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ENGINEERING OPINION
INVESTIGATION OF FOUNDATION PERFORMANCE
RESIDENCE AT 14907 ALDERWICK DRIVE, SUGAR LAND, TEXAS, 77498
Date of Inspection: March 8, 2023
Date of Report: March 10, 2023

SUMMARY

The foundation is performing adequately.

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 relevant conditions documented.

The following information was provided: The house was built in 1983. Two or three bald cypress trees were removed from the back yard. The foundation was repaired at a part (front half) of the exterior perimeter, the AllTexas plan was provided.

Some of the report is boilerplate, advice and information pre-written due to its common nature and used in this report because of its applicability. Boilerplate and outside references will be italicized in this report.

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.

INSPECTION

The foundation is concrete slab-on-ground with steel reinforcement, with conventional wood framing above, clad in brick veneer, a 2 story structure.

Damages and conditions at the exterior are shown on the attached Elevation survey sheet. Damages were concentrated at the left wall and near the corners of the wall. The brick mortar line at the left wall was down in the middle.

Inspection of the exterior found trees within influence of the foundation.

Inspection of the exterior found clay cracks. Inspection also found deficient drainage and landscape conditions at the perimeter of the foundation, as shown on the attached Elevation survey sheet.

Inspection of the exterior found evidence of foundation repair underpinning in the form of concrete breakouts at the chimney, which is outside of the AllTexas plan.

Damages and conditions at the interior are shown on the attached Elevation survey sheet. Damages are few and minor and distributed throughout the house.

An elevation survey throughout the house was performed using a Technidea Zipllevel. The reference zero was the target symbol. The elevations have a range of 2.6 inches, highest at the fireplace, lowest at the front wall of the master bathroom. The foundation generally drops to the front in the back half, and is almost flat and level in the front half.

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

The elevation deflections measured as bending of a straight line calculate to .66/360 (.70 inches in 32 feet, green line, worst case) which does not exceed 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 calculate to .63% (2.2 inches in 29 feet, turquoise line, worst case) which does not exceed 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 calculate to 1.30% (.7 inches in 4.5 feet, red line, worst case), which does not exceed 2.00% (1.2 inch difference across 5 feet).

See attached elevation survey.

ANALYSIS

CONCERN: What is the reason for the current condition of the foundation?

FYI: UNDEFINED REASONS FOR FOUNDATION CONDITION

There is no definite reason for the present condition of this older foundation, but condition could be due to past and present drainage deficiencies, cyclic moisture changes in perimeter soils, past and present drainage plumbing leaks underneath the foundation, tree influence, foundation repair effective or ineffective, consolidation of support soils, or original construction condition.

FYI: TREE REMOVED PRIOR TO PLACING FOUNDATION

The new foundation was placed after removing large mature trees. Trees desiccate soils and shrink those soils with a clay component. Clayey soils are common in the Greater Houston area. When the tree is removed, the dry area around the tree slowly moisturizes to normal, and swells. Placing a foundation over this area before the final state of swelling will result in the foundation in the affected area lifting. This could last for a few years.

DISPOSITION: It is possible that trees were removed to place the foundation (could not be determined through normal research). The existing trees within influence are also an effect on the current condition of the foundation.

CONCERN: The trees within influence, the lower front half of the foundation, the damages at the left exterior wall.

FYI: CLAY CRACKS AND SEPARATIONS

Clay cracks visible on the ground, or separation of soils from the foundation, indicate soil which shrinks and swells with moisture changes, making the foundation susceptible to the effect of trees, drainage, and drainage plumbing leaks. Clay cracks during the wetter winter season indicate a soil more affected by moisture changes.

FYI: TREE EFFECT, FOUNDATION NOT REPAIRED

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.

FYI: TREE EFFECT, FOUNDATION REPAIRED/UNDERPINNED

Trees desiccate soils and shrink those with a clay component. Clayey soils are common in the Greater Houston area. Where the foundation is supported by effective foundation repair underpinning, the shrinking soils do not affect the foundation, and the foundation is stable and flat. Where the foundation is under tree influence and is not supported by deep underpinning, the foundation is supported by the surface soils, and the foundation drops in the area affected by the tree roots. With effective exterior underpinning, with the interior not underpinned and under tree influence, this results in a drop to the interior, sometimes taking a bowl shape in the affected area. This cause-and-effect relationship forms the basis for my analysis.

