Richard A. Nuhn, P.E. Consultants

BUILDING ENVELOPE ASSESSMENT
INVESTIGATION/ENGINEERING/ANALYSIS

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May 8, 2009

Gerald Greeson
General Maintenance
Guilford County Schools
3920 Naco Road
Greensboro, North Carolina 27401

Re: Building Envelope Assessment - Oak Ridge Elementary School
Oak Ridge, North Carolina

Mr. Greeson,

A cursory review of the moisture-related building-envelope concerns at Oak Ridge Elementary School was made in April of 2009. The purpose of this review was to review the as-built conditions of the exterior walls and the interior concrete slab-on-grade as they relate to recent concerns expressed by state inspectors as to moisture conditions within the building.

The areas of concern were identified as the as-built condition of the exterior brick veneer walls, the exterior grading to removed surface water, and under-slab moisture in several classrooms and an assistant principals office.

The field review was made April 16, 2009 during which I was accompanied by representatives from the Guilford County Maintenance Department. The site visit included a review of the exterior conditions of the walls and grading, a review of the flooring installation in numerous rooms and a general walk-through of the entire building. Additionally, we observed the removal of carpeting from an assistant principals office.

FIELD REVIEW

As part of our assessment of the exterior building conditions adjacent to the masonry walls, we examined several issues including landscaping, surface-water drainage, roof drainage, storm-water management, etc. The following is a brief summary of several observations that were made as part of our visual review:

- In areas where there are classrooms, a continuous concrete slab, approximately six feet wide, is present. The slab is nearly flush with the interior floor elevation and slopes away from the building. The concrete slab is impervious and has good slope to drain water away from building walls.

- Exterior masonry on all walls of the building is common brick. Mortar joints are properly tooled and no significant weathering or cracking is noted. On the classroom wings there are two levels of weeps at ground level. The top weep level appears to be at floor level and was a retrofit based on condition of the mortar. There is another level of weeps that is one course below the top level and is barely visible above the concrete walkways. There was no evidence that this condition is contributing to any interior moisture intrusion.

- Water collected on the roof of the building is deposited by downspouts directly into underground piping which then directs the water to catch basins at the perimeter of the building. No roof water is allow to be deposited on the surface adjacent to the building walls. Storm water from the roof should not be contributing to any interior moisture concerns if the concealed piping is functioning properly.

- There are numerous storm-drainage structures around the building perimeter. Extensive ponding water on the surface was not observed as a result of the as-built conditions.

- The interior concrete slabs are covered by either vinyl floor coverings or carpet. No evidence was found of any deterioration of flooring adhesives due to moisture. All areas examined found the concrete slab surface to be dry and the flooring materials showed no evidence of moisture deterioration.

DRAWING REVIEW: OAK RIDGE ELEMENTARY, PREPARED BY CLINTON GRAVELY, JUNE 2003

To assist with our building envelope assessment, a select number of as-built construction documents were reviewed and compared to the field conditions observed during the site visit. The following is a brief summary a few of these drawings that are applicable to this evaluation.

Sheet A-12, Detail 4/A12 shows typical wall section.

At slab-on-grade: The drawings call for 4" concrete slab with a 6 mil poly vapor barrier under slab and a 4" gravel base on compacted subgrade. The gravel base would reduce potential for moisture drive vertically and the vapor barrier should prevent moisture to move into the concrete slab

Below Ceiling level: Components shown in the detail are (starting from outside): brick veneer, 1" air space, 1" rigid insulation, ½" exterior grade gypsum sheathing, 6" wide metal studs at 16" oc with foil-faced batt insulation between studs, and 5/8" foil-backed gypsum board, interior conditioned air space.

Above Ceiling/above exterior soffit: metal wall panel system with 24" air space behind steel studs framing, 1" rigid board insulation (not tight to deck), 2" metal stud framing with batt insulation between studs, structural steel beam for roof framing and unconditioned air above the ceiling and below metal deck.

Detail shows the air space in wall system to be adequately ventilated.

Detail calls for foil-faced batt insulation at cavity side of interior gypsum wall board.

Details call for soffit under metal roof to be perforated metal supported 24" on centers with metal studs.

Sheet A-9

Details shows the metal roofing system to be as follows: metal deck, 5/8" gypsum board, vapor barrier (no description) 3" isocyanurate insulation, and standing seam metal roof panels. Ridge is not vented.

Sheet C-4

Civil drawing prepared by Hugh Creed Associates
Drawing shows layout for underground storm-drainage structures including roof drain piping around the building perimeter. As-built conditions appear to generally match the drawing.

Summary:

The observations of the building construction at Oak Ridge did not reveal any details that would be contributing to moisture intrusion into the building. A general summary of the building elements are as follows:

- The interior concrete slabs were observed to have minimal moisture content and there was no evidence of flooring material failure due to moisture. The details shown on the contract drawings included a stone base and vapor barrier which would minimize any moisture transport vertically up through the slab.

- The exterior masonry wall assembly included a brick veneer, an air space, insulation board, sheathing, metal stud framing, vapor barrier, and interior painted gypsum wallboard. The assembly as designed has a properly ventilated air space, weeps, and code-recommended vapor barrier. High humidity conditions on the outside should not migrate to the interior and contribute to any observed elevated relative-humidity in the classrooms. Note that in North Carolina, the use of in-wall vapor barriers will result in the potential for condensation under certain weather conditions due to our climate being classified “mixed”.

- The continuous concrete walk around the building is impervious and adequately sloped away from the building. This design should minimize the potential for elevated moisture content in the soils surrounding the building perimeter.

- The roof drainage system is designed to keep water from being deposited on the surface around the building perimeter. All water is collected in the gutters and closed-piped to storm drainage structures.

- There are numerous storm drainage structures around the perimeter of the classroom wings. Their locations appear to be consistent with the contract drawings and will minimize the accumulation of water around the exterior of the building.

The summary is based on visual observations only at this time. Numerous building elements are concealed from view when a structure is complete. It may be beneficial to examine portions of the exterior walls around the perimeter to confirm the as-built conditions are consistent with the construction documents. Conditions to confirm would include the following:

- Examine the as-built condition of concealed elements of the soffit area around the classroom wings to confirm that the non-visible materials are consistent with the contract drawings.

- Remove selected portions of the perimeter wall on the interior to confirm the materials used for the gypsum sheathing and the batt insulation. The results of this sampling can be compared to the contract drawings.

Richard A. Nuhn, P.E. Consultants appreciates the opportunity to have been of service to you. Should you have any questions or require additional information, please contact us at any time.

Respectfully submitted,

Richard A. Nuhn, P.E.
Registered Professional Engineer