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ENGINEERING OPINION
INVESTIGATION OF FOUNDATION PERFORMANCE
RESIDENCE AT 16711 BENTFIELD WAY, HOUSTON, TEXAS, 77058
Date of Inspection: February 21, 2019
Date of Report: February 24, 2019

SUMMARY

The foundation is performing well.

BACKGROUND

A request was made for an inspection and report on the performance of the foundation of the subject house. I was assisted by Darrell Bowles, P.E. A visual inspection was performed, elevations were measured, and conditions documented with videos (not included).

Convention regarding directions: Front faces the street, left and right are as seen from the street facing the house. Back-right indicates back side, right end. Right-back indicates right side, back end.

Boilerplate and outside references shown in italics.

INSPECTION

This is a zero lot line house at the right exterior wall.

Damages and conditions at the exterior are shown on the attached Elevation survey sheet. Observed a deviated brick mortar line at the right wall, up in the middle. Also observed a separation at the atrium wall, opened at the top. The left side is siding; siding does not show damages from foundation movement readily. Observed signs of foundation repair at the front half exterior, in the form of concrete breakouts and settlement of backfill.

Inspection of the exterior found a tree in the back-left yard within possible influence of the foundation.

Inspection of the exterior found deficient drainage and landscape conditions, as shown on the attached Elevation survey sheet. These include pits formed by backfill collapse at the atrium.

Damages and conditions at the interior are shown on the attached Elevation survey sheet. No damages indicative of foundation movement were observed.

An elevation survey throughout the house was performed using a Technidea Zipllevel. The elevations have a range of 1.8 inches, highest at the back of the master bathroom, lowest at the front left corner of the garage. The foundation is generally flat and level.

The foundation will be judged by the three following objective criteria.

The elevation deflections measured as bending of a straight line do not approach the generally accepted criteria for foundation performance and repair of 1.00/360 (1 inch bend in 30 feet).

The elevations measured as tilting of a level line across the foundation do not approach the generally accepted criteria for foundation performance (not repair) of 1.00% (2.4 inch difference across 20 feet).

The elevations measured as slope of floors do not approach 2.00% (1.2 inch difference across 5 feet).

See attached elevation survey.

ANALYSIS

FYI: TREE EFFECT, NO FOUNDATION REPAIR

Trees desiccate soils and shrink those soils with a clay component. Clayey soils are common in the Greater Houston area. Where the foundation is supported by these shrinking soils, the foundation drops in the area affected by the tree roots, and drops towards the tree. The effect is stronger during dry seasons. During a wet season, the foundation may rise somewhat. Damages normally occur during the dry summer. This cause-and-effect relationship forms the basis for my analysis.

The tree in the back-left yard is not affecting the foundation at this time.

The front of the house appears to have dropped over time.

The foundation levels fall well within the objective performance criteria.

CONCLUSION

Considering the range of elevations, damages, curvature, tilt, stability, age, and identifiable causes of movement, I find the foundation is performing well.

If recommendations are followed, the foundation should perform well in the foreseeable future.

No foundation repair is recommended.

The foundation appears to be structurally sound.

RECOMMENDATION

Repair the damages if desired.

Correct the detrimental drainage and landscaping conditions.

I recommend the following measures to keep your foundation performing as well as possible: Regarding the soils around the foundation: If needed, place soil around the perimeter of the foundation, you only need four inches of foundation exposure, make sure the soil is sloped so it drains away from the foundation, and keep grass or plants growing for a few feet around the foundation. Regarding watering: You only need water enough to keep the plants or grass healthy, normally only required during the dry Summer months. Do not water at flatwork next to the foundation, such as patios and driveways. There is no need to water where there has been foundation repair. Never allow free water within 2 feet from the foundation, nor water the separation that sometimes appears between the soil and the foundation. Do not plant trees closer than 12 feet from the foundation.

If cracks and other damages appear in the future, call for another inspection. Within two years of today, this inspection may be free, depending on circumstances.

