FEBRUARY 8, 2006 - Investigation of Vapor Emissions in Concrete Slab-On-Grade

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Mr. Garner, a licensed professional engineer with bachelors and master's degrees in civil engineering will present a paper he co-authored with Ramon L. Carrasquillo, Ph.D., P.E, entitled "Investigation of Vapor Emissions in Concrete Slabs-On-Grade," a paper that was presented at the Texas Section Fall Meeting of the American Society of Civil Engineers, Houston, Texas, October 1, 2004.

PRESENTATION SUMMARY

To an audience of about 30, Mr. Garner, a licensed professional engineer with bachelor's and master's degrees in civil engineering, presented a paper he co-authored with Ramon L. Carrasquillo, Ph.D., P.E, entitled *"Investigation of Vapor Emissions in Concrete Slabs-On-Grade,"* a paper that was presented at the Texas Section Fall Meeting of the American Society of Civil Engineers, Houston, Texas, October 1, 2004.

Mr. Garner began by briefly explaining some of the problems that excessive vapor emissions in concrete slabs-on-grade can cause, including flooring failures, down-time for industry operations, delays in construction, poor indoor air quality, and flooring aesthetics issues. He said that some factors affecting vapor emissions include concrete mix design, where a higher moisture content equals more problems, vapor retarders which are designed to prevent water from reaching the concrete but when breached prevents moisture escape, concrete placement and curing, vapor pressure gradients, and ambient conditions. Running the air conditioner will often exacerbate problems, particularly if a floor was laid soon after the slab was placed and then the air conditioner was activated.

Mr. Garner presented methods of assessing the adequacy of measuring the rate of vapor emissions for flooring applications including qualitative procedures such as adhesive pull-off tests and quantitative procedures such as the use of commercially available calcium chloride test kits will be discussed. Industry standards, including ASTM 1907 and ACI 302.1 were presented, and ASTM F 1896, the standard for the VET test, was discussed in detail. The VET test was developed in the 1950s, required 60-72 hours to complete, and its result is an emission rate in (pounds/1000 square feet in 24 hours). Limitations of this test are that only the present condition is assessed, i.e. if ambient conditions change, the test should be rerun, and the test is affected by changes in temperature, humidity and moisture. An acceptable rate of vapor emission is 3-5 pounds/ 1000 square feet in 24 hours, however flooring manufactures may specify a different rate. results from a limited testing program will be presented and interpreted.

As part of his paper, Mr. Garner ran multiple VET tests on his garage slab under different moisture and time constraints. Based on the results of his tests he concluded:

- It is especially important to use multiple test kits, and not rely on one test only.
- The test kit should be left in place for 72 hours.
- Wait 48 hours after a wetting event prior to beginning the test.

Mr. Garner also presented two case studies to show examples of the negative effects of vapor emission. The first case study was a hotel in Puerto Rico with a terrazzo floor. The vapor barrier below the slab was punctured by the rebar chairs prior to slab placement and consequently the high groundwater table

provided a source of water that caused the terrazzo to delaminate from the slab, and form bubbles in the flooring, creating a tripping hazard as well as being unattractive.

The second case study presented by Mr. Garner was a residential concrete slab that was smoothed and stained to be the finished flooring. The engineer specified that the moisture barrier should be placed under the slab, but not under the grade beams. Vapor emissions through the concrete would not normally have caused distress because no flooring surfaces were placed on the concrete. However, multiple coats of wax were applied to the floor, effectively trapping the moisture in the concrete. Eventually the locations of the grade beams were visible as the water wicked up through the grade beams and stained the concrete. Refinishing the concrete and applying a breathable finish to the concrete corrected the problem.

To read a summary of Mr. Garner's October 2004 FPA presentation entitled "Forensic Investigation of Existing Warehouse Concrete Floor", click here

To read a summary of Mr. Garner's December 2003 FPA presentation entitled "Investigations of Existing Building Foundations on High Plasticity Soils", click here

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