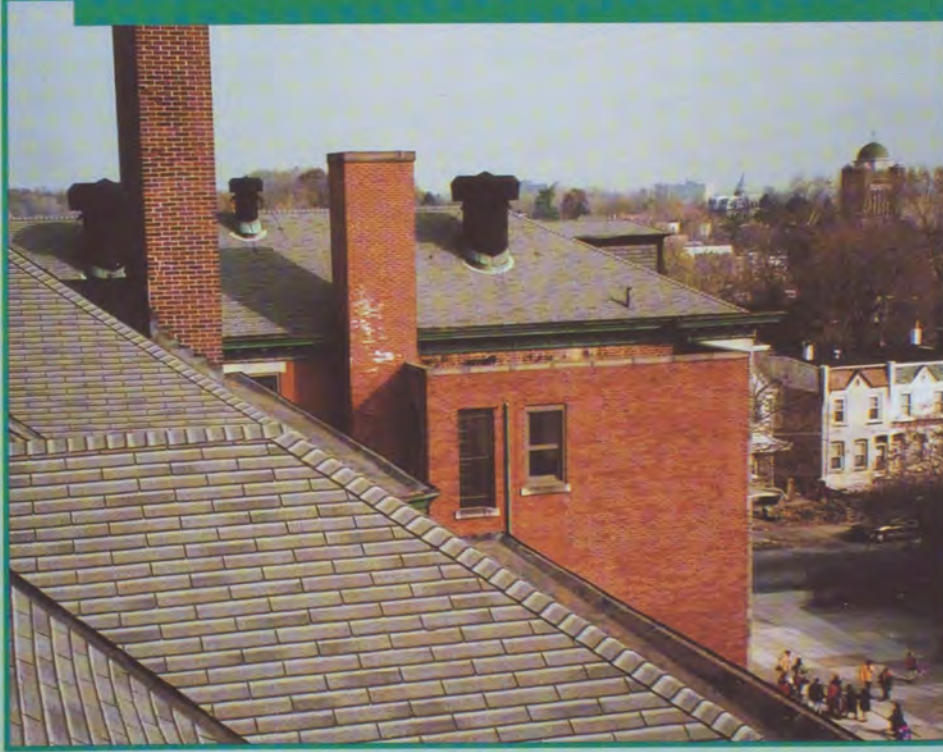




1997 DOCUMENT COMPETITION



The CITADEL CAMPUS ROOF SURVEY

BUILDING NAME	CAPERS HALL	MATRIX II
		LEVEL MARK
		DAMAGED MEMBRANE, SPLITS/RIDGES
		EXPOSED BUR FELT PLYS
		BLISTERING OF MEMBRANE
		DAMAGED MEMBRANE ROOF EDGE FLASHING
		WIND SCOUR/DAMAGE
		BITUMEN MIGRATION/SLIPPAGE
		WATER TRAPPED BETWEEN ROOF SYSTEM AND DECK
		PONDING WATER
		LACK OF CRICKETS/SADDLES
		LACK OF/DAMAGED WALKWAY PROTECTION
		PENETRATIONS LESS THAN 6"
		PITCH PANS- NO UMBRELLS
		COUNTERFLASHING DAMAGED (CF)
		LACK OF PROPER CF
		SURFACE FASTENERS IN CF
		FASTENERS BACKING OUT
		LACK OF PROPER FLASHING
		DETERIORATION OF FLASHING
		CRACKED/SPLIT BUR BASE FLASHINGS (NOT ADHERED)
		DAMAGED WALL FLASHINGS
		LACK OF PROPER CLOSURE OF EXPANSION JOINT (EJ)
		IMPROPER CLOSURE OF MTL JOINTS
		DAMAGED COPING/JOINTS
		DETERIORATION OF SEALANTS/GLAZING
		SPIDER/CRACKING IN FINISH
		SCRIM EXPOSED AT STUCCO
		DAMAGED PARAPETS
		UNSECURED/DAMAGED MECHANICAL UNITS
		DAMAGED WOOD CONSTRUCTION
		CLOGGED ROOF DRAINAGE
		DAMAGED ROOF TOP EQUIPMENT FLASHINGS
		MISSING/DAMAGED ROOF DRAIN STRAINERS/PLASTIC STRAINERS
		DAMAGED/INSUFFICIENT/BLOCKED THRU-WALL SCUPPERS
		DAMAGED GUTTER (METAL)
		TREE OVERHANGS ROOF
		DAMAGE TO ACCESS DOOR