FYI: PARTIAL UNDERPINNING UNDER INFLUENCE

Partial underpinning of a foundation within the area of an influence can result in damages where the underpinning ends, due to the different response of the foundations to the same influence.

DISPOSITION: The lower area at the front is likely due to the trees in the front yard, and the AllTexas foundation repair underpinning at the exterior only would not bring up the front interior, but the putative target of the underpinning was to close up cracks and resist further tree effect on the exterior.

The damages at the left wall appear to be due to the discontinuity of foundation repair underpinning under the effect of the pine tree in the left yard.

The elevations at the back right room drop fastest here, see the 1.30% floor slope. This is within influence of the bald cypress tree in the back-right yard. The floor slope effect would be dependent on foundation repair underpinning at the back wall, which has not been verified. Therefore more information is needed to form a conclusion about this concern.

CONCERN: Are there any other present concerns for the foundation?

DISPOSITION: There are no other present concerns for the foundation.

CONCERN: Is foundation repair underpinning an option?

DISPOSITION: The condition of the foundation is not as constructed, but it is not at the condition where foundation repair underpinning would be advised. There is a better option to bringing the foundation into a more level and stable condition.

CONCERN: Drainage is deficient.

DISPOSITION: *Deficient drainage and landscape conditions do not normally have a noticeable effect on the foundation, though they can have long-term effects. In this case the drainage and landscape conditions are not a factor in the present condition of the foundation.*

The foundation performance falls within the objective performance criteria.

CONCLUSION

Taking all of the evidence into consideration, I find that trees are having an influence on the foundation.

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

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

No foundation repair is required or recommended.

The foundation appears to be structurally sound.

RECOMMENDATION

TREE EFFECT REMEDY

Remove the tree effect on the foundation.

I recommend the installation of root barriers between the trees and the foundation. Removal of the trees will have the same effect. Large trees closer to the foundation than 12 feet should be barriered with caution. If nothing is done the problems will become worse.

The company I can recommend for root barrier work is Nelson Construction and Foundation Repair (713-473-2382). This contractor will comply with the root barrier specification, and we warranty the results of the root barrier installation, and warranty against tree loss. See approximate root barrier location on the attached survey and attached root barrier information. Estimated cost \$4400.

After installing the root barrier or removing the trees, the foundation should respond positively over time. The following effects are expected. This recovery may cause some minor finish damages. The elevations should rise in the area of tree influence to create a more level foundation. You should see some desirable effects from the rebound of the foundation within a few months, but it could take two years before all of the effects to occur, at which point the foundation should be stable. Most of the rebound occurs during the wet Winter season. By two years, if the foundation is not recovered to a desirable extent, then limited foundation repair can be considered. Repair the finish damages after the foundation has reached stability.

The damages have been documented. You may repair the damages if desired.

GENERAL RECOMMENDATION

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.

LIMITED WARRANTY

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 clients, generally accepted information, and scientific principles. 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 of the stated scope of the investigation. The investigation is limited to the stated scope, and 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 (We are not looking for problems or inspecting general conditions, we are investigating stated problems). Property purchasers are urged to have properties inspected by a TREC inspector prior to commitment.



Attachments:

