



Project No. ASR08-055-00
October 8, 2008

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Mr. Edward Pape
San Antonio Housing Authority Task Force
459 Precious Drive
San Antonio, Texas 78237

**RE: Consulting Engineering Services
Residential Study
1503 NW 26th Street
San Antonio, Texas**

Dear Mr. Pape:

Raba-Kistner Consultants, Inc. (R-K) is pleased to submit this document of our engineering services provided for the above referenced project. It is our understanding that this work is being performed to assess the general physical condition of the above referenced residence and to identify specific items that maybe influencing the performance of this monolithic concrete foundation and wood frame. To accomplish this objective we conducted visual observations of the structural frame and foundation along with relative floor elevation measurements and some non-destructive testing of the foundation. This document presents our observations and findings in accordance with our approved scope of work presented in **R-K** proposal No. PSR08-096-00, dated June 16, 2008, as well as the amended agreement, **R-K** Proposal No. PSR08-096-00A, dated August 6, 2008.

INFORMATION REVIEW

Prior to our on-site observation, **R-K** was provided with the following information:

- Construction documents for the San Antonio Housing Authority Mirasol Hope VI Revitalization Program Single Family Housing to include:
 - Architectural Floor Plans and Elevations, Site Plans, Wall Sections, Soffit, Facia, and Door Details, Door/Window Schedule, Electrical and Roof Plans prepared by Bartholomew & Company of San Antonio, Texas, dated between February 19, 1999 and February 28, 2002, sheet A100 to A-103; A-200 to A-220; A-300, A-301, A-303, and A-304; A-400, A-401, and ELEC-1, 2, and 3;
 - A Foundation Plan prepared by Unitech Consulting Engineers, Inc., of San Antonio, Texas, dated July 10, 2000. sheet S-1;
 - MEP Drawings prepared by INCE Distributing of San Antonio, Texas, sheets HVAC-1, 2, and 3, (not dated);
 - Plumbing Drawings prepared by Ashley Plumbing of San Antonio, Texas, sheets MECH-1, 2, and 3, (not dated); and
 - Truss/Wall Panel Design Drawings prepared by Structural Lumber Company of San Antonio, Texas, sheets RF-1 to RF-9 (not dated).

- Geotechnical Report prepared by Nova Consulting Group, Inc. of San Antonio, Texas, dated September 30, 1999, pages 1 through 14 and Appendices A-1 through A-6.
- Inspection Report page 2 of 9 prepared by Amerispec Home Inspection Service, (not dated).

LIMITATIONS

The information provided in this document is directed to the Client, San Antonio Housing Authority Task Force, and may not contain information for others and/or for other uses. Construction documents were provided to us by our Client prior to our site visit; however, a set of the "as-built" construction drawings was not available. Some of our observations were limited due to building finishes, room contents, etc. Additional conditions may exist or may have existed at the time of our observations. This report includes observation information as obtained by R-K and from various other sources. Our comments and opinions are based upon that data. If information provided by others is incorrect, or if additional information becomes available, R-K may need to revise the comments and opinions presented in this document.

BACKGROUND INFORMATION

On Tuesday, June 17, 2008, Jesse H. Aguilar, P.E., and Ignacio Vivanco, E.I.T., of R-K, performed a site visit to the home to make visual observations of the home and to conduct relative floor elevation measurements of the floor slab. On the basis of the meeting held at the home with Mr. and Mrs. Gutierrez, the homeowners, and Mr. Matthew Michulka with the San Antonio Housing Authority Task Force, we were provided the following information:

- Mr. and Mrs. Gutierrez moved in between August and September of 2006 and are the second homeowners.
- The homeowners mentioned that vibrations can be felt within the home when buses drive through the intersection.
- An above-ground swimming pool was installed by the homeowners in the back yard shortly after moving into the home. When the pool is drained, water flows away from the foundation and toward the neighbor's back yard, located behind the residence.
- Sometime during May 2008, the homeowners noticed that the back left bedroom door was sticking to the door frame and would not close correctly. At approximately the same time, they noted that the master bedroom closet door has the same sticking condition to the door frame.
- About three weeks ago, the homeowners noticed a horizontal separation in the master bedroom closet wall along the front edge near the door opening.
- The homeowners use a soaker hose and moveable lawn sprinklers to water along the foundation and the yard on each side of the home two to three times per week for approximately three hours at a time.
- No plumbing leaks have occurred while the homeowners have occupied the residence.
- During heavy rainfall events, water ponds along the front of the garage.

- The planter areas located along the front porch and near the right-front corner of the home were established by the previous homeowner.