CAVEAT

My approach to the mitigation of foundation problems is to eliminate the source of the problem rather than ignore them and install piers or pilings. The installation of piers or pilings can provide immediate results, but ignoring the causes of the foundation performance problems can result in further foundation problems in future years. Eliminating the cause of the problems can involve years before the foundation has recovered and is stable again, and the foundation may not recover to a level acceptable to the owner or professionals.

I will give you the best advice based on my experience, the experiences provided by other professionals, and the experiences of my clients. I may predict future performance based on generally accepted principles and experience, but factors beyond my control or beyond my ability to observe can affect in unpredictable ways.

This report of observations and opinions was prepared for the exclusive use of the client, and is not intended for any other purpose. Gerard J. Duhon assumes no responsibility whatsoever for the use of this report by any third party. Any third party with an interest in this property should obtain a professional opinion to satisfy their own objectives. This report is based upon information provided at the time of this report. The conditions described are limited to structural and finish issues discovered during a visual, nondestructive survey. The scope of this investigation is limited by financial and time constraints.

I am not licensed by the Texas Real Estate Commission (TREC) and do not perform inspections in the manner promulgated by the Commission. Property purchasers are urged to have properties inspected by a TREC inspector prior to commitment.



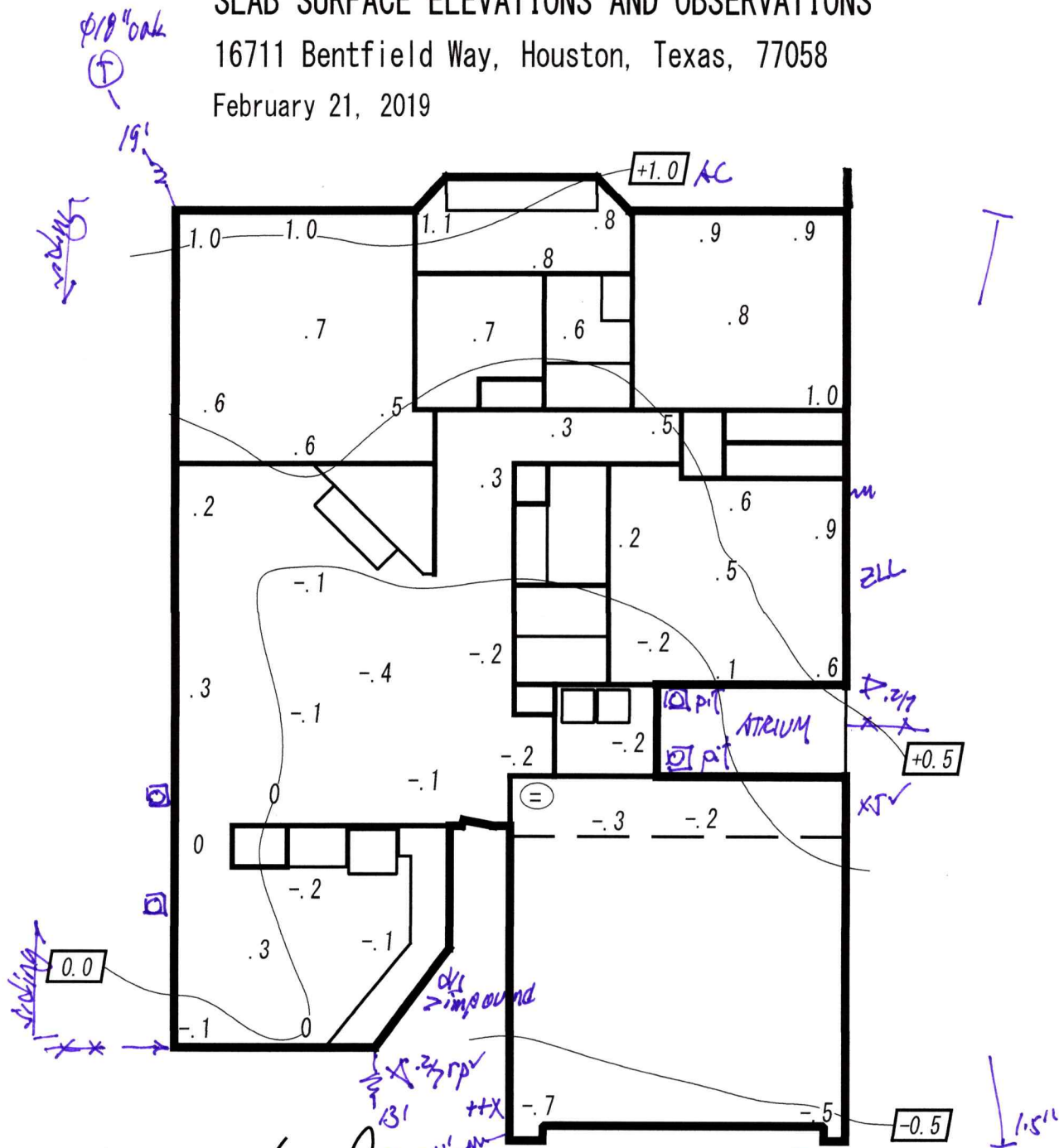
Attachments:

- Elevation survey
- Survey key
- Performance criteria

SLAB SURFACE ELEVATIONS AND OBSERVATIONS

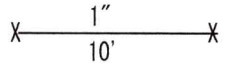
16711 Bentfield Way, Houston, Texas, 77058

February 21, 2019



Gerard A. Nelson, P.E.

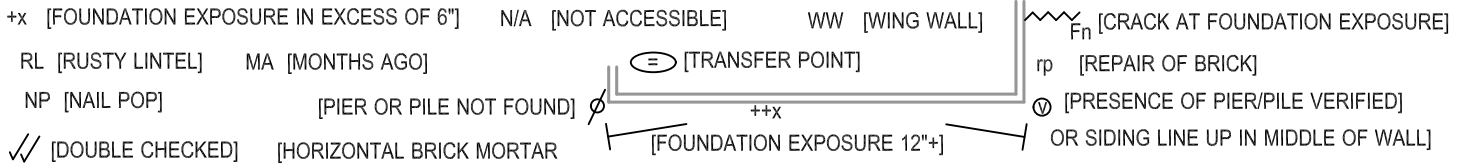
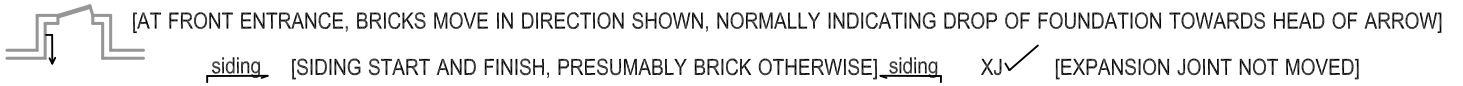
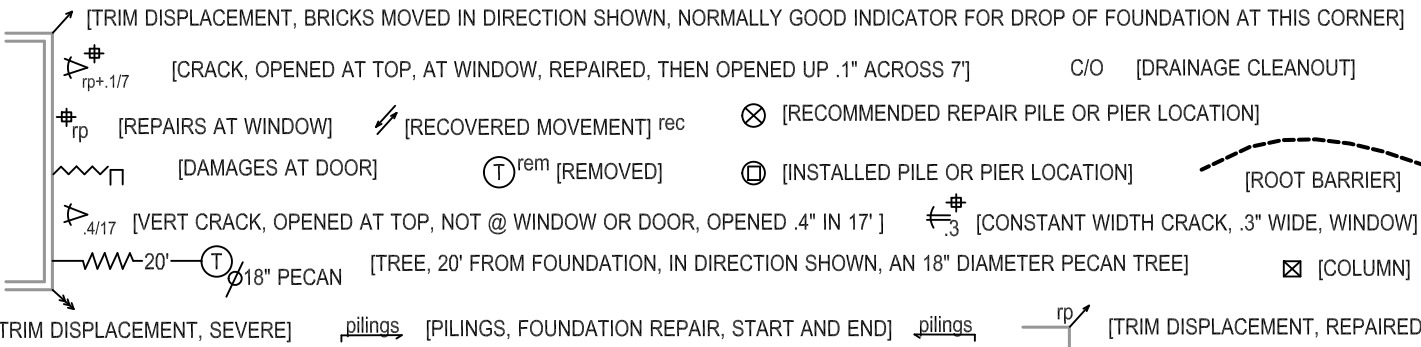
- ELEVATIONS IN INCHES
- CORRECTED FOR FLOORING
- CHARACTERISTIC DAMAGES ANNOTATED
- ISO-ELEVATION (CONTOUR) LINES AT .5 INCH INTERVALS
- GARAGE ELEVATIONS TAKEN AT CEILING