- Elevation survey
- Keys
- Performance criteria
- Root barrier information

SURVEY KEY

EXTERIOR

RULE: ARROWHEAD POINTS IN DIRECTION OF RELATIVE MOVEMENT OF BRICK, NORMALLY A GOOD INDICATOR OF DIRECTION OF DROP

Fn [FOUNDATION] † [CONSTANT WIDTH SEPARATION OR CRACK] Tr [TRIM] Sd [SIDING] Br [BRICK] St [STUCCO]
 -x-x-x [FENCE] ∅Fn [NOT FOUNDATION RELATED] T_N [NEIGHBOR'S TREE] † [CRACK] FnJ [FOUNDATION JOINT]
 [TRIM DISPLACEMENT] \$ [SEPARATION] ∅P [NO PROBLEM] Cab [CABINET]
 ↑_{rp+.1/7} [CRACK, OPENED AT TOP, AT WINDOW, REPAIRED, THEN OPENED UP .1" ACROSS 7"] c/o [DRAINAGE CLEANOUT]
 #_{rp} [REPAIRS AT WINDOW] ↗ [RECOVERED MOVEMENT] ⊗ [RECOMMENDED REPAIR PILE OR PIER LOCATION]
 ~~~~~ [DAMAGES AT DOOR]    T<sub>rem</sub> [REMOVED]    ⊙ [INSTALLED PILE OR PIER LOCATION]    - - - [ROOT BARRIER]  
 ↑<sub>.4/17</sub> [VERT CRACK, OPENED AT TOP, NOT @ WINDOW OR DOOR, OPENED .4" IN 17"]    †<sub>.3</sub> [CONSTANT WIDTH CRACK, .3" WIDE, WINDOW]  
 ~~~~~-20'-T ∅18" PECAN [TREE, 20' FROM FOUNDATION, IN DIRECTION SHOWN, AN 18" DIAMETER PECAN TREE]    ⊠ [COLUMN]  
 [TRIM DISPLACEMENT, SEVERE] pilings [PILINGS, FOUNDATION REPAIR, START AND END] pilings —^{rp} [TRIM DISPLACEMENT, REPAIRED]
 [AT FRONT ENTRANCE, BRICKS MOVE IN DIRECTION SHOWN] ++x [FOUNDATION EXPOSURE 12"+]
 siding [SIDING START AND FINISH, PRESUMABLY BRICK OTHERWISE] siding xJ ✓ [EXPANSION JOINT NOT MOVED]
 +x [FOUNDATION EXPOSURE IN EXCESS OF 6"] N/A [NOT ACCESSIBLE] WW [WING WALL] ~~~~~_{Fn} [CRACK AT Fn EXPOSURE]
 L † [LINTEL CRACK] [PIER OR PILE NOT FOUND] ∅ [EXTERIOR WALL SHOWN] ⊙ [PRESENCE OF PIER/PILE VERIFIED]
 MA [MONTHS AGO] [DOUBLE WALL LINE INDICATES SEPARATE Fn] [HORIZONTAL BRICK MORTAR OR SIDING LINE UP IN MIDDLE OF WALL] RL † [RUSTY LINTEL CRACK]

