TORELLO ENGINEERS
DESIGN - INVESTIGATION - INSPECTION

215 Essex Plaza
Essex, CT 06426
Phone: 860-767-7075

February 25, 2021

Jodie Redacted
38 Redacted Rd
Anytown, CT 064

RE: 123 Autumn Lane - Anytown, CT.

Ms. Client,

On February 21, 2021 we visited the above referenced location to inspect the foundation of the existing residential structure - specifically the crack(s) noted during a recent home inspection. This inspection was limited to areas of the foundation that were viewable at the time of inspection. The following are our findings:

OBSERVATIONS

GENERAL

The subject structure is a 2010 built, approximately 1,600 sq. ft. single family residence with a poured concrete foundation, full height basement, and peaked roofs. A two car garage exists at the main level.

SITE GRADING AND DRAINAGE

In many areas the grading around this structure is not ideal, low spots exist that may lead water to the foundation. Downspouts have been connected to an underground drainage system. The grade to the west of this structure slopes toward the subject structure. This grade allows water to run off of the surrounding properties and arrive at the west wall of this structure. This water adds weight to the soil which increases the soil force against the foundation, known as hydrostatic pressure.

FOUNDATION

The foundation is a 10” thick poured concrete foundation, 7’-6” at its full height, the north and east wall of which step down following the contour of the grade. A poured concrete slab on grade exists as the floor in the basement.

On inspection of the foundation walls we observed prominent vertical cracks, (Key Plan Observation Item #1) vertical hairline cracks, (Key Plan Observation Item #2) and diagonal cracks (Key Plan Observation Item #3). These are located on our attached key plan.

Efflorescence (white salt deposits), an indication of water entry into the basement was observed along the interior of all foundation walls as well as the slab in the southern portion of the basement. (Key Plan Observation Item #7)

VERTICAL FOUNDATION CRACKS

Generally, two types of vertical cracks are found in poured concrete foundation walls; Hairline or very small shrinkage cracks, and wider settlement cracks. Settlement cracks appear as larger vertical cracks, or cracks that are tighter at the top or bottom.

As concrete shrinks during the curing process, vertical cracks form in the concrete, some so small they can hardly be seen. This generally does not affect the basement wall structurally, but could allow moisture to enter if the outside wall's waterproofing isn't flexible enough to span the crack. Often smaller concrete cracks of this type can be caulked or injected with an epoxy to limit further moisture infiltration.

Prominent vertical cracks 1/8 in wide or larger are no longer "keyed" together by the aggregate in the concrete, and the wall may move laterally if forces are applied to the cracked wall, resulting in the observed displacements.

Prominent vertical cracks were identified during this inspection, on the north, south and west walls. (Key Plan Observation Item #1)

Two of these cracks (located in the north and south foundation walls) are corresponding cracks; they exist at approximately the same point along both the north and south foundation walls. These cracks are tighter at their base, and wider at the top, an indication of minor settlement. A previous attempt was made to cover these cracks with some type of repair material. This material was not applied within the crack, rather was applied at the wall surface only. This repair material is brittle and not well bonded to the concrete, and provides no structural value and will not prevent water entry. This crack repair has begun to cracked again at the crack location since the repair, indicating some small amount of movement has occurred since this repair was made.

The third prominent vertical crack is located in the west foundation wall. This crack has likely developed as a result of both minor foundation settlements, and hydrostatic soil pressure acting against this foundation wall.

An additional crack of note exists beneath the southern beam pocket of the eastern-most beam in the basement**.** (Key Plan Observation #5) The inside corner of the foundation has been damaged at this location to facilitate plumbing installation. The concrete directly beneath the beam is cracked, and may not provide adequate support for the beam above.

DIAGONAL FOUNDATION CRACKS

There are several common types of diagonal cracks in basement walls. One of the most common is when the crack begins at the top of the concrete basement wall and moves diagonally down to a corner. This is usually accompanied with inward tilting of the top of the foundation wall. Another type of diagonal crack can appear anywhere in the wall and is usually wider at the top and tighter at the bottom. This type of crack is often caused by the foundation settling.