GENERAL INFORMATION

The front, back, left and right directions used in this document are determined by facing the front door of the home. The home is a single family, two-story wood frame dwelling supported on a reinforced concrete beam and slab-on-ground foundation. The home is supported on a reinforced concrete beam and slab-on-ground "floating" foundation. The exterior wood frame of the home is covered with fiber cement board siding on the left, back, and right sides of the home, while the front is covered with a combination of cement board siding and brick veneer. The wall framing is supporting a wood roof manufactured truss framing system with a composition shingle roof covering. The framing of the perimeter walls consists of standard pressure treated 2x4 wood studs spaced about 16-inches on center. The roof framing system consists of prefabricated wood trusses spaced about 24-inches on center.

The downstairs portion of the home is comprised of the living room, kitchen, utility closet, pantry, and garage. The upstairs portion of the home includes the stairway, master bedroom, master bathroom and closet, hallway bathroom, left-rear bedroom, right-rear bedroom, and right-front bedroom. The concrete floor slab is covered with a vinyl tile floor system with the exception of the living room, which is covered with wall to wall carpet. The garage and covered entry porch is exposed concrete. Views of the outside of the residence as it exists today are shown on Photographs 1 through 4 included Attachment B of this document.

EXTERIOR OBSERVATIONS

While walking around the exterior of the home, we noted the following:

Front

- Surface grading is considered poor with the ground sloping toward the foundation as shown on Photograph 5 of Attachment B.
- The metal edging located along the front planter bed traps runoff water within the planter and against the foundation as shown on Photograph 5 of Attachment B.
- The downspout located at the left-front corner of the porch exits onto a splash block located within the planter bed as shown on Photograph 6 of Attachment B.
- There are two large trees located in the front yard. The tree located closest to the foundation is approximately 15-ft in front of the porch as shown on Photograph 7 of Attachment B.
- There is about a 1/8-inch wide vertical mortar joint separation within the brick veneer located above the front door as shown on Photograph 8 of Attachment B.
- There is about a 3/4-inch wide horizontal separation at the joint between the porch foundation and the driveway slab and the fiberboard joint filler has collapsed within the joint as shown on Photograph 9 of Attachment B.
- There is a slight swale in the driveway slab where it meets the garage foundation.

Right

- The ground surface along the right side of the home is relatively flat.
- Butt joints between the fiber cement board siding have been re-caulked as shown on Photograph 2 of Attachment B.
- There is a horizontal separation between the soil and the perimeter grade beam along the right side of the home that varies up to about 5/8-inch in width, as shown on Photograph 10 in Attachment B.

Back

- The downspouts located at the right-rear and left-rear corners of the home exit adjacent to the foundation as shown on Photographs 11 and 12, respectively, of Attachment B.
- The ground surface has a gentle slope away from the foundation. However, there are several low spots in the yard located adjacent to the foundation where runoff water can pond as shown on Photographs 12 and 13, respectively, of Attachment B.
- There is a diagonal crack in the left-front corner of the concrete back door stoop slab that varies up to about 1/16-inch in width.
- There is a previously repaired crack in the vertical face of the perimeter grade beam where the back door stoop slab ties into the foundation as shown on Photograph 14 of Attachment B.

Left

- The ground surface has a gentle slope away from the foundation.
- There is a horizontal separation between the soil and the perimeter grade beam along the left side of the home that varies from about 3/4-inch to 1-1/4-inches in width, as shown on Photograph 15 of Attachment B. The depth of the separation was measured to be at least 4-inches.
- The HVAC condensate drain pipe exits adjacent to the left exterior grade beam as shown on Photograph 16 of Attachment B. The ground surface was wet and higher in elevation where the drain pipe is located than the rest of the ground surface along this side of the home. In addition, algae staining is on the siding beneath the drain line.

INTERIOR OBSERVATIONS

While performing visual observations of the interior of the home, the following observations were noted:

Living Room

- The front door does not close completely.
- There is a vertical tape joint compression bulge above the top-rear corner of the left wall window.
- A noticeable slope can be felt when walking across the floor throughout the living room.

Kitchen

- No signs of cracking or separations were noted.

Utility Closet

- No signs of cracking or separations were noted.

Pantry

- No signs of cracking or separations were noted.

Garage

- Cracks were observed in the concrete floor slab and were measured to range from hairline up to about 1/8-inch in width as shown on Photograph 17 of Attachment B.

Master Bedroom (Left-Front Bedroom)

- There is a horizontal sheetrock crack near the top-front corner of the closet doorframe that telegraphs through the partition wall, into the closet, and varies up to about 1/16-inch in width as shown on Photographs 18 and 19 of Attachment B. This crack is reflected through the wall.
- Inside the closet, there is a separation at the top-front corner of the wood trim located along the doorframe that varies up to about 0.05-inch in width.
- The closet door does not close completely.