INTERIOR

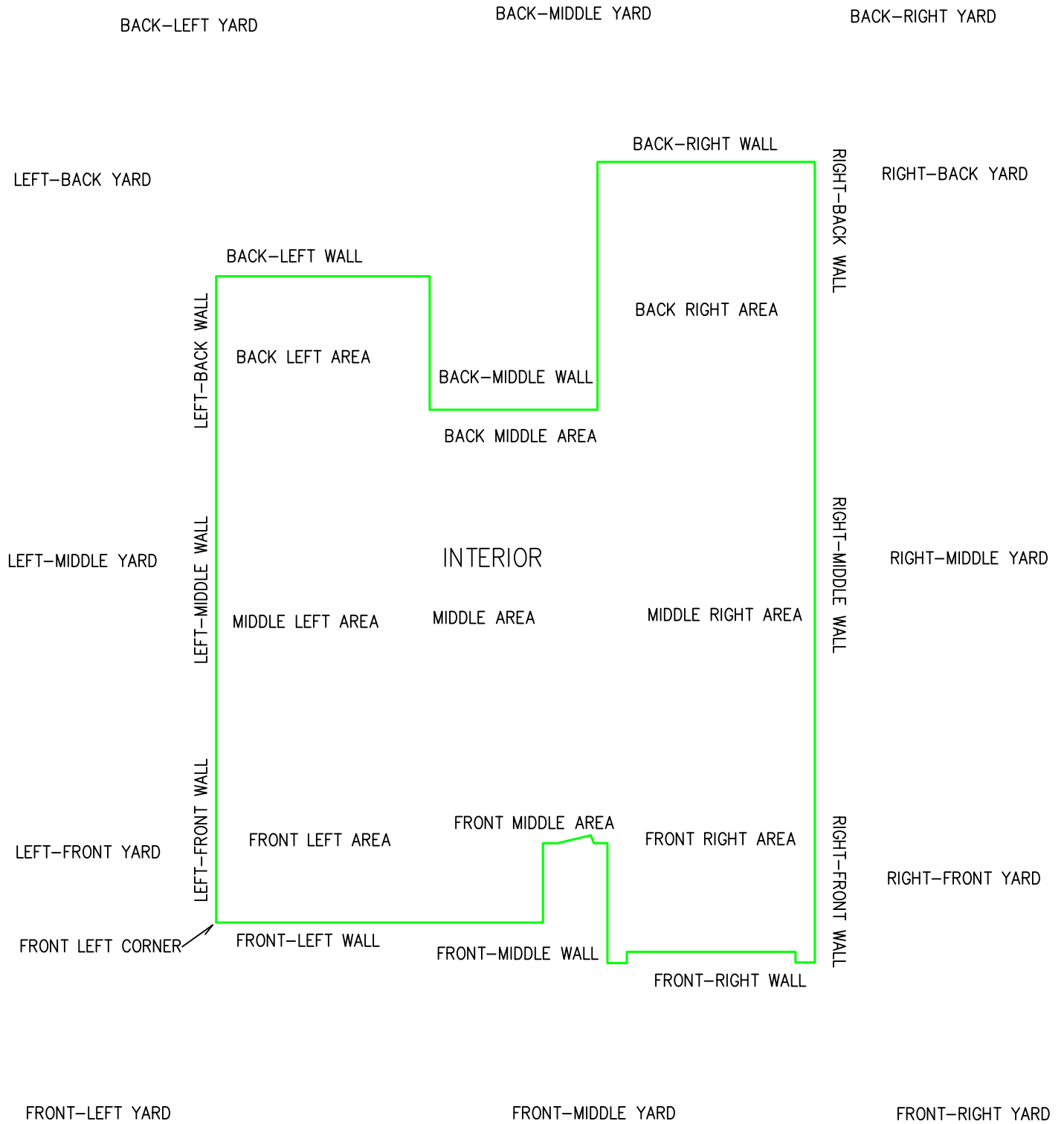
C ~~~~~ C [CEILING CRACK] +var [POSITIVE SEASONAL VARIATION] var [VARIES]
 2C ~~~~~ 2C [UPPER LEVEL CEILING CRACK] Wdm [WATER DAMAGE]
 [WALL TO WALL DISTRESS] F ~~~~~ F [FLOOR CRACK] < > [CRACK SEPARATING] NP [NAIL POP]
 [WALL TO CEILING DISTRESS] ● [REFERENCE ZERO] ⊕ [WATER HEATER] □ [REFRIGERATOR]
 W\$F [WALL TO FLOOR SEPARATION, GAP] W ~~~~~ W [WALL CRACK]
 W\$C [WALL TO CEILING SEPARATION, GAP] W ~~~~~ [WALL CRACK CONTINUES TO CEILING] ↑ [DOOR INTERFERES AT TOP]
 [SEVERE WALL TO WALL DISTRESS] C [CONDITION DOUBLE CHECKED] ⊗ [SHOWER] ⊕ [ELEVATION TRANSFER POINT]
 RULE: AT INTERIOR, ARROWHEAD POINTS TO INTERPRETED DIRECTION OF DROP
 [AT DOORWAY, INTERPRETATION OF DOWN DIRECTION, DAMAGES AT DOWN SIDE] □ □ [WASHER/DRYER]
 [AT DOORWAY, INTERPRETATION OF DOWN DIRECTION, DAMAGES AT DOWN AND UP SIDES]
 [AT WINDOW, INTERPRETATION OF DOWN DIRECTION, DAMAGES AT DOWN SIDE]
 [AT DOOR, INTERPRETATION OF DOWN DIRECTION, DOOR BINDS, DOOR/JAMB MARGIN UNEVEN]
 [MINOR, NON-INTERPRETED DAMAGE AT DOOR, BINDING AT SIDE] □ [WALL OPENING, NON-INTERPRETED Dm]

DRAINAGE

RULE: ARROWHEAD POINTS IN DIRECTION OF MOVEMENT OF WATER d/s>impound [GUTTER DOWNSPOUT DRAINS TO IMPOUND]
 . . . [ROOF DRIP LINE] < [ROOF VALLEY RUNOFF] -dn [SURFACE DRAINAGE TOWARDS Fn]
 d/s+6 [d/s DISCHARGES 6" FROM Fn] Dn? [TRUE DRAINAGE OBSCURED] d/s+ [DISCHARGING TO POSITIVE DRAINAGE]
 impound [WATER CAPTURED NEXT TO FOUNDATION] pond [WATER RESTS NEXT TO FOUNDATION] → [DIRECTION OF Dn]
 † [YARD DRAIN INLET] hole [WATER APPEARS TO DRAIN UNDERNEATH Fn] cond [AC CONDENSATE DRIPS NEXT TO Fn]
 OTD [OBSTRUCTION TO DRAINAGE]
 pits [GROUND DEPRESSIONS]