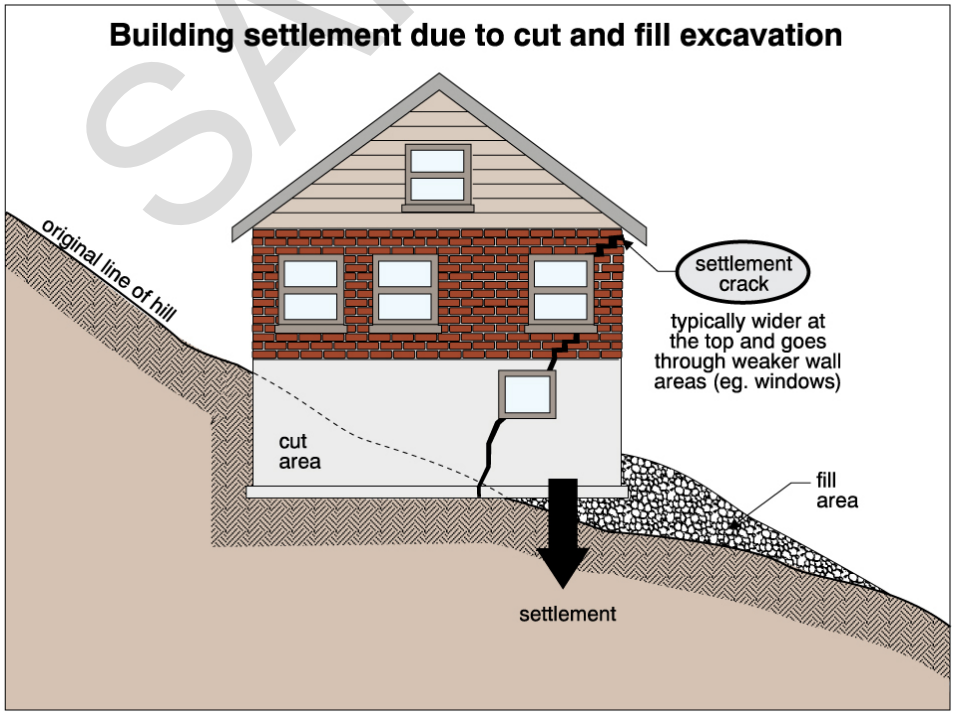
A third type of diagonal crack appears at the corner of a window or door opening. This can have several causes, however the most common is concrete shrinkage similar to that described in the vertical cracks section.

Diagonal cracks were identified during this inspection, on the east and west walls. (Key Plan Observation Item #3)

The diagonal cracks along the foundation walls also showed signs of displacement, or inward movement of a section of the foundation wall. (Key Plan Observation Item #8) At the time of the inspection, the observed movement was minimal, with displacement of less than 0.03 of an inch, an indication that site soils have or are exerting hydrostatic pressure on these walls.

Settlement is the downward vertical movement of a foundation after it is poured. Settlement can occur when the earth or fill material below has not been compacted properly, when organic materials in the soil decay and create voids, or when the footing for the foundation wall is not large enough to support the loads above.

When a sloped lot is contoured for building, a “cut & fill” method is often used to create a flat terraced section of land suitable for building. A portion of the hill is cut, and the material is used to fill the lower elevation, creating a flat area. This cut material is typically re-compacted in its new location, however it is may not be as stable as the virgin, undisturbed soil beneath the other areas of the structure. The topography of this site suggests that this was the case at this location.



In this case, the settlement is likely due to improperly compacted soils. After the foundation is poured the weight of the concrete and structure above consolidates the soil over time until compaction is reached. Settlement caused by consolidation of foundation soils may take weeks, months, or years to be considered "complete."

BASEMENT SLAB

Cracks were also noted in the basement floor slab and are located on our attached Key Plan. This slab has been poured without any control joints. The typical placement of control joints in the concrete surface at predetermined locations creates weakened planes where the concrete can crack in a straight line. This produces an aesthetically pleasing appearance since the crack takes place below the finished concrete surface; the concrete has still cracked - which is normal behavior - but the absence of random cracks at the concrete surface gives the appearance of an un-cracked section. Without control joints, this slab has cracked in a random pattern. Slab cracks observed do not indicate a structural deficiency.

OTHER ITEMS

We noted the following additional conditions:

The shims beneath the south west beam in the basement are loose and do not provide adequate bearing. The shim beneath the southern end of the beam which runs alongside the basement stairs does not provide adequate bearing. (Key Plan Observation Item #4)

The bases of columns located in the basement area show signs of deterioration. Currently, this deterioration is surface level only, and has not compromised these columns. (Key Plan Observation Item #5)

RECOMMENDATIONS

SITE GRADING AND DRAINAGE

The detection of efflorescence on the basement slab and walls, and slight inward displacement of foundation walls, is an indication that the soils surrounding this structure are becoming inundated with water. Proper site grading to reduce the amount of water standing around the structure is recommended.