Master Bathroom

- No signs of cracking or separations were noted.

Hallway Bathroom

- No signs of cracking or separations were noted.

Left-Rear Bedroom

- The bedroom door does not close completely as shown on Photograph 20 of Attachment B.

Right-Rear Bedroom

- No signs of cracking or separations were noted.

Right-Front Bedroom

- The bedroom door does not close completely.

RELATIVE FLOOR ELEVATIONS

During our site visit, relative floor elevations were measured by using elevation measuring equipment placed at various locations on the downstairs floor surfaces throughout the home. Presented on Figure 2 of Attachment A are the relative floor elevation measurement values to the nearest hundredth of a foot. The relative floor elevation measurements were tied to a temporary reference benchmark located on the concrete entry covered porch slab. To facilitate the relative floor elevation survey and for the purposes of this document an arbitrary value of 4 feet has been assigned to the reference benchmark. All other floor elevation measurements used in producing the drawing are relative to this assigned value of 4 feet.

Presented on Figure 2, is the highest relative floor elevation measurement on the carpet surface in the living room at elevation 4.73 feet, recorded near the right-rear corner of the living room. The lowest measured elevation on carpet surface in the living room near the left-front corner of the living room is 4.48 feet. The maximum floor differential between the highest and lowest elevation on carpet was determined to be 0.25 ft or about 3.00 inches over a 20 foot distance (about 7/8 inch over a 6 foot distance). In general, the overall elevation profile of the foundation is at a tilt with the floor slab sloping from back to front and from right to left. From our review of the elevations, it appears that the foundation form boards from the partition wall between the living room and kitchen to the front of the foundation may have been purposely sloped toward the front at the time of concrete placement.

GENERAL FOUNDATION INFORMATION

Using a Schmidt rebound hammer, R-K measured the in-place relative compressive strength of the surface concrete on the garage floor slab to be in excess of 3,000 psi. Additionally, R-K determined the location and spacing of the slab reinforcing steel using a reinforcing steel detector. The steel in the garage floor slab is estimated to be about 3-1/2 inches below the

finished floor surface. The spacing of the reinforcing bars in the garage floor slab varies from about 15 to 18 inches on center each way in front to back and left to right directions.

SOILS INFORMATION

Information provided in the geotechnical report prepared by Nova Consulting Group, Inc., it is our understanding that the soils conditions encountered within this site consist of a 1 to 2-foot thick layer of surficial fill materials overlying highly plastic natural clay soils. Further, we understand that the Potential Vertical Rise (PVR) values calculated for this area range in magnitude of 4-1/2 to 6-inches. It should be noted that information regarding the site preparation of the foundation footprint was not available at the time of the preparation of this document.

On August 28, 2008, R-K performed a second site visit to the home to obtain two soil samples from two locations adjacent to the perimeter grade beam for physical characteristic testing (Atterberg Limits testing) using a 3-inch diameter hand auger to collect soils at a depth below the grass from 12 to 33 inches at about the depth the concrete foundation is judged to be bearing upon. Sample S-1 was obtained near the middle of the left living room wall, about 1-1/2 ft from the foundation and can be described as highly plastic dark brown clay. Sample S-2 was recovered near the middle of the right side garage wall, about 1-1/2 ft from the foundation and can be described as highly plastic dark brown clay with roots. The soil samples described above have the following physical characteristics using ASTM D 2216, D 4318 and D 1140 procedures:

Laboratory Test	S-1	S-2
Moisture Content	28.0	26.0
Liquid Limit	72	68
Plastic Limit	21	19
Plasticity Index	51	49

The clay soils that exist beneath the home are considered to be highly expansive soils. Expansive soils are clay soils that can experience volume changes with changes in soil water content. Expansive soils shrink or reduce their volume when they lose water (damp to dry) and swell or increase their volume when they gain water (damp to wet). The foundation design Plasticity Index on the foundation drawing sheet marked S-1 dated August 3, 2000 is 65. The average Plasticity Index determined by our soils testing is about 50. The design Plasticity Index is 15 points greater than the site specific soils.

COMMENTS

With the exception of some localized movements that have occurred between the kitchen and the left-front corner of the living room, the floor slab is relatively flat and is performing within the boundaries for floor slab elevation differentials in the San Antonio locale. In general, the random cracking conditions observed in the floor slab at the time of our site visits are considered to be minor and is not a structural deficiency.

