



John and Jane Doe
1234 E. Some Place
Anywhere, AZ

RE: Engineering Evaluation, Distress Cracks on Interior Floor Tiles and Slab
1234 E. Some Place
Anywhere, AZ

A previous home inspection report of the home at 1234 E. Some Place, Anywhere, AZ recommended an Engineering evaluation of 'the causes of issues indicating significant movement of exterior structures has occurred' (see Attachment 1). At the request of John and Jane Doe, a visual site inspection was performed and subsequent Engineering Evaluation by Ralph G. Baca, P.E. of BBaca Engineering, LLC. The report that follows was prepared based on that inspection.

The intent of this inspection was to evaluate, through non-destructive test and visual inspection, the current condition of the structural system of the home of this building and to determine what, if any, significant maintenance, repairs, and/ or replacement to this system might be currently expected. Also, if the root cause of the problem could not be determined visually, steps or tests were to be outlined that would help in narrowing the potential cause(s) of a problem.

As you requested, this report focuses on the 'causes of issues indicating significant movement of exterior structures has occurred' and its affect on the remaining sub-structure/ or super-structure systems. This inspection & report does not include code compliance, municipal regulatory compliance, subsurface investigation, or records research related to this building.

Based on visible evidence, the structural condition of the foundation system of this home is considered fair but stable with repairs required at this time. In our opinion, the crack(s)/ or signs of movement are most likely due to excessive water accumulation/ or infiltration along/ or around the exterior stem wall and foundation areas. Without recommended repairs & further testing continued displacement may continue to occur which could lead to instability with eventual and localized foundation failure(s). We recommend the following repairs & testing to ensure stability of the home & its foundation is maintained. Specifics of repairs are included in the body of the report:

- Remove or limit watering and grade along the front and east exterior stem wall and foundation areas such that water drains away, i.e. one inch per foot to a distance of at least three feet. Estimated Cost to Repair: \$
- Install extensions at downspouts to divert water away from stem walls , porch and patio areas. Estimated Cost to Repair: \$
- Evaluate water supply and drain lines to ensure there are no underground water leaks. Estimated Cost to Repair: \$
- Evaluate and repair any sprinkler system water leaks in under or above ground water supply lines. Estimated Cost to Repair: \$
- Remove carpeting in master bedroom where flooring surface uneven to determine extent of , if any damage to concrete substrate underneath carpeting. Estimated Cost to Repair: \$

After repairs, we recommend you continue to monitor the exterior and interior areas for a period of six months to a year for any signs of reoccurrence that might indicate other contributing factors had been involved. However, with normal care and attention to maintenance of a stable moisture content in the soil surrounding the foundation, the property should remain structurally sound in the foreseeable future.

Respectfully Submitted,



Ralph G. Baca, P.E.
Principal Engineer

BBACA ENGINEERING, LLC

Property Inspection Report

Engineering Evaluation, Interior Floor Tiles/ Drywall Distress; Sloped Flooring

Client: John and Jane Doe

***Property Location: 1234 E. Some Place
Anywhere, AZ***



Inspection Date:

Engineer: Ralph G. Baca, P.E.

AZ. License: 30637

Phone: 480-706-6222

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BBACA ENGINEERING, LLC. HOME & BUILDING INSPECTION SPECIALISTS

2401 E. TAXIDEA WAY - PHOENIX, AZ. 85048 480-706-6222

1. Introduction

A previous home inspection report of the home at 1234 E. Some Place, Anywhere, AZ. recommended an Engineering evaluation of ‘the causes of issues indicating significant movement of exterior structures has occurred’ (see Attachment 1).. At the request of John and Jane Doe, a visual site inspection was performed & subsequent Engineering Evaluation by Ralph G. Baca, P.E. of BBaca Engineering, LLC. The report that follows was prepared based on that inspection.

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This inspection report is limited to observations made from visual evidence. No destructive or invasive testing was performed. The report is not to be considered a guarantee of condition and no warranty is implied. This report is, however, an opinion about the condition of this building. It is based on visual evidence available during a diligent inspection of all reasonably accessible areas. No surface materials were removed, no destructive testing undertaken, nor furnishings moved. This report is not an exhaustive technical evaluation. Such an evaluation would cost many times more.