ALL DAMAGES NOTED ON SURVEY PRESUMED TO BE FROM FOUNDATION MOVEMENT.
 MOST COMMON NOTATIONS SHOWN, LESS COMMON NOTATIONS DERIVED OR WRITTEN OUT.
 WALLS SHOWN GREEN. BRACKETED ITALICS ARE EXPLANATION FOR SYMBOLS
 INTERPRETATION IS THE DETERMINATION OF DOWN SIDE MADE BY THE ENGINEER/TECHNICIAN BASED ON DAMAGES, MEASUREMENTS, AND CONDITIONS.

LOCATION KEY



TERMINOLOGY

FOUNDATION

GRADE: The level of the surface of the ground.

LANDSCAPE, GRADES (noun): The surface of the ground.

LANDSCAPE (verb): To change the surface geometry of the ground.

PIERS: A general term for all concrete foundation support products, or a specific term for the bell-bottom poured-in-place product.

PILES: A specific term to the pre-cast cylinder foundation support products, which have most of the market in residential repair.

FOUNDATION REPAIR: Not repair of the foundation itself, but leveling of the foundation. Term not precise but in general usage. Proper term would be foundation leveling. For foundation repair, piles or piers are placed at intervals, normally at 7-8' for one story and 5-6' for 2 stories. Underpinning is the general term for the piers or piles in place.

EXPANSIVE SOIL: Soil with clay constituents, common in the Greater Houston area and other areas, which will swell when moisturized and shrink when dried.

FOUNDATION EXPOSURE: The portion of the foundation visible from the yard. Code requires 4 inches of exposure below bricks. Too much exposure normally means not enough of the grade beam is below grade, resulting in accelerated aging of the foundation. The foundation normally extends inches to feet below grade at the perimeter.

LINTEL: The steel angle iron at the top of masonry (brick) openings, such as over windows, doors, overhead garage doors.

GRADE BEAM: The very thick edge of the foundation. It is usually 12" wide, and 12"-18" thick in good older construction, and 22"-36" thick in good newer construction. Some of the grade beam is above ground (exposure), and some of it is below grade.

EXPANSION JOINT: Vertical gap/joint in the brick veneer walls, about ½"-1" wide, normally filled (not required), in long straight walls. Expansion joints will close and open due to the flexure of the wall, and thereby resist cracking of the brick veneer nearby.

FRIEZE TRIM: The trim found below the soffit covering (trimming) the top of the brick veneer wall.

DRAINAGE

PIT: Larger depression in the grade near the foundation. Can be caused by collapse of backfill soils after foundation or plumbing repair.

POND, PONDING: Water puddling in an area, presumably standing and not being absorbed into the soil easily.

IMPOUNDING, IMPOUNDED: The action of resisting proper drainage and retaining water due to a border around the area.

OBSTRUCTION TO DRAINAGE: Normally an area of high grade which obstructs proper drainage.

POSITIVE DRAINAGE: Drainage away from the foundation. NEGATIVE DRAINAGE: Drainage towards the foundation.

HOLE: A deep narrow void in the ground near the foundation, may be an entry for water under the foundation.

GAP: A narrow space between the foundation and the soil, usually found when the soil is dry, may be a place for water to drain at the foundation with negative results.

CLAYEY SOIL: Soil which has a significant clay content. Clayey soil will shed water and form the drainage surface. Clayey soil will stick together when soil is moist and compressed in your hand grasp. Clayey soils are native to most areas of Greater Houston, more so towards the coast.

SWALE: A landscape feature which will drain water. The swale is normally started as a ditch which has the proper drop for drainage. Once the ditch is proven successful, the sides are broadened and integrated into the existing soil surface, creating a natural looking landscape feature effective at drainage.