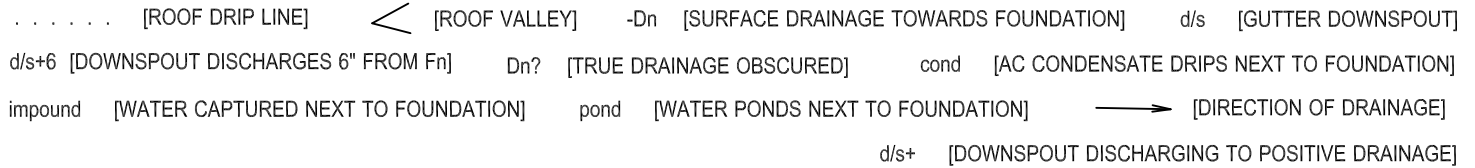
SURVEY KEY

EXTERIOR (X) □ [WALL OPENING] † [CONSTANT WIDTH] Tr [TRIM] Br [BRICK]

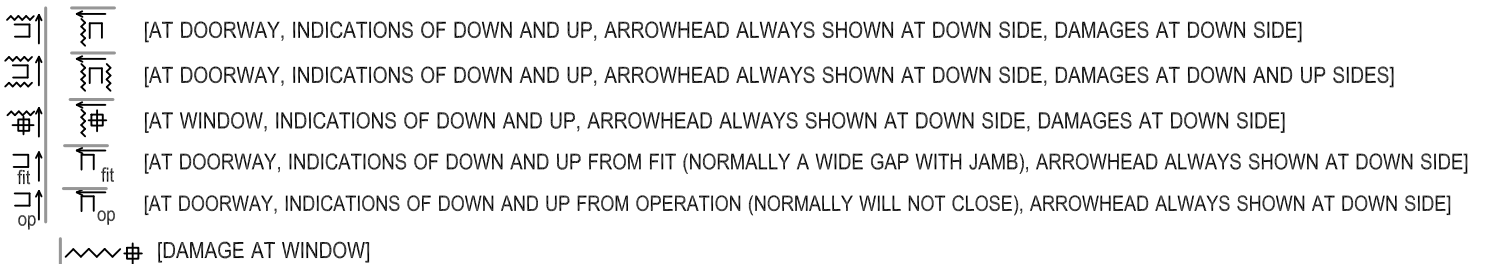
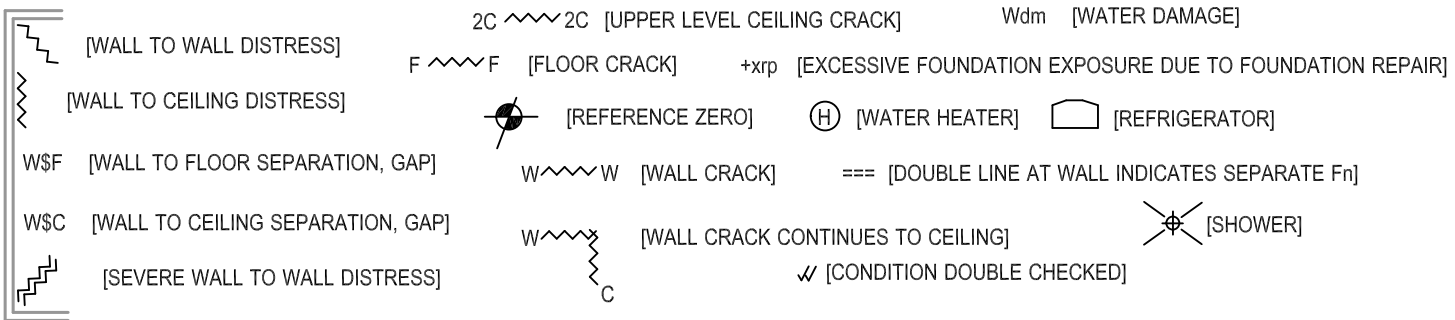
✕✕✕ [FENCE] ∅Fn [NOT FOUNDATION RELATED] (T) [NEIGHBOR'S TREE] † [CRACK] FnJ [FOUNDATION JOINT]