As Professional Engineers, it is our responsibility to evaluate available evidence relevant to the major systems in this building. We are not, however, responsible for conditions that could not be seen or were not within the scope of our service at the time of the inspection.

2. Description

This house is a single-story, large-sized residence with wood frame and stucco exterior walls and purportedly originally built and first occupied in 2005. It is unknown whether there have been additions/ or conversions made to the home/ or whose dates of construction were unknown. There is a sloped concrete tile roof surfacing over the main portions of the home. For purposes of this report, the building is assumed to face south.

3. Structure & Observations

Any home, regardless of code compliance requirements, should satisfy basic engineering principles and good construction practice. We have taken these principles into consideration when evaluating the capacity of the framing and other components where the choice of materials, their capacity, and their installation are relevant to future performance of this home.

The following areas were inaccessible or not visible, and this limited the extent of our structural inspection:

- Wall framing covered with drywall.
- Roof framing in portions of the attic areas where the ceiling was raised.
- Concrete slabs covered with flooring.
- Roof framing covered with insulation material.

For your reference, the following definitions may be helpful:

- o **Excellent**: Component or system is in “as new” condition, requiring no rehabilitation and should perform in accordance with expected performance.
- o **Good**: Component or system is sound and performing its function, although it may show signs of normal wear and tear. Some minor rehabilitation work may be required.
- o **Fair**: Component or system falls into one or more of the following categories: a) Evidence of previous repairs not in compliance with commonly accepted practice, b) Workmanship not in compliance with commonly accepted standards, c) Component or system is obsolete, d) Component or system approaching end of expected performance. Repair or replacement is required to prevent further deterioration or to prolong expected life.
- o **Poor**: Component or system has either failed or cannot be relied upon to continue performing its original function as a result of having exceeded its expected performance, excessive deferred maintenance, or state of disrepair. Present condition could contribute to or cause the deterioration of other adjoining elements or systems. Repair or replacement is required.
- o **Adequate**: A component or system is of a capacity that is defined as enough for what is required, sufficient, suitable, and/or conforms to standard construction practices.

All ratings are determined by comparison to other buildings of similar age and construction type.

The following history of the property was given by the current owner, not necessarily in chronological order:

- o During a home inspection it was noted that there were various interior tiles and drywall areas that had distress cracks along with uneven flooring noted in the master bedroom (see Attachment 1).
- o At the request of the potential buyers John and Jane Doe, BBaca Engineering performed an Engineering Evaluation of the cracks noted.

The following is a description of the systems and their condition at the time of the site visit:

Substructure – Foundation & Interior Concrete Slabs

Description

From visual observations, the basic construction of this home most likely consists of a traditional foundation method to support a structure where a footing is placed below the frost line and then the walls are added on top. The footing is wider than the wall, providing extra support at the base of the foundation. A T-shaped foundation is placed and allowed to cure; second, the walls are constructed; and finally, the slab is poured between the walls.

Condition

The foundation and stem wall areas were in good condition with no repairs required at this time.

- o There were no signs of significant distress nor were the amount of other distress cracks noted beyond what would be considered typical for a house of this age.

Recommendations

- o Not applicable.

Exterior - Load Bearing Walls

Description

From visual observations the exterior walls consist of a wood framing with a combination stucco & stone surfaced construction, standard for homes of this age.

Condition

The exterior walls were in good condition with no repairs required at this time.

- There were no signs of significant distress on the exterior walls nor were the amount of distress cracks noted beyond what would be considered typical for a house of this age.

Recommendations

- Not applicable.

Superstructure – Roof Framing

Description

From visual observations the attic framing most likely consists of an engineered wood truss construction, where the framing members span and bear on the exterior walls and possibly interior walls of the home. This is a standard method of construction for a home of this age.

Condition

The attic framing was not considered relevant to this evaluation and therefore not evaluated.

Recommendations

- Not applicable.