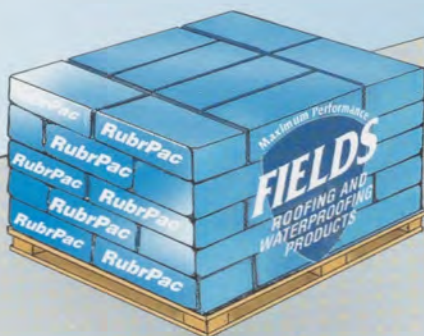
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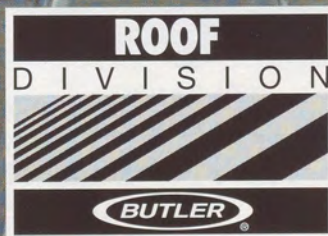
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Disclaimer: The articles contained in this publication have been prepared for and are intended to provide information that *may* be useful to members of the Roof Consultants Institute. RCI does not necessarily endorse this information. The reader must evaluate the information in light of the unique circumstances of any particular situation and independently determine its applicability. Entire contents, © RCI.

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On The Cover: Entries in the 1997 RCI Document Competition, counter-clockwise, from top left: 1) Sketch of the Octagon House, San Francisco, CA owned by the National Society of the Colonial Dames of America in the State of California, and prepared by Technical Roof Services, Inc. 2) One part of a two-tiered matrix chart showing actual components, materials, and deficiencies for a roof report done by Austin-Dillon-Cook Engineering Co. for The Citadel, Charleston, SC. 3) An overview photo of the Edwin F. Fittler Elementary School, Philadelphia, PA, submitted by NTH Consultants, Ltd.

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PRESIDENT'S MESSAGE



Robb G. Smith, RRC, RRO

There's nothing new about mentoring. Homer tells us that when Ulysses left for the siege of Troy, he asked his friend Mentor to watch over his son Telemachus. Mentor acted faithfully as teacher, friend and surrogate father to Telemachus throughout the 20 years that Ulysses was away.

The Greeks believed that we learn skills, culture and values from people whom we look up to or admire. The principles of mentoring have been important elements in the continuity of art, commerce and crafts from ancient times.

The master/apprentice relationship within the craft guilds of the Middle Ages is a good example.

Research indicates that mentoring is one of the crucial and important factors in business success. Having a mentor or going through some type of program dramatically increases one's chances for success. In essence, what mentoring provides is a safe, protected environment in which one can learn. One benefits from the mentor's experience without having to go through the trial and error of learning those same lessons over the years. Time is compressed; mistakes need not be repeated. Valuable lessons, knowledge, attitudes, and recognition of opportunities are passed on.

The mentor guides his protégé in developing skills, methods and work habits which the mentor developed painstakingly over his entire career. Examples range from the mundane, such as the use of forms and agreements, establishing and maintaining orderly files and project documentation, to the complex—calculating wind uplift pressures or developing a proposal for and managing a multi million dollar project, or hiring and managing a growing staff of five to twenty people.

It seems clear that although it is not fatal to lack a mentor, it certainly helps a great deal to have one, both in technical and conceptual knowledge. It allows learning from a broad base of experience while rapidly gaining a wealth of contacts. Being mentored by the right person is an important and viable bridge to success.

With our industry growing at the rate it is, and with the fairly high rate of people having problems passing the RRC exam, mentoring may be one solution to assist newer members in their development.

In the coming months, you will be hearing more from me about the new RCI mentor/protégé program. In the meantime, I invite all of you who are interested—either in being a mentor or protégé—to send me a fax (702-825-9256) or e-mail (advrooftech@sprintmail.com) to express your interest. Based on the responses, a committee will be established to develop questionnaires for the participants, and to assign partnerships.