DRAINAGE (Dn) pits [GROUND DEPRESSIONS AT FOUNDATION PERIMETER] OTD [OBSTRUCTION TO DRAINAGE]



INTERIOR (N) C ~~~ C [CEILING CRACK] +var [POSITIVE SEASONAL VARIATION] var [VARIES]



ALL DAMAGES NOTED ON SURVEY PRESUMED TO BE FROM FOUNDATION MOVEMENT
 MOST COMMON NOTATIONS SHOWN, LESS COMMON NOTATIONS DERIVED OR WRITTEN OUT

ENGINEERING OPINION CRITERIA FOR FOUNDATION PERFORMANCE

The main generally accepted objective criteria for foundation performance is L/360, one inch of curvature/deflection/bending in 30 feet, accompanied by some damages in the area. A thorough discussion of the subject of foundation performance can be found in the Foundation Performance Association FPA-SC-13, Guidelines for the Evaluation of Foundation Movement for Residential and Other Low-Rise Buildings.

My criteria deviate somewhat from the FPA, but the findings regarding the adequacy of foundation performance are about the same.

The following are my main objective criteria for judgment of foundation performance.

- Deflection in excess of L/360 across 20+ feet of distance, in middle third of span.
- Tilt, across the entire foundation, in excess of 1%.
- Slope, across at least 5 feet, in excess of 2%.
- Doors and windows non-functional.

The deflection, tilt, slope, and functional criteria above are objective and useful for judging the performance of the foundation. Other criteria, both objective and subjective, are considered in making a determination of foundation failure. These other criteria include:

- Structural damages, including foundation, consider amount and type.
- Finish damages, consider amount and type.
- Proper fit of doors and windows, consider amount and type.
- Area and directions of floors in excess of deflection criteria.
- Area of floor exceeding tilt and slope criteria.
- Age of building.
- Stability of foundation.
- Identifiable causes of foundation distress.
- Residence or attached garage, consider type of area affected.
- Range of elevations.

Foundations performance is normally described as very well, well, adequate, and inadequate. There is some engineering judgement involved in choosing the classification.

The rule is that a foundation which is judged inadequate will have foundation repair recommended, and vice versa. In cases where the rule is not applied, the engineer should have valid reasoning and be well-explained.

Tilt between 1% and 1.5%, with low level of deflection and damages, may be considered inadequate with no recommendation for foundation repair, or may be considered adequate. Tilt in excess of 1.5% will be considered inadequate but only recommending repair if other problems exist. Tilt in excess of 2.0% will be considered inadequate and requiring repair.

The term sub-standard regarding foundation performance indicates adequate performance with no foundation repair recommended, but the conditions of the foundation and due to the foundation may diminish the market value of the house.



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