Interior and Exterior – Non Load Bearing Walls & Concrete Slabs

Description – Interior Concrete Slabs

From visual observations the interior concrete slabs consist of a typical interior slab that may or may not be a ‘floating’ slab between the perimeter stem wall areas. The interior walls most likely consist of wood framing over which drywall is applied then textured and painted. Typical homes of this size and age may have interior load bearing walls or concrete footings or slabs. No drawings were available to verify this.

Condition – Interior Concrete Slabs

The interior and garage concrete slabs were in fair condition with further evaluation and possible repairs required at this time.

- There was uneven flooring of the carpeted area along the north edge of the master bedroom and where it enters to the bathroom area (see photos). Due to the carpeting covering the concrete slab the exact cause could not be determined.
- There were distress cracks in the tile surface of the guest room or casita, main home front entry interior and main home hallway areas (see photos). The cracks are not considered significant, i.e. all less than 1/16th inch wide at their widest point and none had any measureable vertical displacement. In our opinion the displacement has been caused by water accumulation/ or infiltration from poor drainage along the exterior stem wall and foundation areas.
- There were no other signs of significant distress nor were the amount of other distress cracks noted beyond what would be considered typical for a house of this age.

Recommendations – Interior Concrete Slabs

- Remove carpet in master bedroom where uneven flooring noted. Based on visual observations we recommend the following:
- Assuming concrete slab cracks are less than ¼ inch wide and with minimal vertical displacement, i.e. less than 1/8 inch the following repair method would suffice:
 - Remove all loose concrete/ or dirt and soil along all concrete slab cracks. Use compressed air blown into the crack prior to epoxy installation.

- Repair crack(s) per manufacturer's instructions with Simpson Strong-tie 'Crack-Pac' epoxy system, Master Builder's Concessive or equivalent. Due to width and depth of crack it may be necessary to apply several applications. We recommend a low viscosity be used to insure epoxy reaches all areas of the crack.
- After epoxy has dried, the areas along the crack should be ground flush and level with the existing slab to provide a smooth and even finish for tile installation. Insure installation is completed using manufacturer's installation instructions.
- Install slip sheet prior to if any new tile installation.
- For concrete slab cracks greater than ¼ inch for an extended length, i.e. greater than four to six feet and with a greater than 1/8 inch vertical displacement consult a registered professional engineer for repair as a stronger bonding repair may be required.

Description – Exterior Concrete Slabs

The exterior concrete slabs consisted of typical floating, non-load bearing concrete slabs for the front porch, garage, and rear patio areas.

Condition – Exterior Concrete Slabs

The exterior concrete slab and flooring surfaces are in good condition with no repairs required at this time.

- There were no signs of significant distress nor were the amount of other distress cracks in the garage or patio area noted beyond what would be considered typical for a house of this age.

Recommendations - Exterior Concrete Slabs

- As part of general maintenance and after drainage repairs we recommend the distress cracks in the garage and patio areas be sealed to prevent the potential of moisture entry which can lead to further cracking. .

Description – Interior Walls & Ceiling Areas

The interior walls and ceilings consist of wood framing over which drywall is applied, textured and then painted.

Condition – Interior Walls and Ceiling Areas

The interior garage walls and ceilings were in good condition with minor general maintenance repairs recommended at this time.

- There were distress cracks at various interior wall and ceiling areas. This corresponds to the displacement noted and discussed above. These are common for a house of this age and typically due to normal settling.
- No signs of 'significant' distress on the interior walls were noted nor were the amount of distress cracks noted beyond what would be considered typical for a house of this age.

Recommendations – Interior Walls and Ceiling Areas

- After required repairs we recommend the distress cracks be sealed as part of general maintenance for aesthetic reasons.

Plumbing System – Water Supply, Drainage & Sprinkler Systems

Description

From visual observations the water supply system consists of copper plumbing and the drainage system made up of ABS, materials.

There was a sprinkler system installed for watering of the grass and flower bed landscaped areas

Condition

The plumbing system is in good condition with no repairs or further evaluation required at this time.