There are several factors that can cause and/or influence cracking of beam and slab-on-ground "floating" foundations including; soil-related movements, initial drying and shrinkage related cracking during the curing of the concrete following placement, thermal expansion and contraction, internal or external restraint to shortening; settlement of the supporting soils; and the applied loading to the foundation system to name a few. Based on our preliminary observations, the random cracking has not negatively affected the performance of the foundation system.

As stated earlier, there are two large size trees located in the front yard, with the closest tree located about 15 feet from the porch foundation. Additionally, there is a planter bed located along the front of the porch and at the right-front corner of the garage. Trees and other large plants can remove water from the soils beneath the foundation via their root systems. The reduction of water content in expansive clay soils can cause shrinkage in the soils resulting in reduced support and downward movement of the foundation in the vicinity of the tree(s). The roots of trees generally extend past the extents of their drip lines (canopies). It is believed that some species of trees growing closer to the foundation that 1-1/2 times their ultimate height can affect the building foundation. We believe that this tree may be contributing to movement of the foundation near the front of the home.

Poor drainage conditions observed along the exterior of the home's foundation represents that there is an increased potential for soil-related differential movements that may affect the performance of the foundation. With the exception of the gutter and downspout, located along the roof eave on the right side of the garage, runoff from the rooftop falls onto the ground surface and may pond adjacent to the foundation where the ground surface grading is not sufficient to drain this water away from the perimeter of the foundation in an efficient manner. Water that ponds adjacent to the foundation will likely soak into the soils located along the perimeter grade beam and could possibly wet the soils beneath the home. Inconsistent watering of the yard near and along the perimeter of the foundation and changes in seasonal moisture content can also contribute to soil-related differential foundation movements. Possible plumbing leaks beneath the foundation may also contribute to differential foundation movements. We recommend that plumbing leak testing be performed to assess if leaks are occurring beneath the concrete foundation.

As mentioned previously in this document, the homeowners mentioned that vibrations are felt throughout the home when school buses drive past the front of the home, along 26th Street. At this time, there is no indication that the vibrations have affected the performance of the foundation. The setback distance of the foundation from the street exceeds the minimum 10-ft distance required by the City of San Antonio. Furthermore, the highly expansive clay soils encountered throughout this development, as referenced in the geotechnical report prepared by Nova Consulting Group, Inc., naturally dampen and reduce vibrations as they move through the soil.

A review of the density test reports and the 79-G letter prepared by InTEC revealed that at most, only about 1 foot of the fill materials was tested during the site grading activities performed within the residential lots located in close proximity to the subject residence. If the fill soils were not correctly compacted, settlement related movements could occur resulting in possible cracking of the foundation and interior/exterior finishes. On the basis of the soils

information and testing documentation provided to us, we do not have enough information to assess the possible contribution of other causes of cracking to the foundation and structural frame of the home.

OPINIONS

On the basis of our observations / foundation measurements, measured relative floor elevations, site-specific soils testing information provided by others, and our knowledge of beam and slab-on-ground "floating" foundations founded on expansive clay soils, it is our opinion that:

- The Sheetrock crack in the partition wall between the master bedroom and closet, the cracking conditions observed at this home appear to be a result of some soil-related movements. These movements are likely a result of a combination of variations in climatic conditions, vegetation effects, and surface grading conditions around the home.
- The cracks in the concrete foundation are plastic shrinkage and dry shrinkage cracking and crack widths are related to soil movements supporting the foundation and are not a structural deficiency.
- The monolithic beam and slab on ground reinforced concrete foundation supporting the home and the wood frame are considered structurally adequate.

RECOMMENDATIONS

To the extent possible, all sources of water around and beneath the foundation should be controlled and regulated; therefore:

- The plumbing lines beneath the foundation should be tested for leaks. If the system leaks, the exact leak locations should be determined and repairs made by a licensed plumbing contractor.
- Irrigation should be controlled within a 10-foot zone around the perimeter of the home. The moisture content of the surface clay soils should be maintained at a uniform condition year round. The ground within this area should not be allowed to become dry to the point where the ground cracks and pulls away from the foundation. This is particularly true of this residence where these conditions were noted along the left and right sides of the foundation. Water should also not be allowed to pond in these areas or near the foundation.
- The soils in the yard need to be maintained adjacent to the foundation year round. This can be managed by watering along the perimeter of the foundation with soaker hoses connected to 12-foot long garden hoses that are attached to the hose bibbs along the exterior of the home. The soaker hoses can be laid out in an "S" pattern extending preferably five feet, if property lines allow, away from the foundation as shown on Figure 3 of Attachment A of this document. Generally, slow soaking watering for a maximum of about 4 hours per week will provide a uniform water content in the yards surface soils during dry weather conditions. The flow rate of the water through the soaker hoses should be

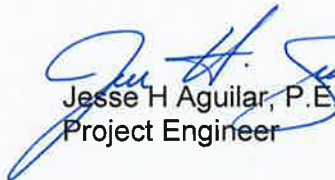
maintained at a 3/4 valve turn at the hose bibbs. Watering should be controlled so that there is no trapped or ponded water near the foundation.

