



RESIDENTIAL STRUCTURE EVALUATION

Prepared For:

MRS. S. IRELAND

Site Location:

2788 Vicksboro Road
Henderson, North Carolina 27537

Prepared By:

**CARTER ENGINEERING & CONSULTING, PLLC
STRUCTURAL + CIVIL**



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I. SCOPE

- 1) **Assessment Date:** 31 January 2024
- 2) **Subject:** Evaluation of the structural condition of the residential home.
- 3) **Location:** 2788 Vicksboro Road, Henderson, North Carolina 27537
- 4) **Response:** Provide opinion of visually observable structural conditions of the residence, particularly to floor framing, foundation cracks, and interior distress.

II. LIMITATIONS, TERMS & CONDITIONS RESTRICTIONS QUALIFICATIONS

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III. CONSIDERATIONS

A. Environment

The environment of this home includes seasonal cyclical temperature and moisture fluctuations. The effects of abnormal and extreme (too dry or too wet) precipitation levels on local soil optimum moisture content are soils that compress where moisture loss has left voids, or soils that shift [pump] when over saturated. These dynamics promote soil migration and foundation movement (settlement) that subject the exterior and interior materials to cracking. This area of North Carolina is known for expansive clay soils that tend to influence foundation movement and crack developments compared to other regions.

B. Drainage

Surface drainage from precipitation events can cause erosion, foundation deterioration and instability, and structural failure. Yard and roof drainage should convey water away from a structures foundation. Incorrect site grading, a lack of gutters, or downspouts without leaders can result in excessive water / moisture in the soil within the foundation zone that can adversely affect the properties of the construction materials, the soil and masonry. Maintaining good drainage around the house will help prevent or minimize moisture and pest infiltrations, foundation settlement, and interior distresses.

C. Construction

The intent of this visit is to identify readily visibly observable concerns for user wellbeing [personal safety] and structural stability, rather than [current] code compliance or code departure.

IV. FINDINGS & RECOMMENDATIONS:

Primary:

1. Interior surfaces throughout the house have faults that reflect movement of the house framing, settlement of the house foundation, and/or movement of the foundation supporting soils. Others are attributable to normal wear over time that are aesthetic matters. The following are areas related to structural movement and are discussed within this report.
 - a. The foyer and front family room floor has sag and slope from movement of the floor framing and its supporting pier has moved. Within the crawlspace along the central main floor beam at 11.4-ft from the right wall, the beam bearing is deficient and improper with multiple block shims. Remove the shims, jack the beam up to satisfactorily level the floor surface, then properly insert shims to compensate for pier settlement. Shims shall be hardwood blocks, HDPE blocks, or galvanized sheet metal plates, providing a minimum 4-inch width and 6-inch length to bear the full width of the beam.
 - b. The family room ceiling [10-ft from the front wall and between 7.5-ft and 14.5-ft from the right wall] has cracked and has sag. Within the attic above this location the lumber used for the ceiling joists are spliced to span from the front wall to the rear wall with intermediate bearing on the interior wall. The location of the splice is 10-ft from the front wall where the ceiling cracking has developed. In the attic, there is no support for the splice to resist “hinge” motion as the joists pivot over the intermediate interior wall. Over this area, level the ceiling plane by pushing up the joists, then reinforce each splice with a minimum 6-ft 2x6 plank set bottom flush to the joist, centered on the splice, and secured using 3-rows of 10d framing nails [or equivalent 2.5-inch power driven structural fasteners] spaced 10-inch on-center.

- c. The floor surface between the front family room and the rear dining area has a hump from movement of the floor framing and its supporting piers. Reference previous remark 1a.
- d. The kitchen floor has a dip adjacent to the refrigerator location from a fractured floor joist. Within the crawlspace below this location at 7-ft from the rear wall and 4-ft from the right wall the 2x8 floor joist has a fracture that has reduced the cross-section structural value of the wood. Coat the joist with an anti-microbial wood preservative, jack the joist up to satisfactorily level the floor surface, then apply to one side a 8-ft 2x8 scab using construction grade adhesive and 3-rows of 10d framing nails [or equivalent 2.5-inch power driven structural fasteners] spaced 10-inch on-center.
- e. The floor of the bedroom corridor has sag and slope from movement of the floor framing and its supporting piers.