The roof drainage system deposits into an underground system; its functionality should be verified. Proper operation of this system is key to reducing the amount of water arriving at soils surrounding this foundation.

It is unknown if a curtain drain exists surrounding this structure, however we would recommend the verification or installation of a properly designed curtain drain at the west side of this structure which will adequately reduce the amount of water being delivered to the foundation and surrounding soils. Reducing the water in soils surrounding the foundation will reduce hydrostatic pressure against the foundation.

FOUNDATION

The pattern of cracks observed in this foundation indicates to us that some settlement has occurred during the life of this structure. Our recommendations are a combination of epoxy injection and monitoring.

Typically, unless there is an underlying soil problem, settlement happens early in the life of the structure, and as the soils below compact over time, the amount of settlement per year decreases. **Based on the relatively small movements observed during our inspection, it is our opinion that gross settlement is unlikely to continue along these foundation walls.**

Prominent vertical cracks (greater than 1/16” in width), and all diagonal cracks should be epoxy injected. We recommend using **Sika Sikadur** products. These cracks should then be monitored for future movement, with a recording crack monitor capable of 3-axis recording. Slight cracking of the repair area is expected and can be re-patched, however, should these cracks open significantly (more than 1/8”), or additional displacement is detected, further investigation of this foundation and analysis of the supporting soils will be required.

The crack located beneath the beam pocket (Key Plan Observation Item #5) should also be epoxy injected as above, to restore integrity at this location. We additionally recommend the installation of a properly designed column and footing, as close as possible to the installed plumbing, to provide additional support for the beam above, as the beam pocket can no longer be relied upon for support.

The observed hairline cracks are not a structural issue. These cracks should be monitored for water infiltration, and if present can also be epoxy or urethane injected.

OTHER ITEMS

Beams should be properly supported with either hardwood or masonry supports, providing full bearing between the beam and beam pocket. Installed shims should be secured in place.

Columns in the basement should have surface rust removed, and be repainted to prevent further deterioration of these columns. This condition, if uncorrected, can cause eventual column failure.

