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Senior Structural Engineer

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December 26, 2016

Anita Taylor  
112 Radcliff Circle  
Durham, NC 27713

Re: Structural Investigation  
Project #16143

Dear Ms. Taylor:

We made an inspection of the property located at the above address. This house is a split-level single-family house with a wood-framed superstructure over a crawl space/slab-on-grade foundation system.

For purposes of this report, all directions (left, right, rear, etc.) are taken from the viewpoint of an observer standing in front of the house in the street and facing it.

**FIELD OBSERVATIONS:**

**Exterior-left side:**

- There was a horizontal crack in the brick façade near the crawl space (photo 1).
- There was also a stair step patch at this same location (photo 1).
- There was a horizontal crack in the brick façade at the corner of the house (photo 2).

**Exterior-front:**

- Two bricks were missing mortar at the front steps (photo 3).
- There was a stair step crack at the front of the front porch that was patched and has re-cracked (photo 4).

**Exterior-left side:**

- There was a stair step crack at the left side of the front porch that was patched and has re-cracked (photo 5).

- The patch at the left side rear has not cracked at the time of this inspection (photo 6).

#### **Exterior-rear:**

- There was a crack behind the downspout at the left rear corner (photo 7).
- The fireplace chimney had a piece of trim down the side that was added to hide a gap between the chimney and house (photo 8). This gap has gotten bigger and was visible.

#### **Interior:**

- There were vertical drywall cracks above three doors at the interior (photos 9, 10 & 11).
- There was a crack between the firebox and front of the fireplace that had cracked and was patched (photo 12).

#### **Crawl Space:**

- The crawl space has been sealed. The walls, floor and walls were not visible for inspection (photo 13).
- There was temporary post at the left center (photo 14 to 16). It's unclear why this post was installed.

#### **CONCLUSION:**

The cracks in the foundation walls and chimney movement were caused by soil settlement. The soil beneath the foundation settled (moved downward) causing the structure to move and crack. The issue is not with the structure of the house but **with the soil that surrounds the foundation.**

What causes soil settlement? In newer homes, poorly compacted fill dirt, the use of inappropriate fill dirt (tree roots or other organic material), or softer, weaker soil under the foundation can cause soil settlement. Building inspectors typically check for these soil issues prior to the construction of the foundation system.

In older homes, expansive clay soils typically cause soil settlement. Expansive clay soil (common in this area) is a type of soil that is capable of absorbing large amounts of water. These expansive soils act like a sponge. They swell as they absorb water and shrink as they dry out. As soils adjacent to and beneath foundation walls and footings shrink and swell, according to the moisture in the ground, the foundation may move either vertically, horizontally, or both.

As long as the soil movement is minimal, it is typically not a problem. Smaller hairline cracks may occur over time depending upon the amount of moisture in the soil. Seasonal

changes can also affect changes in soil moisture. Long hot summer droughts can cause the soil to lose moisture and shrink causing foundations to settle and crack. These same cracks can close during the rainy cold winter months due to swelling of the ground.

If this soil movement is left unchecked, then larger more serious cracks may occur over time. The potential for structural damage often can be minimized or avoided altogether by following certain landscaping practices. On expansive soils, the main goal is to minimize changes in soil water content. It is important that the soil not get too wet or too dry. Proper surface drainage, plant choices, mulching and watering practices are all-important.

Drainage improvements can help to slow the settlement issues. The drainage improvements should keep the water away from the foundation walls and footings. The drainage improvements may include re-grading, installing a drainage system or a combination of both. The ground adjacent to the house should be sloped away from the house at a slope of one inch per foot for at least six feet to prevent problems with excess water against the house. Native red clay soil should be used for any grading work. Potting soil and rich black soil should not be used, as they tend to retain water.

The homeowner contracted with Regional Waterproofing Co., Inc. to install twelve (12) helical piers in 2002. These piers were installed at perimeter of the house at the problem areas noted in this report. The house has settled slightly from the time of this repair. The cracks we observed are minor and do not represent a serious structural issue at this time. The cracks should be patched to prevent rainwater from entering the wall cavity.

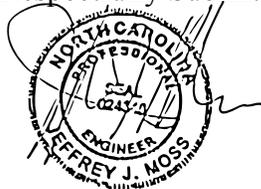
It is impossible to determine the rate of movement or whether the wall is still moving after one site visit. Based upon our interview with the homeowner and our knowledge of this house, we conclude that the foundation may continue to move but at a very slow rate. It may take many years or even decades for additional movement to occur. We do not recommend any repairs at this time due to the slow movement.

The condition of the cracks should be monitored every three months or so. If there were no changes after a year, we would recommend monitoring every year. If new cracks occur or if the existing cracks get worse (1/8" or wider) then a structural engineer should be contacted. You may also contact Regional Waterproofing Co., Inc. to adjust the helical piers "to tighten up the cracks" however the small movement we observed is not uncommon even with the addition of helical piers.

The crawl space was sealed. A properly sealed crawlspace has no wall vents, or the wall vents have been sealed permanently. The entire ground is permanently covered with a thicker sealed vapor-barrier, which is sealed to foundation walls and piers. All gaps and seams are taped or sealed with foam. In theory, this prevents all moisture from entering the crawl space, which helps to prevent mold and wood rot on the floor joists. Any moisture that does enter (by opening the crawl space door or other smaller cracks) will be removed through the use of a humidifier and/or the HVAC for the house.

However, this crawl space had no humidifier therefore any moisture that does enter the crawlspace will be trapped inside.

Respectfully Submitted:



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Enclosures