Within the crawlspace the central 3-ply 2x8 main floor beam [oriented side-to-side] between 5-ft and 12-ft from the left wall has damage typical of wood rot and wood destroying insect activity that has reduced the structural value of the wood. Properly and generously treat the wood with an anti-microbial wood preservative, then apply to both sides another 2x8 ply spanning from pier to pier using 2-rows of 5-inch structural screws [GRK or similar] spaced 10-inch on center for the full length of the new lumber.

Within the crawlspace the central 2-ply 2x8 main floor beam [oriented side-to-side] at 5-ft from the left wall has damage typical of wood destroying insect activity. Treat for wood destroying insect activity, then apply to both sides another 2x8 ply spanning from pier to pier using 2-rows of 5-inch structural screws [GRK or similar] spaced 10-inch on center for the full length of the new lumber.

- 2. Visible along the exterior and within the crawlspace, cracks have developed through perimeter masonry walls. The walls from the floor elevation to the roof overhang consist of a brick veneer tied to the house exterior wall wood framing. The walls from the floor elevation down to the grade consist of brick veneer bonded to the concrete block foundation wall. Though others exist that were considered insignificant or concealed from view there are two notable crack developments.
 - a. At the front wall and 23-ft from the left wall adjacent to a downspout is an open stair-step crack measured 2.0-mm wide with no measurable face shear. The physical conditions suggest the cracks to be a continuation of an older condition. This and other inconsequential cracks are typical of incremental foundation settlement into the supporting soils that have been subject to excessive moisture over the life of the house. Excess moisture over-saturates the soils and reduces the surface bearing capacity of the immediate foundation soils. This water is from exterior yard and roof surface runoff, specifically roof gutter downspouts and grading along the rear. This water filters through the soils and under the foundation walls. Efflorescence and discoloration along the base of the foundation walls is a common indication of excessive moisture presence on the opposite side. Visual examination of the foundation found significant distresses (irregular pier cracks, etc.) that are indicative of abnormal foundation settlement.

The exterior grade adjacent to the foundation presented a generally firm condition. Soil testing or coring was not part of this scope of work. The dynamic expansion and contraction of the earthen

material may react to large fluctuations between the rise and fall of the water level, which may lead to relief cracks along the perimeter foundation.

At the time of this visit, while no historical information was available to gauge development, the visibly observed cracks presented no structural stability concerns for the foundation. Improve yard and roof drainage control measures to promote foundation supporting soils stability that influences foundation movement. Conduct routine yard and roof runoff drainage maintenance to ensure water is not allowed to flow and pool along the foundation. Monitor the cracks for dormancy. The cracks may be mortar patched for aesthetic purposes.

