

Project No. ASR08-009-00
February 13, 2008

DRAFT

Mr. Bart Swider
San Antonio Housing Authority Task Force
459 Precious Drive
San Antonio, Texas 78237

**RE: Consulting Engineering Services
Slab Cracking Observations and Moisture Investigation
438 Precious
San Antonio, Texas**

Dear Mr. Swider:

Raba-Kistner Consultants, Inc. (R-K) is pleased to submit the report of our work for the above referenced project. The purpose of this study was to provide consulting engineering services to help our client evaluate the concrete slab cracking conditions that have developed within the residence, located at **436 Precious Drive** in San Antonio, Texas. In addition, **R-K** has performed Moisture Vapor Emission Rate (MVER) testing at select locations across the exposed concrete floor slab to assess the presence of moisture emitting through the slab. Further, we have been asked to develop a scope of work to provide repair recommendations.

LIMITATIONS

The information provided in this document is directed to San Antonio Housing Authority Task Force (Client), and may not contain information for others and/or for other uses. Our observations were generally focused on items related to the existing slab cracking conditions and moisture vapor transmission through the concrete floor slab of the home, and may have been limited by wall and floor finishes, room contents, etc. Additional conditions may exist or may have existed at the time of our observation. This report includes observation and testing information regarding the home as obtained by **R-K** and from various other sources. Our comments and recommendations are based upon that data. If the information described in this document, some of which was 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. Illustrative digital photographs were taken by **R-K** during this observation and will remain in our file.

GENERAL INFORMATION

The home is located within a residential subdivision in southwest San Antonio, Texas. On the basis of the verbal information provided to us by Mr. Edward Pape, with the San Antonio Housing Authority Task Force, and a copy of the foundation plan provided to us by the Client during our site visit held on Friday, February 1, 2008, it is understood that the home is constructed on a conventionally-reinforced, concrete beam and slab on fill foundation. According to the foundation plan, prepared by South Texas Engineering, the project's structural engineering firm of record, the slab is 4-inches thick and is reinforced with either No. 3

reinforcing steel bars spaced 18-inches on-center, each way; grade 60, W5 by W5 welded wire fabric with 10-inch by 10-inch openings; or grade 60, W6 by W6 welded wire fabric with 12-inch by 12-inch openings. The slab is underlain by a 6-mil polyethylene vapor barrier followed by an 8-inch thick layer of select gravel fill material.

The construction of the home was completed sometime during 2000. The home has been vacant for some time while repairs are being made to repair finishes that were damaged by water infiltration through the exterior wall system. According to Mr. Pape, the slab cracks were first noticed after the floor coverings were removed. In addition, the homeowner reported that a bubble formed beneath the linoleum floor covering located in the kitchen. It is understood that when the homeowner punctured the linoleum floor covering water was released from the bubble. After removing the linoleum floor covering, a dark stain was noted on the floor slab where the bubble had formed. This condition prompted the CLIENT to request our help in identifying the source of the moisture.

In addition, we understand that the perimeter of the home is currently being regraded to promote positive drainage away from the foundation. Previous grading activities resulted in the condensate drain line being buried beneath the regraded soils along the right side of the home. The front, back, left, and right directions described in this document are determined by standing on Precious Drive and facing the home.

FIELD ACTIVITIES AND LABORATORY TESTING

On Friday, February 2, 2008, Jesse H. Aguilar, P.E., and Ignacio Vivanco, E.I.T., with R-K, made an initial site visit to the home to make general visual observations of the existing slab cracks and to install four moisture test kits at select locations throughout the slab surface to measure the Moisture Vapor Emission Rate (MVER) through the floor slab.

Slab Crack Observations

Visual observations of the visible slab cracks were performed throughout the different spaces within the home. At the time of our site visit, the cracks, in general, varied in width from about 0.03-inches up to about 0.06-inches. In addition, a 4-ft digital hand level was used to measure floor slopes across the floor slab. In general, the floor slab slopes from front to back, while the left and right sides of the slab slope toward the middle. The largest floor slope was recorded in the kitchen and was measured to be 0.5 degrees sloping from right to left across the floor slab. The sloping conditions along the left and right sides of the floor slab may indicate that the edges have experienced edge lift conditions associated with soil-related movements.

Moisture Vapor Emission Rate Testing

Four calcium chloride moisture test kits were installed on the concrete slab surface to measure the Moisture Vapor Emission Rate (MVER). The locations of the test kits are provided in the following table. The test, performed in general accordance with ASTM F 1869-03, is designed to measure the emission rate of water vapor from a concrete floor slab, recorded in units of pounds of water per 1000 square feet of floor surface per 24 hours (lbs H₂O/1000 ft²/24 hrs). At the end of an approximately 71-hour test period, on February 4, 2008, the kits were removed

and returned to our laboratory for processing. The results of MVER testing are shown in Table 1 below.

TABLE 1: SLAB MOISTURE VAPOR EMISSION RATE TESTING		
Test No.	Location	Emission Rate*
1	Near the Middle of the Kitchen	6.1
2	Near the Middle of the Master Bedroom	2.8
3	Near the Middle of the Front-Left Bedroom	2.7
4	Near the Back-Left Corner of the Living Room	2.7

* presented as lbs H₂O/1000 ft²/24 hrs

COMMENTS

On the basis of our visual observations, the floor slopes recorded during our site visit, and our previous experience with similar residential structures, it appears that, the cracks observed within the floor slab have not adversely affected the performance of the floor slab. These cracks may be related to a combination of shrinkage cracking and minor soil-related movements. It is our understanding that surface grading conditions are currently being improved along the perimeter of the home. Maintaining positive drainage away from the foundation is critical to reducing the potential for additional cracking associated with soil-related movements.

The results of the MVER testing performed between February 2 and 4, 2008 indicates that with the exception of Test No. 1, the concrete slab has not been affected by moisture vapor emissions. The vapor emission test result measured in Test No. 1 indicates that a slightly higher than normal moisture emission rate was recorded. In general, normal emission rates are anticipated to range between 2 to 5 lbs.

The emission rate data collected from Test No. 1 indicates that the previous linoleum floor covering was affected by moisture vapor emission from beneath the concrete slab. At this time, the source of the vapor emission is not known. It is possible that this higher vapor emission is a result of the vapor barrier not having been installed properly at the time of construction, or it was damaged prior to or during concrete placement, allowing moisture to penetrate the barrier. Potential sources of moisture beneath the house that can cause an elevated MVER include domestic water supply line leaks and surface water runoff and roof rainfall runoff that are infiltrating the fill materials and sub-grade soils along the front and right sides of the home.

RECOMMENDATIONS

On the basis of our findings, we recommend the following:

- At this time, we recommend that the slab cracks be sealed with epoxy or an elastomeric sealant prior to installing new floor coverings.
- Ceramic tile flooring could be used in lieu of vinyl covering in order to allow the slab to breath

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- Positive surface drainage conditions need to be maintained during the life of the home in order to promote drainage away from the foundation.
- Core samples of the concrete floor slab should be obtained in order to assess the condition of the vapor barrier and to determine the moisture content of the fill materials beneath the location where the bubble formed under the linoleum floor covering in the kitchen (Test No. 1 location).

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.

Ignacio Vivanco, E.I.T.
Project Consultant

Jesse H. Aguilar, P.E.
Project Engineer

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Copies Submitted: Above (1)