ROCK TRENCH: A drainage method consisting of digging out a trench at the perimeter of the foundation, and filling with rocks. This results in water being in contact with the foundation exposure, which can be detrimental to the foundation and cause water damage to flooring. In the best case, the water drains quickly from the trench and no detriment occurs. In the worst case water stands in the trench and its presence is not observed.

ALGAE, MOSS: Living organic matter indicating chronic high moisture. If found on the foundation it usually means water is being absorbed into the concrete, which can result in water damages to flooring.

ANALYTICAL DESCRIPTIVE TERMS

INDICATIVE, INDICATES: Strong direct cause-and-effect evidence.

SUPPORTIVE: Weak or indirect cause-and-effect evidence.

IN AGREEMENT: May be due to the stated condition.



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ENGINEERING OPINION CRITERIA FOR JUDGING 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 1.0%.
- 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 also considered in making a determination of foundation performance. 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 1% slope. Slopes in excess of 1% are considered noticeably unlevel.
- Age of building.
- Stability of foundation.
- Identifiable causes of foundation distress.
- Residence or attached garage, consider type of area affected.
- Range of elevations.

For purposes of communicating the performance of the foundation, it is normally described as doing very well, well, adequate, and inadequate. There is some engineering judgement involved in choosing the classification.

As a rule, 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 is a criteria which may not cause damages and is difficult to correct, and is more difficult to use to judge a foundation. Tilt between 1% and 1.5%, exceeding the 1% tilt criteria, with low level of deflection and damages, may be considered adequate with no recommendation for foundation leveling. Tilt in excess of 1.5% will be considered inadequate and usually requiring leveling. Whether the tilt was created at construction or the foundation moved later, and whether the tilt is considered stable, are two important factors to consider in judging tilt.

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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SPECIFICATION, DISCLOSURE, INFORMATION, AND WARRANTY FOR ROOT BARRIERS

The specification section governs the installation of root barriers to prevent or eliminate tree root influence on foundations. The remaining sections will provide more information, and address the installation of the root barrier by a single contractor. This direct assignment has benefits for all parties.

Specification

Trenching care: Contractor to identify and locate the underground services impacting the location of the root barrier. Services damaged by installation must be repaired by the Contractor.

The path: The Contractor and the Homeowner to decide on the path of the root barrier. The path will consist of a trench into which the root barrier is installed. If one tree is to be isolated the path is ideally a half-circle around the tree. Distance from the foundation must be at least 2', distance from the tree should be 10' or greater, if possible, for a total of 12' recommended separation distance of the foundation from the tree. For multiple trees in the same area, either an elongated arc or path around the foundation would be proper. If large trees are closer than 12' from the foundation, a path around the foundation to maximize root area is recommended. The root barrier trench may transgress the 2' rule but only for a short distance. The root barrier trench may transgress the 10' rule if the tree is young, smaller, no other practical path can provide the 10', the tree is not lopsided in the canopy, and the Contractor and Homeowner agree on this transgression. In no case should tree roots be cut closer than 5' from the tree. Trees too close for a root barrier should be removed.

The trench: Contractor digs a 24" deep trench between the foundation and the house in the path as agreed with the Homeowner. If tree roots are found in the lowest 4" of the trench, continue to dig in 4" increments until no tree roots are encountered. In the Houston area, a 24" depth has been found to be unfailingly sufficient. Reaching a clay layer normally means no more roots are to be encountered.

Moisture barrier and placement: When the root barrier is closer than 5' from the foundation, a water/moisture barrier should be installed in that section of the trench. The water/moisture barrier must be installed first onto the trench wall on the foundation side. Then install the root barrier into the trench over the membrane, with nodules facing the tree. The barriers must reach from the top to the bottom of the trench. Both barriers must be overlapped in the vertical and horizontal direction as

needed to fully cover the trench wall. Staple the barriers to the trench wall. Use caution during backfilling to not displace the Biobarrier and membrane. Backfill in stages, wash the backfill and tamp for compaction purposes before applying another stage.

Materials: The water/moisture barrier material should consist of double 6 mil poly, 10 mil or thicker poly, or Stego Wrap (10 mil Class A or C, or 15 mil thick). The root barrier materials must be BioBarrier, available locally at retail at San Jacinto Environmental, 2221 W 34th St, Houston, Texas, 77018, 713 957 0909, 800 444 1290, sales@sanjacsupply.com. Keep Biobarrier in its container bag, away from heat, keep bag tied between uses.