- b. At the left wall and 4-ft from the front corner where the location of the electric service is an open “V” shaped vertical crack above the meter box. This is attributable to movement of the electric wire from the roof conduit to the power pole at the street that pulls on the conduit. The crack is stress release from the interaction with the conduit. This presents no structural concern for foundation or wall framing stability. Seal this crack with mortar or exterior grade construction caulk to prevent moisture entry into the wall framing.
3. Within the crawlspace front bay all joists had damage that reduced the structural value of the joists. The floor framing has been restored by sistering new lumber to the damaged joists. No additional repairs are needed. Improve air circulation in the crawlspace to reduce the wood framing exposure to moisture.
4. Within the crawlspace the 2-ply 2x8 beam had damage had been reinforced with the addition of a 2x8 ply on both sides. However, the nails bonding the plies together are rusting and the plies are separating. Along this beam inject construction grade adhesive between the separation, squeeze the separation closed, then secure with 3-rows of 10d framing nails [or equivalent 2.5-inch power driven coated structural screws] spaced 12-inch on-center for the full length.
5. Within the crawlspace through the front foundation wall is the access to the front porch. This opening allows humid air to enter the main crawlspace where the moisture is absorbed by the wood framing of the floor. Place over this access a minimum 8-mil vapor barrier, hung at the top from the foundation sill and anchored at the bottom to the ground. The curtain should be liftable by hand to allow easy access into the crawlspace below the porch.
6. Within the crawlspace of the front porch are dry-stacked masonry blocks turned with the cells opening to the side, which is the weak orientation of these blocks. These blocks were used during the construction of the front elevated concrete deck. Once the concrete hardened, these blocks were no longer needed to support the deck. The orientation and dry-stack of these blocks presents no concern for the support of the concrete deck. Though no repairs are necessary, consider packing these blocks solid with non-shrink mortar for their supplementary benefit.
7. Within the front bay and rear bay of the crawlspace exists bracing to supplement floor joist resistance to deflection and reduce floor bounce. The bracing is located at midspan of and perpendicular to the floor joists. The bracing consists of a dropped beam set on dry-stacked concrete blocks. As this bracing is supplemental and does not provide primary support, the dry-stacked blocks and lack of traditional footings does not present a structural issue for the floor framing. Note that this bracing is subject to settlement and block displacement given the basic construction.

Secondary:

8. Within the crawlspace the base of the perimeter piers and brick masonry curtain walls exhibit indications (discolorations, efflorescence, etc.) of occurrences of moisture along the foundation. These are results of exterior surface drainage moisture accumulation along and penetration through the foundation, into the crawlspace, which can slowly degrade materials and overtime develop into structural movement and concerns. This moisture can navigate toward interior piers, evident by paths of soft soils. Excessive moisture in the crawlspace promotes pest/insect presence and organic growth, which deteriorate the structural wood framing that leads to costly damage repairs. Improve and maintain exterior yard and roof surface drainage controls to promote foundation soil stability and to minimize moisture entry into the crawlspace.
9. Generally, the property slopes from the right side yard down across the foundation footprint and down to the left side yard. Yard and roof drainage has the potential to pond and accumulate at various areas about the foundation, particularly along the front. Water movement and pooling near structural foundations causes erosion and unstable oversaturated soil conditions that can create foundation issues.

Along the front foundation wall: remove all organic material; place dense fill dirt with a minimum slope of 3% down and away from the wall for a minimum swath of 20-inch [from the foundation]; pack fill; then, top dress with mulch, vegetation, or other. Ensure soil, not mulch, at the base of the foundation slopes down and away from the foundation. Elevate low spots along the foundation to slope down and away from the foundation, especially the area to the left of the front entry and the front left corner of the main house. Fill depressions and build up flat areas against the foundation with soil free from organic material. Foundation French drains are not recommended at this time given the relatively flat topography and the class of soils for this area. Perform regular yard and grade maintenance to ensure proper drainage.

10. Roof drainage systems (gutters, downspouts, and leader pipes) should collect and convey water away from the foundation to prevent over saturation of the foundation supporting soils. Ensure all gutters properly slope down to downspouts and don't have sag that allows overflow of the rim.

Downspouts that discharge at the base of foundations place large volumes of water at the base and introduce excessive moisture to the foundation supporting soils. Oversaturated soils erode and shift, which impacts foundation movement. All downspouts should have a leader extension of solid pipe without perforations. Leaders should be securely attached to downspouts to discharge drainage at least 6-feet from the foundation. Leaders should be attached to the vertical down pipe, not the elbow spout, otherwise backflow occurs. If connecting multiple downspouts to one buried collector pipe, then the collector pipe must be sized [minimum 6-inch diameter] to receive the increased volume. Ensure leader pipe discharge is not redirected back to the foundation by buildup, roots, or landscaping, but continues to flow away from the foundation. Perform regular maintenance to ensure proper drainage.