- A high level test of the water supply line was conducted, which consisted of turning all water off to the home and then watching the meter. A cursory check of the water meter with all water in the house turned off did not indicate any movement or substantial leaks in the water supply system. No visible water leaks were noted around the exterior of the home.
- The nozzles for the bushes along the exterior were installed in close proximity to the stem wall areas. This in conjunction with the negative grade there can allow an excessive amount of water ponding/ or accumulation.

Recommendations

- a. For the drain and water supply lines we require the following tests and evaluation:
 - As a precaution and prior to any other repairs the drain and water supply lines should be thoroughly tested for leaks that could be causing water infiltration under the home/ or foundation area. The drain & water supply lines should be tested by a licensed plumbing specialist or a professional and licensed leak detection company such as 'American Leak Detectors' (602-242-8573) or 'Hydrophysics Pipeline' (480-391-9694) for any water leaks, especially under the concrete slab areas. Repair any water leakage as required.
 - All shower and tub drain line and drain line joints should be inspected and tested by a licensed plumbing specialist to determine if there are any areas of water leakage that could result in water infiltration to the soil under the concrete slab/ or foundation support.
- b. For the sprinkler system we recommend the following repairs:
 - A full evaluation of the sprinkler system should be completed to ensure there are no water leaks in the above or underground water supply lines, especially along the stem wall areas.
 - The watering of all plants/ or grass along any other main home foundation areas be monitored, moved, or removed if not in use so that an excessive amount of moisture does not accumulate as a result. Also periodic maintenance is advised to insure there are no plumbing system water leaks along these areas. This will help maintain a more stable soil content there and prevent any more than normal settlement from occurring.

Visual Grade & Drainage

Description

From visual observations the grade and drainage consists of a general sloping of the landscaping away from the stem wall and foundation areas.

Condition

- a. Drainage of the property is in fair condition with repairs required at this time.
 - There was a negative grade and low spots along the main home exterior landscaped areas (see photos). This can allow water to drain/ or accumulate near the main home stem wall and foundation areas. We mention this because water accumulation near the foundation and foundation supports is a frequent source or contributor to its movement/ or settlement and can also be a source of attraction for termites.
 - There was no access for water to drain along the front porch east and west of the front entry from the gutter and downspouts (see photos). This can allow water to drain/ or accumulate near the main

home stem wall and foundation areas. We mention this because water accumulation near the foundation and foundation supports is a frequent source or contributor to its movement/ or settlement and can also be a source of attraction for termites.

- b. The gutters and downspouts were in fair condition with repairs required at this time.
 - o There were downspouts installed around the home without extensions to ensure water drains away from the home (see photos). This can allow water to drain/ or accumulate near the main home stem wall and foundation areas. We mention this because water accumulation near the foundation and foundation supports is a frequent source or contributor to its movement/ or settlement and can also be a source of attraction for termites.
- c. The AC water condensation lines were in fair condition with repairs required at this time.
 - o The AC water condensation lines drain to the bottom of the east and west exterior walls (see photos). Since it has nowhere to drain but along the stem wall this creates a damp soil condition during the monsoon season and which was evident at the time of the inspection.

Recommendations

- o Provisions should be made such as improved grading, or the installation of gutters & downspouts, French drains, etc. to insure that water drains away from the foundation exterior stem wall areas. Start grade at three to four inches down, from the top of the stem wall. Where required, fill or remove soil, compact to 90 – 95% of natural grade, re-grade, and install soil erosion materials to insure water is diverted at least twenty-four inches to thirty inches from the main home foundation and stem wall areas at a slope of one inch per foot of grade. This will maintain a more stable soil content there and help in preventing any more than normal settlement from occurring.
- o Install extension/ or erosion control devices at the bottom of all downspouts and the areas re-graded (where applicable) and diverted away from the stem wall to insure proper drainage. This will help maintain a more stable soil content there and prevent any more than normal settlement from occurring.

OR

A more reliable but expensive solution to the gutters and downspouts would be to install an underground French drain system which all downspouts tie or drain to. This would involve a preliminary design by a licensed engineer or general contractor to ensure adequate drainage is obtained at all applicable areas.