Contractor

By not having 3 Contractors provided, but only one, most of the Contractor's visits to quote the installation will result in contracted work, which keeps cost down for the Contractor and the Homeowner. The Contractor will provide competitive quotes that do not take advantage of their dominant position. The Contractor designated has installed root barriers without incident for many years. Any concerns by the Homeowner or Engineer are to be readily communicated and addressed by the contractor. The Contractor will comply with the root barrier specification, which has been created to ensure a very high level of success for removing tree influence from foundations.

Homeowner

Not having to deal with three Contractors to quote has its advantages. The prices from the contractor will be competitive and always much less than the other option of foundation repair. If Homeowner complies with this specification, Homeowner is provided a warranty for the results of the root barrier installation. This type of assurance is unavailable anywhere else. Homeowner is also provided a warranty for the ability of the tree to survive the procedure.

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The contractor pays the Engineer a small portion of their receipts from the referred work; this allows the escrow to provide the warranty. The money provided by the Contractor to the Engineer goes towards re-visits after unsuccessful root barrier installations and the reimbursement to the Homeowner under warranty.

Other information

No tree has ever been proven to have been lost due to a root barrier installation. Only one customer has made that claim, and it was of dubious merit. The Engineer will reimburse in case of tree loss due to the Contractor installing the root barrier, but the claim must be made with 3 months of the root barrier installation.

Root barrier installation advice is successful at providing the desired result in about 98% of the installations. It is almost as effective as removing the tree, and less permanent (in case the advice was wrong).

If a tree is affecting the foundation, and the effect is undesirable, the appropriate action is to remove the effect of the tree. Trying to remedy the effect on the foundation from a tree by installing underpinning/foundation repair may be initially successful, but will ultimately fail in most cases.

A recommendation for a root barrier is not made unless the Engineer is highly confident of tree effect. When not sure, the Engineer will usually return and inspect later in the year at no extra charge. But nature can fool the Engineer. In almost every case where root barrier installations have been unsuccessful, the installation was correct, the product and its performance were correct, the finding based on evidence by the Engineer was reasonable, but the appearance of cause and effect did not tell the true story.

The root barrier specified, Biobarrier, has a 15 year warranty. The manufacturer has evidence that it will be effective for over 35 years. Normally if a root barrier is installed at year 15 in the life of a tree, over 35 years later (age 50 for the tree) the tree is not actively producing roots, so for all practical purposes the protection is permanent.

The Biobarrier is not a physical barrier, such as concrete or heavy plastic. It is a fabric with plastic balls imbedded in the fabric. The balls contain a bio-chemical which diffuses into the adjacent (about 1 inch) soil, and when roots reach the biochemical, the roots cannot grow any further. The biochemical acts by not allowing the root cells to divide, which they must to extend their reach. The biochemical is not toxic, it does not kill the root tissues, it does not stress the tree, it does not affect surface plantings.

The advantage of the Biobarrier over a physical barrier is that a physical barrier can be skirted by roots which were cut to place the physical barrier. Physical barriers do not have the success rate of Biobarriers.

If the root barrier installation is closer than 10 feet from the tree, then some taproots may be cut, which could affect the ability of the tree to resist falling over in a wind-storm. The tree should never fall towards the house due to the removal of tap roots to install the root barrier.

The warranty allows all Homeowners to either receive a beneficial effect or not incur a loss, so there is less hesitancy on deciding on the installation.

There may be some Engineering follow up after the root barrier installation. Sometimes a Homeowner wants to document the recovery of the foundation; the Homeowner will be charged for this service. Sometimes the Homeowner suspects there has been no recovery or other desired results; in that case the Engineer can reinspect. If

