints occur when there is too much time delay between subsequent "pours" into the foundation forms. An astute inspector, by noting the position, pattern, and slope of the cold pour joint, can probably determine the position from which the concrete was poured into the forms (the high end of the sloping lines) and the extent of delay between pours (evidence of water leaks through the joints indicates that enough time passed for the lower pour to solidify).
- **Concrete shrinkage cracks** are not usually a structural problem but may

permit water leaks through the foundation wall.

- **Holes and penetrations in concrete foundations** such as poorly-sealed openings left for piping for water or electrical lines or where form ties were broken off may form points of water entry into the structure but are not normally a structural concern.
- **Concrete foundation settlement cracking** such as from footing settlement, absence of or poorly prepared footings, water leading to settlement or actual loss of soils, thus undermining the footings (this can occur and can damage most foundation types), or movement of the foundation due to nearby blasting or excavation work.
- **Concrete foundation damage from horizontal loading, vehicles, frost** is less commonly seen than with unit-construction materials such as brick or masonry block but might occur under unusual conditions.
- **Concrete foundation damage from unusual point loads**

b. Pre-Cast Concrete (Modular) Foundation Defects



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Congratulations John!!

May 21st 2007, Windsor, CT -- John Waiveris, owner of local web design business Invisible Gold LLC., has been named the 2007 Home Based Small Business Champion by the Connecticut Small Business Administration.

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Pre-cast foundation walls such as the Superior Wall R-5™ or Xi™ (extra insulation) systems provide sections of concrete foundation walls which are lifted into place and bolted together, often sitting on a simple gravel footing-base. The wall sections are sealed, typically with gaskets or caulk or both.

The defects we've observed were in installation and did not involve evidence of structural failures.

- **Incomplete sealing** between foundation sections, leading to later basement leaks and water entry
- **Poor modular foundation section alignment**, poor sealing between sections, particularly at building corners, resulting in foundation leakage
- **Inadequate footing drains** (or none), and/or inadequate roof drainage system installation (gutters and leaders) resulting in flooding the foundation and water entry passing under the wall bottom and up over the basement slab at the slab/wall joint.
- **Excessive spanning** of areas with no fill and no footing at all (shown in photo above)
- **Basement water entry and leak problems** require adaptation of common internal trench and drain systems, as cutting the slab to excavate for an internal drainage trench exposes the gravel footings

Inspectors should look closely at the connections and sealant between wall sections and look for evidence of leakage.

Foundation waterproofing companies such as B-Dri™ who are asked to address water entry in homes built with these systems have to use modified intercept drain materials because the absence of poured footings

under the walls gives less depth for an in-basement trench.

We also observed one builder installing some pre-cast foundation wall sections over empty space, spanning voids below the foundation wall of up to four feet. The author, not a structural engineer, performed no analysis on this installation method but it seems likely to demand more of the wall structure sections and connectors than the manufacturer may have intended.

c. Stone Foundation Defect List

- **Bulges:** due to frost, water, vehicle loading if vehicles are driven close to walls
- **Cracks** (if mortared): settlement, vehicle driving close to walls
- **Other:** interruptions for mechanicals may destroy the integrity of these walls. In original construction, stones were placed in an overlap pattern from course to course. Removing a section of wall may result in future wall movement unless other steps are taken to stabilize the modified section.

Stone foundation walls on pre-1900 buildings are often quite thick, up to four feet at their base. In their original design, these walls tolerated water in the outside soils by permitting it to seep through the wall and often to drain away through a dirt floor or even a through-wall drain in a low corner. Beware of such walls which were later made "water proof" by mortar or by casting an inside thin veneer of concrete against the stone. If this change is made without also taking steps outside to keep water away from the building,

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frost and water damage to the wall may occur.

d. Brick Foundation Defect List

This historic brick structure had already begun to collapse when we inspected its condition. The root cause of failure was water from roof leaks and at the building right side (not visible) in-slope grade and surface runoff which soaked the structure's lower foundation walls and permitted frost



damage. As bond courses break and walls bulge, structures of this type are unstable and dangerous.

- **Bulging brick walls:** this is likely to be a bond-brick or bond-course failure - potentially extremely dangerous and very urgent - can presage sudden catastrophic building collapse!
- **Cracks and Bulges in brick walls** (such as the photo above): frost and earth loading - can push a below-grade brick foundation wall inwards. Often the wall is bulged inwards as well as showing horizontal and step cracking and loose bricks over the bulged area. Damage occurs from slightly above ground level to roughly the frost line.
- **Cracks and loose bricks:** frost, settlement, expansion, usually diagonal or stair-stepped, often at building corners where roof spillage is concentrated.
- **Loose bricks and missing or lost mortar:** and movement where mortar is severely washed-out by roof spillage or other water

movement against the foundation. Loose and lost bricks may also occur where wood blocks, originally set into a wall to permit nailing of interior components, is damaged by insects or decay. Similarly, if wood joists are damaged and bend excessively or collapse (insect damage, rot, fire) the collapsing joist can, as its in-wall end moves, damage the foundation or building wall. (Fire cuts on wood joists in brick walls were intended to minimize this damage source by angling the end of the joist where it was set into the wall pocket.)

- **Spalling bricks:** spalling is caused by water and frost, such as water leaking into a brick structure at (improperly) caulked and rusty steel lintels, improper brick masonry structure or wall "repair work" or re-pointing using hard mortar on soft brick where originally a soft high-lime mortar was used.

c. Masonry block (concrete and "cinderblock") Foundation Defect List



In masonry block construction, foundation or wall cracks occur more commonly in mortar joints but can also occur across blocks. Horizontal cracks are more immediately threatening of serious collapse than vertical cracks. Expansion and shrinkage cracks may occur but are less common than in some other materials. Cracks tend to be more severe in the center of walls from external loading and pressure (from any source). Cracks occurring near foundation corners are often from water and frost. In freezing climates, "frost

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lensing" can cause soil to stick to and lift a building foundation when the ground freezes. These cracks are usually visible above grade.

- Leaning: water, frost, vehicles, footings
- Buckled: water, frost, vehicles - potentially urgent depending on circumstances and amount
- Cracks: water, frost, vehicles, shrinkage/expansion, footings
- Poured concrete
- Leaning: water, frost, vehicles, footings
- Cracks*: settlement, shrinkage, cold joints
- Spalling: poor mix, cold weather construction, erosion
- Shrinkage: improper misdiagnosis. Concrete blocks don't shrink. Check the other possibilities.
- Wood foundations (not considered here)
- Pile foundations (not considered here)
- Tipping/undermining - serious defects
- Identify (possible) missing components
- Missing footings, piers, reinforcement, drainage

e. Wood Foundation Defects

"30-year guaranteed treated wood foundation products" used below grade mean that no permanent building foundation has been provided. This is a temporary structure. In areas of wet soils and insect damage, risk damage may occur sooner than the warranty period.

Daniel Friedman - www.inspect-ny.com

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