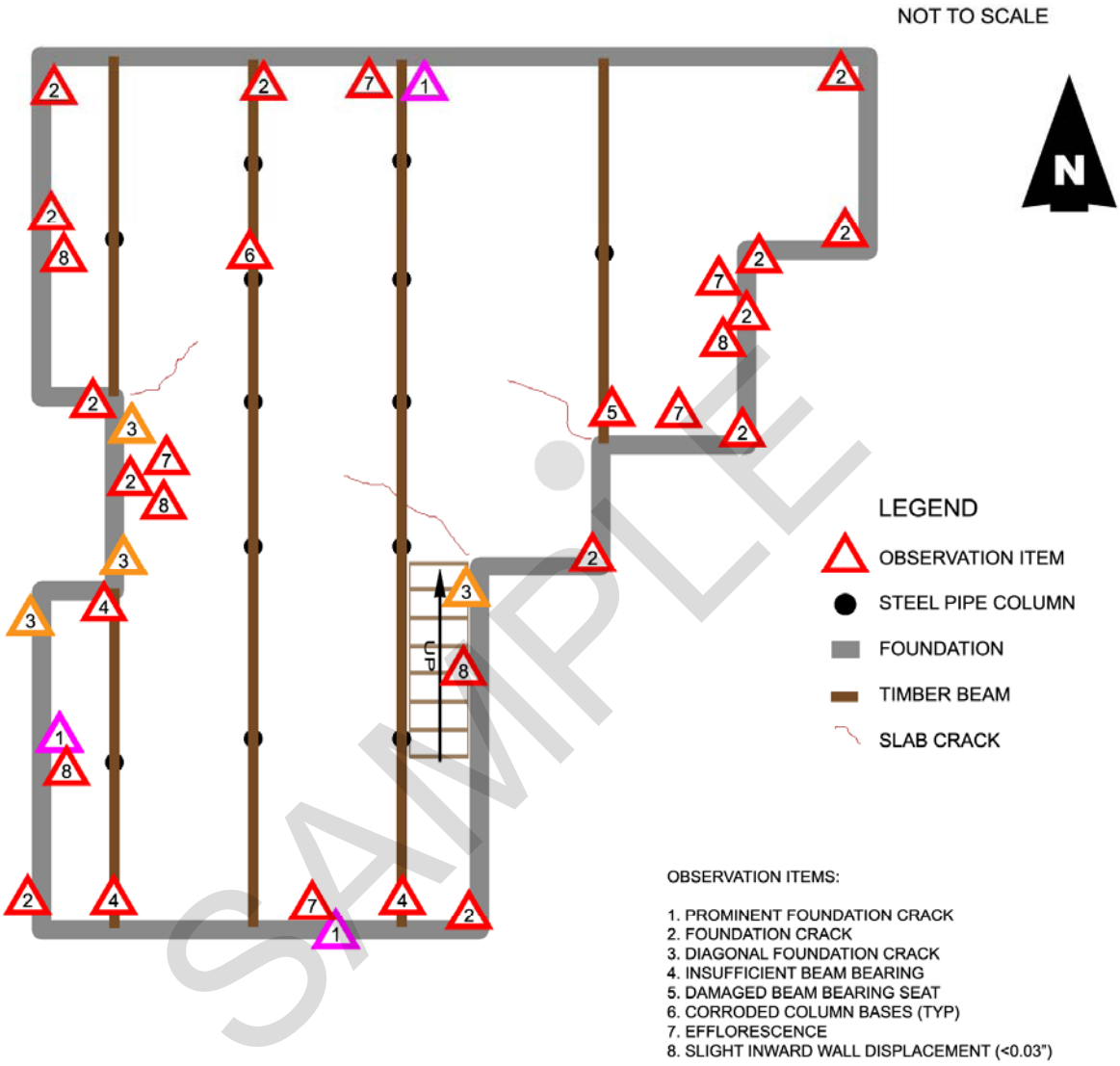
CONCLUSION

The observed cracks in this foundation are a combination of hairline vertical cracks that were likely formed during the curing process, and more prominent vertical cracks and diagonal cracks that indicate to us some settlement of the foundation has occurred. It is our opinion that most of the settlement issues noted are relatively minor in nature and while they may result in rather small cracks and possible smaller future cracks, they pose no real threat to the stability or longevity of the structure. Properly injected, monitored and maintained the foundation should fulfill its purpose without any major problems comfortably for the life of the structure.