- In order to help control the effects of surface water around the home, all water draining off the roof eaves should be collected and redirected to drain to the street located along the front of the residence.
- Thoroughly clean the cracks in the garage floor slab and seal them with a urethane crack sealant.
- Patch and re-paint the Sheetrock crack in the partition wall between the master bedroom and closet.
- Adjust the doors to open and close correctly.


We appreciate the opportunity to be of service to you on this project. Should you have any questions about the information presented in this document, or if we may be of additional service, please call.

Very truly yours,

RABA-KISTNER CONSULTANTS, INC.


Jesse H. Aguilar, P.E.
Project Engineer




Richard W. Kistner, P.E.
Vice-Chairman

JHA/RWK/jg

Attachments: A – Figures 1 through 3
B – Photographs 1 through 20

Copies Submitted: Above (3 Originals and 1 Electronic Copy)

ATTACHMENT A

ATTACHMENT B



PHOTOGRAPH 1



PHOTOGRAPH 2



PHOTOGRAPH 3



PHOTOGRAPH 4



PHOTOGRAPH 5



PHOTOGRAPH 6



PHOTOGRAPH 7



PHOTOGRAPH 8



PHOTOGRAPH 9



PHOTOGRAPH 10



PHOTOGRAPH 11



PHOTOGRAPH 12



PHOTOGRAPH 13



PHOTOGRAPH 14



PHOTOGRAPH 15



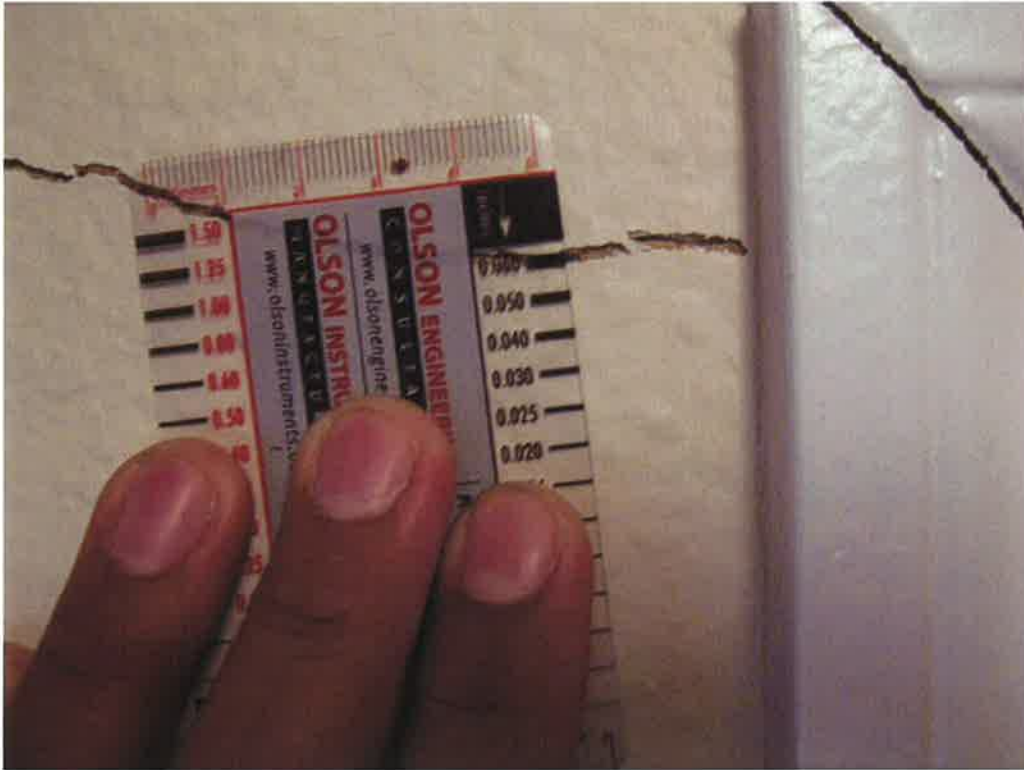
PHOTOGRAPH 16



PHOTOGRAPH 17



PHOTOGRAPH 18



PHOTOGRAPH 19



PHOTOGRAPH 20