President

Interface

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ADVERTISING SALES

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LETTERS TO THE EDITOR

Editor's note: The controversy regarding use of polystyrene insulation directly on metal roof decks, which Interface aired in our November 1996 issue (see Letters to the Editor), continues. We herein print opposing views of PIMA (the Polyisocyanurate Insulation Manufacturers Association) and SPI (the Society of the Plastics Industry, Inc.). RCI is taking no stand on this issue. Instead, we offer the arguments of both parties and leave our members to form their own judgments.

PIMA News Release (Edited for length)

PIMA has expressed grave concerns with a developmental Underwriters Laboratory (UL) fire test that has been advanced without building code participation or fire test expert peer review. PIMA, along with other associations and individuals, is urging the International Conference of Building Officials Evaluation Services (ICBO ES) Committee to deny acceptance of this developmental UL fire test method for roof systems using polystyrene insulation.

"Our members, colleagues and peers in the industry are opposed to this developmental UL fire test because it has not been shown to meet the requirements of the current ICBO code, leaving questions about serious fire safety and property protection risks still unanswered," said Jared O. Blum, PIMA president. "UL granted Fire Classification to certain roof systems based on this new test prior to notifying the building code officials and without seeking the input of trained roofing industry and fire professionals."

In spite of the verified empirical data confirming its safety, the developmental UL fire test has been the basis for use of polystyrene insulation directly on metal roof decks, without a thermal barrier, in certain parts of the U.S. This is a practice that is considered by many professionals in the construction industry to pose a potential fire hazard.

Currently, the Uniform Building Code uses two reference standards, ANSI/UL 1256 and the FM 4450 Calorimeter, as qualifying tests for the elimination of the thermal barrier in roof applications that incorporate foam plastic insulation on metal decks. Both of these fire tests have a long history of development and are included in all

of the model building codes in the U.S. As reference standards for the proper use of foam plastic insulation in roofing, the developmental UL fire test does not meet the intent of the current codes. There is no apparent assessment of underdeck spread of fire and the test allows for "venting" of the test roof sample. This venting permits the escape of combustible material to the atmosphere, causing the test apparatus to measure only a portion of the heat release from the combustible material in the test roof sample.

PIMA has endeavored to further these messages about the importance of fire performance in insulation:

- Test standards apply to a broad category of construction materials and are used to avoid misuse of materials in various applications.
- FM 4450 Calorimeter and ANSI/UL 1256 are the recognized tests that have served the public well for many years.
- Not all foam plastic insulation performs the same in fire tests.
- The developmental UL fire test does not address important performance criteria; it pertains only to polystyrene insulation and may be less rigorous and protective than FM 4450 or UL 1256.
- Polyiso is the only foam plastic insulation to pass both the FM 4450 and UL 1256 without the use of a thermal barrier, and can therefore be applied directly to a steel deck.

PIMA has not been alone in its misgivings and resistance

LETTERS TO THE EDITOR

to the developmental UL fire test. Others in the industry have joined in to express their apprehensions about the test and the way in which it was developed.

The National Roofing Contractors Association (NRCA) filed their opposition to the adoption of the developmental UL fire test in a written statement. They questioned the need for an alternative test method and noted that the new test does not have a consensus acceptance from the industry and users.

In a letter to Patrick McCullen of the ICBO Evaluation Services Committee, Joe F. Hale, a Fellow with the Roof Consultants Institute, expressed his concerns with the developmental UL fire test. He wrote, "As a professional roof consultant, specifier of roofing systems materials, and a Fellow of RCI, I would like to voice my concerns with regard to the proposed inclusion of a new UL fire test in the ICBO ES Acceptance Criteria for foam plastic insulation. I feel this proposed change is being pushed through without thorough, complete test comparison to currently recognized standards for life safety."

Karl Houser, Director of Technical Services at the Gypsum Association, in both written and verbal comments, noted that there are major flaws in the test apparatus, the test acceptance criteria and the correlation to other long-standing test methods and field fire performance. He recommended that the proposed test should undergo peer review as an ASTM standard and be circulated for comment by the fire protection community.