Respectfully Submitted,

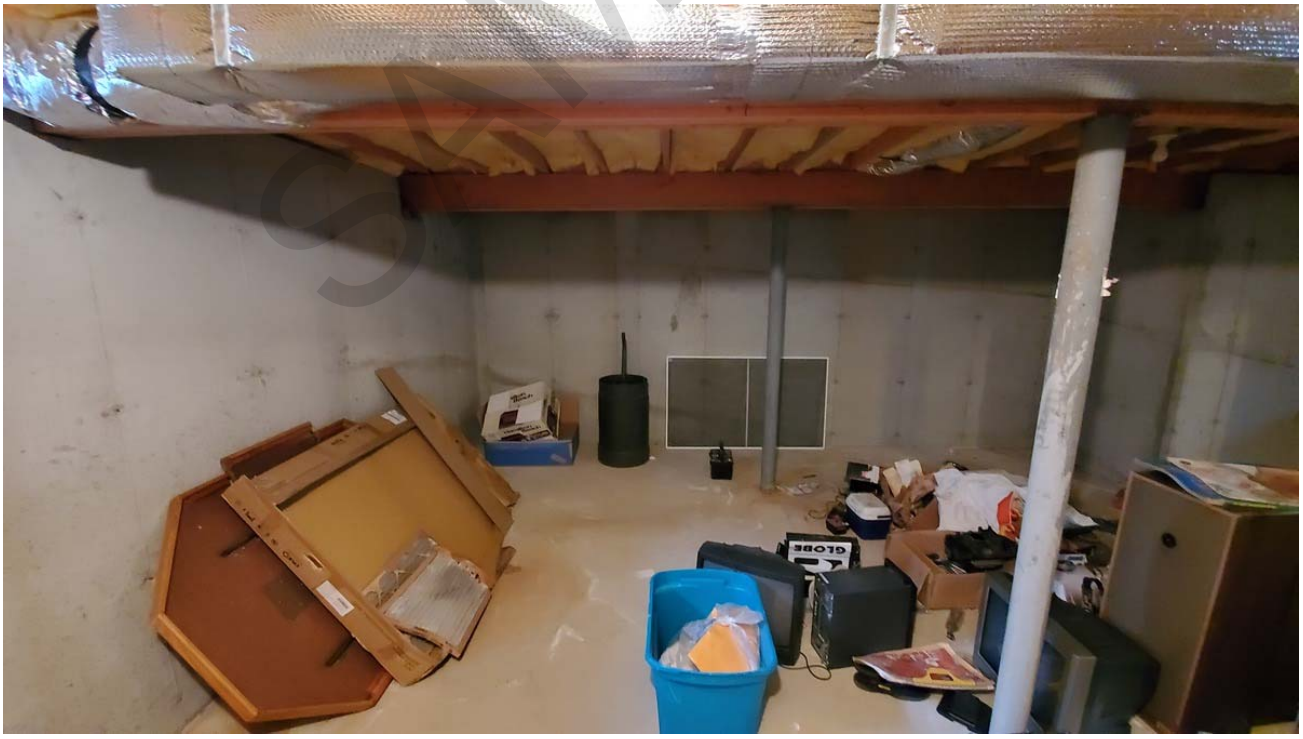
Anthony Torello
Construction Inspector

Franklin Grussy. P.E.
Project Engineer



KEY PLAN

Grade to the west slopes toward structure.
Drainage system functionality should be verified.

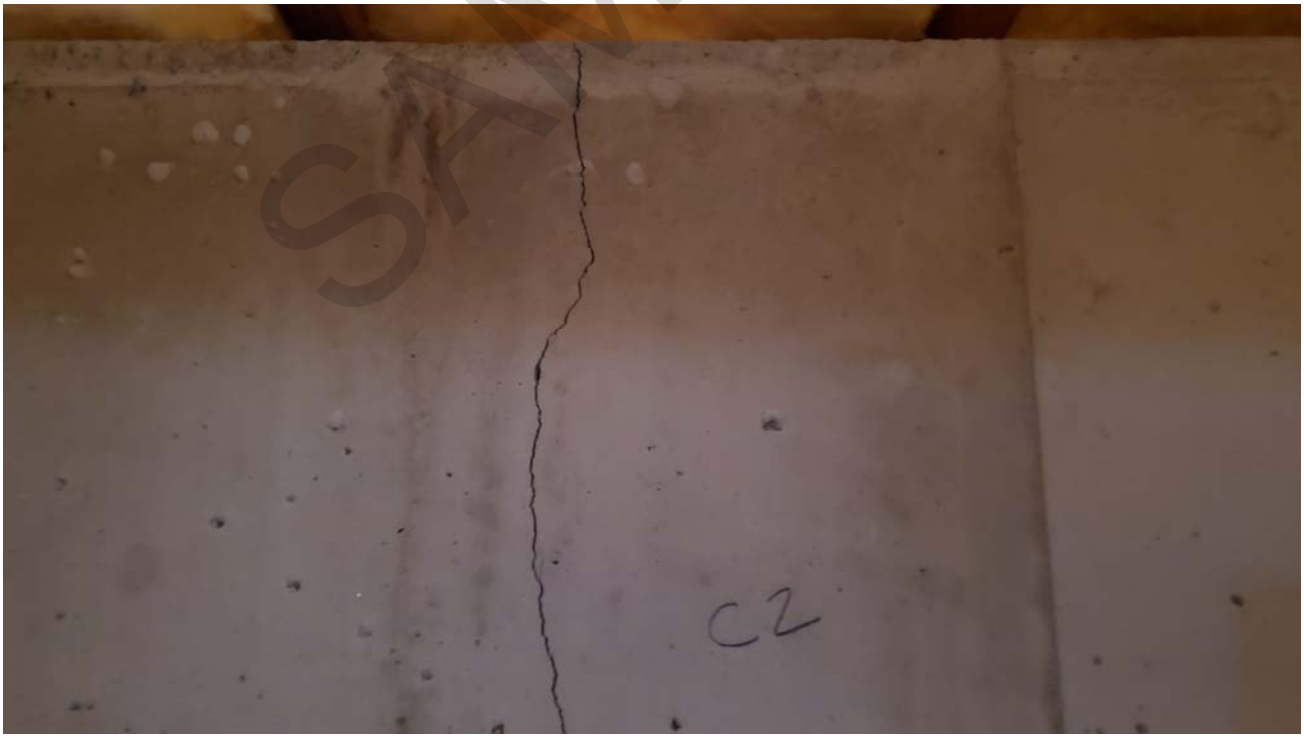


Efflorescence and water stains observed on foundation walls and floor slab.

Prominent vertical crack in foundation south wall.

Additional view of prominent crack in foundation south wall.

Prominent crack in foundation north wall.



Prominent crack in foundation west wall.

Diagonal crack in foundation west wall.

Diagonal crack in foundation west wall, with efflorescence.

Diagonal crack in foundation east wall.

Hairline crack (Typical)

Cracked beam pocket, eastern-most beam.

Additional view of crack at beam pocket, eastern-most beam.

Loose shim at beam pocket, south – western beam.

Inadequate bearing provided by shim, beam alongside basement stairway.

Corrosion at column bases.