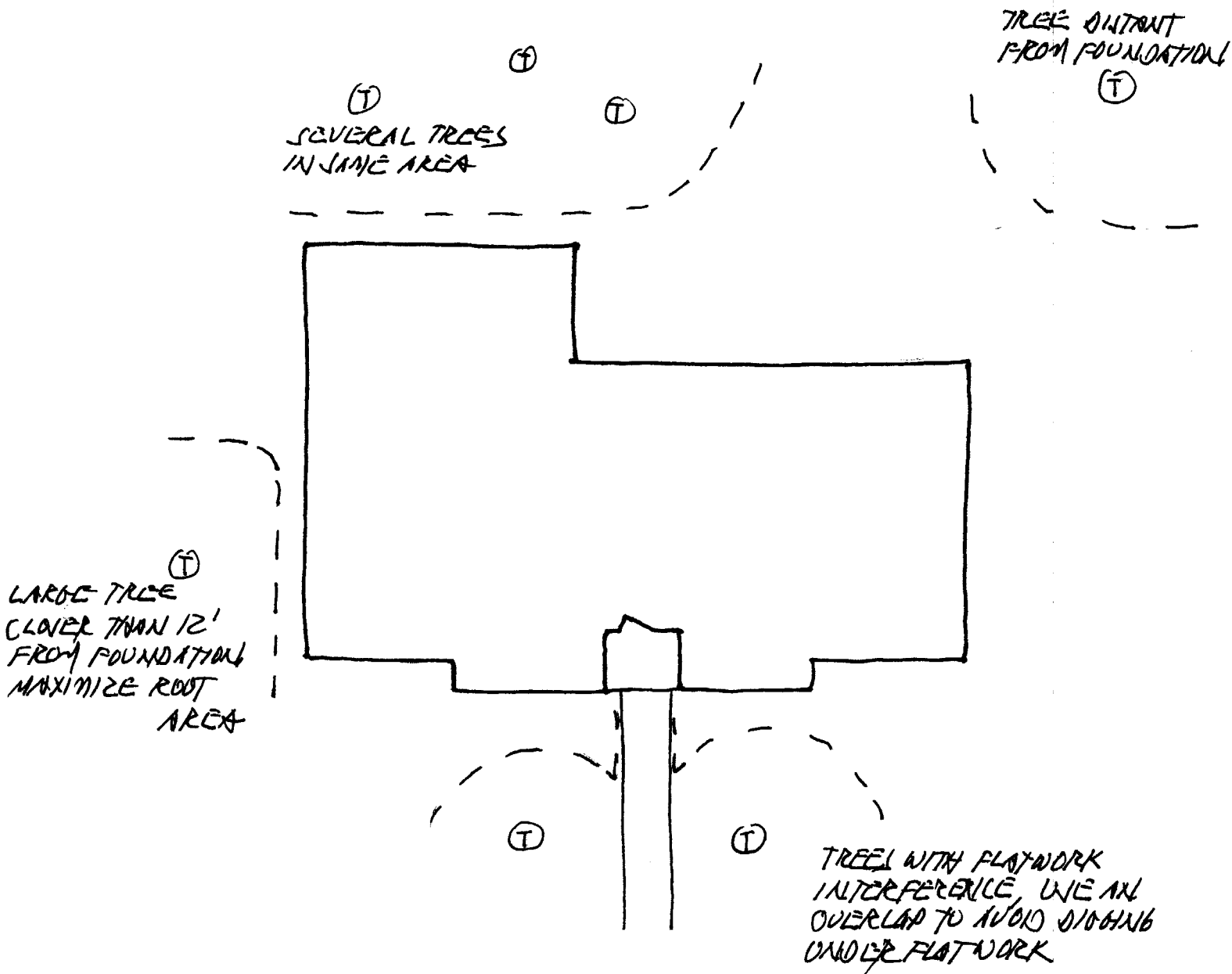
recovery or other desired result has occurred, then the Engineer will charge for this service.

If the Homeowner suspects there has been no recovery or other desired results, in that case the Engineer can reinspect. If investigation shows a recommendation by the Engineer for root barrier installation, installation of the root barrier was performed by the designated Contractor, and beneficial and expected results from the installation of the root barrier for the benefit of the Homeowner has not occurred, the Engineer will not charge for the inspection. Upon reaching the conclusion that no benefit from root barrier installation has occurred within a reasonable time, the Engineer will execute the warranty.

Warranty

If root barrier is advised by Gerard J. Duhon, P.E., and installed by the designated Contractor, and if results are not beneficial to the foundation performance (results normally being recovery, stability, or lack of future effect, usually stated in the report), Gerard J. Duhon will reimburse the Homeowner for the cost of the root barrier installation. Compensation for drainage or other work will not be reimbursed.

Gerard J. Duhon



TYPICAL ROOT BARRIER PLAN