Frank McGarry, former President of the National Association of State Fire Marshals, has also voiced concerns about the developmental UL fire test. "With more than 30 years as a fire prevention professional, both as the President of NASFM and as the former Fire Administrator for the state of New York, I have witnessed the results of improperly used building products," said Mr. McGarry. "Unless thermoplastic foam materials, such as expanded polystyrene or extruded polystyrene, are used with a thermal barrier, these materials will not meet the experience-based performance requirements which were developed after the Livonia, Michigan fire. These requirements were specifically designed to address the major cause of the fire's rapid growth—melted and ignited asphalt that dripped and quickly spread the fire along the roof and through the interior of the building. This UL test has not undergone necessary review by industry or fire authorities and should, therefore, not be included in the current code. I urge the ICBO ES Committee to thoroughly review this developmental UL fire test to ensure that the costly lessons of the past do not have to be relearned."

On Sept. 13, 1996, the ICBO Evaluation Services Committee held a hearing to consider the proposed revision to the Acceptance Criteria for Foam Plastic Insulation—a

revision that would have recognized the developmental UL fire test method. As a result of industry opposition to the proposed revision, as well as a request from the proponents, the matter was referred for further study to be reviewed at the ICBO ES Committee hearing in January 1997. That hearing was delayed until April 1997 because of a request from the proponents. The April meeting has not been delayed until July 1997, again because of a request by the proponents.

These continued delays gravely concern PIMA, which has publicly questioned the validity of the developmental UL fire test, asking for appropriate and supporting data to be provided. In a recent letter to the ICBO ES Committee, PIMA wrote, "We find it disturbing that in the Eastern half of the U.S., the proponents have presented a confidence in the new fire test and are using it to justify this application of their products. Yet at the same time, they can't seem to provide valid technical and safety data to the ICBO ES Committee to support their request for approval of the new UL fire test as an alternate to the long recognized ANSI/UL 1256 and the FM 4450 Calorimeter."

Patrick V. McCullen, of the ICBO BS Committee, responded to PIMA's concerns about the delayed hearings in a recent letter. Mr. McCullen said that, although a grace period has been granted to allow the proponents of the developmental UL fire test additional time to complete their testing, no approval of the test has been granted.

PIMA, because it is so concerned about the potential danger of this and other substandard tests, is now putting forth these calls to action:

PIMA demands that the developmental UL fire test be subjected to rigorous peer review and acceptance consensus, similar to that currently used in other building code requirements.

PIMA demands that the developmental UL fire test be suspended as a qualifier for application of foam insulation in direct-to-steel-deck applications.

Finally, PIMA demands that this issue not be delayed again at the next ICBO ES Committee meeting in July 1997. If UL is unable to provide appropriate data about their new fire test at that time, the test must be withdrawn for consideration.

PIMA will continue to cover such topics as efforts by the proponents of the developmental UL fire test to link the test's safety to the large-scale White House test. There is controversy surrounding this because the proponent's insulation product allegedly passed the large-scale White House test conducted by UL, yet no supporting data have been provided to explain construction method details used in the test.

SPI's Response

Dear Ms. Ammerman:

There has been criticism directed at a proposal to accept a new test procedure developed by Underwriters Laboratories (UL) for qualifying certain types of plastic foam insulation for use on steel roof decking without a thermal barrier. Unfortunately, this criticism is ill founded because it starts from the wrong place. It overlooks the basic principle of fire performance testing, the concept of validation of laboratory tests, and the review process of the Evaluation Services.

In the early 70s, the entire foam plastics industry was taken to task by the Federal Trade Commission (FTC) for relying on small scale laboratory fire tests to qualify foam plastic insulation products. Action by the FTC culminated in a consent agreement signed by major industry members, including the suppliers to all facets of the foam plastics industry. The consent agreement included a five-year, \$5 million research program to develop tests which reflected actual fire performance. This research program was predicated on the fire performance evaluation principle that large-scale fire tests, replicating end-use applications and appropriate fire scenarios, were preferable as a means of evaluating fire performance of foam plastics and that smaller-scale tests should be "validated" or "correlated" with the large-scale fire tests. Results using procedures which did not necessarily reflect real life conditions must include a disclaimer to that effect.