- o An erosion control device be installed at the base of the AC condensation lines such that water is diverted away from the stem wall areas. This will help maintain a more stable soil content there and help in controlling any more than normal settlement from occurring, as well as avoiding an attraction for termites.

Follow-up After Evaluations & Repair

- o After repairs continue to monitor and measure any structural movement / or continued stem wall cracking for a period of six months to a year. If no further movement or secondary distress is noted, then one can assume the most likely cause of the previous distress or movement was eliminated and that no further evaluations or repairs would be required. If continued or a reoccurrence of displacement in the stem wall is noted further and a more detailed evaluation/ or testing may be required. ***It should be noted that this could be an added expense to you in the future.***

4. Conclusion

Based on visible evidence, the structural condition of the foundation system of this home was considered fair but stable with repairs required and repairs recommended at this time. In our opinion, the interior flooring tile

and drywall distress cracks are mainly due to excessive water accumulation/ or infiltration along/ or around the stem wall and foundation areas. Without required repairs continued displacement of the interior concrete slab(s)/ or stem wall and foundation could lead to instability with eventual and localized foundation/ or interior concrete slab failures. We have outlined the specific repairs above and in the body of the report. After repairs, we recommend you continue to monitor the exterior and interior areas for a period of six months to a year for any signs of reoccurrence that might indicate other contributing factors had been involved. However, with normal care and attention to maintenance of stable moisture content in the soil surrounding the foundation, the property should remain structurally sound in the foreseeable future.

If you have any questions about this report or inspection, please feel free to call our engineer for clarification. There is no additional charge for a reasonable number of phone consultations. Should an additional visit to the home be necessary, however, an additional fee may be charged.

Thank you for the opportunity to be of assistance to you.

Sincerely,

Ralph G. Baca

Ralph G. Baca, P.E.

Enclosures

Attachment 1 Home Inspection Report



Prepared For: Matt & Allison Moore

Property Address: 2996 E Palo Verde Street
Gilbert, AZ 85296

Inspector: Jason Bradley
Company: Red Mountain Inspections, Inc.
dba WIN Home Inspection Red Mountain
(480) 659-0695
WINREDMOUNTAIN@WINI.COM

Services included in this Report:

Extended Home Inspection

aval of evidence of movement & site drainage issues noted on page 3 of win Home Insp. Summary Report



CERTIFIED INSPECTOR

121008



Extended Home Summary Report

We have identified various items on the subject structure that either require maintenance now or require periodic maintenance in the normal course of ownership. This is only a summary report and is intended as a guide to be used in both short and long term scheduling of maintenance items. Please read the complete report carefully as additional information and details are contained therein. It is always advisable to use experienced tradespeople or a qualified handyperson when contracting for work that may not be within the scope of your capabilities.

The main entry door is considered to face: South

1. Structure Perimeter Exterior - Evidence of Movement:

Yes

See Figures 1-4

The following issues were noted with the house that indicate significant movement has occurred to the house in the past. I recommend having a licensed structural engineer evaluate the home to determine the causes of the movement and make any/all repair recommendations. At least some of these issues may be related to drainage issues noted later in the report. There is a pool in the back yard close to the home which may also have cause some of the issues. The issues are not in any order of importance.

1. The guest casita floor is noticeably heaved/lifted and there is a significant drywall crack noted above the door to the bathroom area.
2. The tire stop area in the garage is cracked with differential movement noted between the sides of the crack. This crack is basically in line with the guest casita area so it may be related to those issues.
3. There is considerable drywall cracking noted in the garage.
4. There is separation/cracking noted in the west side perimeter wall.
5. There is a considerable crack in the back patio near the doors to the master bedroom.
6. The master bedroom floor is uneven especially between the bed and the entry area to the bathroom. The carpeting will most likely need to be lifted to expose the floor in this area.
7. There is drywall seam separation/cracking noted along the east side of the master bedroom and master bedroom sitting/office area. I pulled the carpet in a small area along this wall and noticed the interior slab is raised above the bottom of the drywall in at least one area.
8. There is cracking noted through the floor tiles in the hallway/front entry area. There is no differential movement noted at this time so this cracking may be the type more associated with initial settlement of the home.
9. The drywall is cracking/buckling along the windows that face the back patio in the living room/dining room and breakfast nook area.

