



This is the new roof cavity of Ledford High School in Thomasville, N.C., showing just-installed 6 inches of fiberglass insulation. This project is one of 15 in the Davidson County School District to be re-roofed with a retrofit metal roofing system. CHUCK HOWARD PHOTOS

Retrofitting an entire district

By Chuck Howard, PE

In 1989, James Palmer, maintenance director for Davidson County Schools in Lexington, N.C., visited a nearby school district to see how it had solved its flat roof problems by using a sloped metal retrofit roof system. This visit was prompted by the fact Davidson County was continually spending money on fixing flat roofs, only to end up with the same flat roof design. Palmer and the school board were

determined to find a more permanent solution to their costly and continual problem.

Bill Bilger, PE, an employee of the North Carolina Department of Public Instruction, had designed and overseen the construction of the project Palmer was visiting. I was fortunate to be the contractor for this project, one of the first performed in North Carolina. This visit resulted in the design, bidding, and construction of the first metal retrofit roof in Davidson County at East Davidson

High School the following year. I was, again, fortunate to be able to provide the construction services for this project, with Bilger providing the design services.

What seemed to be a rather random series of activities developed into a very decisive direction of roof replacement for the school district. Now, more than 16 years later, the district's foresight has provided 15 of its schools with metal retrofit roofs. These school projects amount to more than 800,000 square feet of this type



Subframing was attached to the flat roof of Ledford High School in preparation for a metal retrofit roof.

of roof system and approximately \$5.5 million in capital outlay, with more currently in the design stage. Throughout the process, I have been able to provide construction support through actual contracting or consulting for most of the projects.

One of the most recent projects was Ledford High School, designed by Bilger, and constructed by LaFave's Construction Company of Landis, N.C. LaFave's had previously completed approximately 103,000 square feet of metal retrofit roof at West Senior High School, and is currently performing the same type of work at Hasty Elementary School, both a part of the Davidson County School District. The Ledford project was bid in August 2004, started in the last quarter of that year, and finished in October 2005. It is almost 113,000 square feet and covers a flat, smooth-surface BUR and a graveled BUR.

This project had the same basic design concepts utilized 16 years prior to permanently solve the leaking flat roof

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Ledford High School (top) in Thomasville, N.C., with its new metal retrofit roof. At right is the leaky flat roof of Ledford before the installation of a metal retrofit roof.

problem. Some of the basics of this design are as follows:

A base clip is attached to the existing structural system, without removing the existing roof system. This is accomplished by placing the base clip on the existing roof and installing a long fastener into the building's structural members. Bilger analyzed these members for their structural capacity under the loads introduced by the new retrofit framing system to determine their adequacy to accommodate those loads. Then the fastening materials and quantities necessary to resist the design wind loads were determined.

A variable height 16-gauge channel was then attached to the base clip. The height of this post was calculated to produce a minimal positive roof slope. In the case of Ledford High School, a minimum slope of 3/8 inches per foot was chosen. While this slope is relatively flat, when a hard surface like



a metal roof panel was used for the weathering surface, water is allowed to flow freely to the building perimeter instead of ponding on the roof membrane. This fact, positive drainage, is the simple but most potent characteristic of a metal retrofit roof system that provides the greatest changes in the roof component of the building.

A metal "Z" purlin was attached to the top of the variable height posts. After installation, this purlin system created a sloped plane on which to install the standing seam metal roof panel. In order for the new clip/post/purlin components to bond into a structurally sound support system,

it was necessary for certain bracing members to be incorporated. This bracing allows the subframing system to act independent of the covering system in directing the loads into the existing structural system.

A standing seam roof panel system was installed on the subframing system. This panel system consisted of 24-gauge Galvalume coated steel, formed into a flat pan panel design with vertical male/female legs spaced at 16 inches on center. These panels were attached to the subframing purlin with the use of concealed fastened clips, designed to expand and contract in order to accommodate the movement that will be present in the system due to thermal changes in the materials. The seams have factory applied caulk, providing a continuous gasket that experiences a constant pressure due to the power crimping of all of these joints. The resultant weathering surface is a steel surface, protected by an aluminum and zinc coating expected to last well past 45 years, and is gently sloped toward a gutter and downspout system around the entire building.

In addition to the new roof system being able to accommodate expected weather and loads, insulation was added in the new cavity to increase the thermal performance of the roof and, thus, reduce the energy costs associated with the building. This insulation, consisting of 6 inches of unfaced fiberglass material, was laid on the original roof prior to the installation of the new metal roof panels. To control condensation and allow any moisture in the existing roof to escape, ventilation able to create five air changes per hour was incorporated into the design.

James (Buddy) Kiger, assistant superintendent of Davidson County Schools is proud to say the use of this roof system showed "great foresight by the Davidson County school board." While it was initially an attempt to

find a more permanent solution to the flat roofs, it has been a permanent fixture in the commitment to use the school's monetary resources in an efficient manner. "With an over \$4 million line item in our budget for energy costs, it is important that we provide the best thermal package for our buildings," Kiger says.

Adding the insulation in the cavity, venting that cavity, and using a roof surface to reflect more than 80 percent of the sun's rays, all contribute to minimizing that line item for the school. And, oh yeah, their metal retrofit roofs do not leak! ■

Chuck Howard is owner of Metal Roof Consultants of Cary, N.C. He has designed and built more than 20 million square feet of metal roofing during the last 30 years. He can be reached at chuck@metalroofconsultants.net.



Ledford High School inspection by Bill Bilger, PE, of Bilger Engineering, and Joe LaFave, president of LaFave's Construction Company, Inc.

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