2. Structure Perimeter Exterior - Site Drainage:

Maintenance

See Figure 5

There is questionable to very poor drainage/drainage practices around this home. Some of the drainage issues may be at least partially responsible for the movement issues noted earlier in the report. I recommend having the engineer who evaluates the movement also evaluate the drainage and/or having a licensed drainage contractor evaluate and make all needed repairs. Water draining/ponding against/near the home is a leading cause of settlement issues. The following issues are not in any order of importance.

1. There are gutters installed along the front courtyard area. The downspouts for these gutters are discharging against the side of the house in the front courtyard area. This is a very poor design/idea as all water from downspouts should discharge away from the home in an area where all water will drain at least six feet away from the home.
2. The front yard is landscaped so that drainage/water will pond in the yards when excessive moisture is noted. It is typically recommended that all water drain to the street and not pond on the property.
3. The condensate drain discharge for the west side A/C unit is getting trapped between the

Engineering Evaluation Reference Photos



Photo 1: Front porch downspouts drain to west end porch and along guest room stem wall areas.



Photo 2: Front porch downspouts drain to east end porch and along main home stem wall areas.



Photo 3: Low spot and negative grade front exterior just west of entry along guest room stem wall.



Photo 4: View looking west into guest room. Distress crack on floor tiles running diagonally through room.



Photo 5: View looking east from guest room. Distress crack on floor tiles running diagonally through room.



Photo 6: Cracks measured at less than 1/16th inch in width with no vertical displacement in guest room.



Photo 7: Hairline cracks on drywall of south wall of guest room.



Photo 8: Hairline cracks on drywall at corner of interior door of guest room.



Photo 9: Hairline cracks on drywall at corner of entry door of guest room.



Photo 10: View looking east from guest room. Distress crack on floor tiles running diagonally through room.



Photo 11: Hairline cracks on drywall at corner of interior door of guest room.



Photo 12: View looking down hallway in main home. Distress crack on floor tiles at entry to bedroom.



Photo 13: Hairline cracks on drywall at corner of interior door of bedroom.



Photo 14: View looking north into master bedroom. Uneven flooring of carpet at entry to bathroom area.



Photo 15: View looking west into master bedroom. Uneven flooring of carpet at entry to bathroom area.



Photo 16: Distress crack in drywall of MBR closet area.



Photo 17: Front exterior view west end of home. Negative grade along garage south and west ends.



Photo 18: Front exterior view west end. Negative grade along stem wall.



Photo 19: Distress crack on garage ceiling drywall.



Photo 20: Distress crack on garage wall drywall above cabinets. .



Photo 21: Distress crack on garage concrete at step up along east edge.



Photo 22: Distress crack on garage wall drywall above entry door. .



Photo 23: Front exterior view east end. Low spot and negative grade at utility entrances.



Photo 24: Front exterior view east end. Low spot and negative grade at utility entrances.



Photo 25: Front exterior view east end. Low spot and negative grade at utility entrances.



Photo 26: Rear exterior view east end. Low spot and negative grade. Signs of previous pool pump repair north end.



Photo 27: AC condensation line drains to east stem wall.



Photo 28: Rear exterior view.



Photo 29: Rear exterior view east end. Signs of previous pool pump repair north end.



Photo 30: Downspout drains to rear exterior stem wall.



Photo 31: Rear exterior view.



Photo 32: Distress crack on rear exterior stucco surface.



Photo 33: Rear exterior view. Downspout drains to patio column support.



Photo 34: Rear exterior view west end. Downspout drains to stem wall.



Photo 35: Distress crack on rear patio ceiling drywall.



Photo 36: Distress crack on rear patio concrete slab.



Photo 37: AC condensation line drains to stem wall along west exterior.



Photo 38: West exterior view. Downspout drains to stem wall and low spots noted along stem wall.



Photo 39: West driveway slopes to main home.



Photo 40: West driveway slopes to main home.

Appendix A

Map of 2996 E Palo Verde St, Gilbert, AZ 85296-9421