This fire performance evaluation principle has been part of the fire safety policy of the Society of the Plastics Industry, Inc. (SPI) for many years. SPI's Fire Safety Policy states that SPI endorses technically sound "...research into combustibility characteristics of materials and products using fire tests that reasonably relate to material or product behavior in real fire situations...and...development of technically supportable standards, codes and regulations..."

This fire performance evaluation principle actually predates the FTC action of the '70s. In fact, it is the basis for the fire tests that were developed after the GM transmission plant fire in Livonia, Michigan in 1953. The Livonia fire was "recreated" by the development of the so-called White House test, a structure 10' high x 20' wide x 100' long, in which the interior was exposed at one end to fire conditions defined by ASTM E 119 and the spread of flame on the underside of the deck was evaluated. Using the results obtained from a series of White House tests, UL and FM correlated results in their respective small-scale laboratory tests—the Steiner tunnel, in UL's case, and the Construction Materials Calorimeter in FM's case. These tests became UL 1256 and FM 4450, respectively. The acceptance criteria for these tests were based on the perfor-

mance of the constructions evaluated in the large-scale White House tests.

Critics of the new UL proposal evidently have forgotten the important role of large-scale tests in evaluating the fire performance of materials, and, instead, incorrectly assumed that the small-scale UL 1256 or FM 4450 are the sole judge of acceptable performance. In reality, these small-scale tests are surrogates for the large-scale White House test. The usefulness of a small-scale surrogate depends on its ability to reflect performance in the large scale. The breadth of the usefulness of the surrogate depends on the breadth of the products tested in both scales and the correlation of performance of the products in both scales. However, regardless of the results of small-scale tests, performance in a large scale is a better judge of fire performance in actual end use.

UL is proposing this new small-scale procedure because, in its judgment, the performance of certain plastic foams in UL 1256 does not correlate with the performance of these foams in the large-scale White House test. This led UL to develop this new procedure which, again, in its judgement, reflects the performance of these foams in the White House test. Both the BOCA ES and the SBCCI ES have agreed with UL's judgment, and, on the basis of this alternative diversified testing, have granted research reports for several products based on UL's classification. Specific approvals are explicitly permitted in the model codes to allow for the introduction of new technology. ICBO-ES now has the UL proposal under consideration as an acceptable alternative diversified fire test for issuing ICBO ES research reports.

The critics have made an issue that the UL proposal has not been subjected to "peer review." They dismiss the technical judgment of UL, an internationally recognized fire safety laboratory, and the judgments of the BOCA-ES and SBCCI ES professional staffs and committee members. This is, in fact, a form of peer review. And it doesn't recognize the ongoing ICBO ES process as a form of peer review. This multiple review process by the Evaluation Services of sponsored research is one that has been used many times to develop acceptance criteria and, eventually, revisions in building codes to permit new testing and product technology, based on realistic data. This process should be permitted to work in this instance.

SPI stands behind sound fire research and performance principles in making judgments about fire test methods and product performance. All those interested in reasonable, safe use of materials should do the same.

Sincerely,
Hugh Patrick Toner
Vice President, Technical Affairs, SPI

Roof Expansion And Control Joints

By Kris Zielonka, P. Eng.

Introduction

Roof expansion and control joints frequently pose a set of difficult if not unusual problems to the roof designer and installer. By their very nature, an expansion or control joint on a roof has to have the ability to meet and accommodate movement (horizontal, vertical and in shear) while remaining waterproof for the life of the roof. Traditionally, the approach has been to raise the expansion joint above the plane of the roof and then install flashing roof membrane around it, with the objective of moving the actual waterproofing of the joint above the water line. This approach, while having some advantages, can also introduce problems to the roof's performance over its service life.

This article will examine the various methods and approaches of designing and detailing expansion and control joints in roof assemblies. Design parameters considered include the amount of movement required in a joint and the detailing and installation procedures involved, while taking into consideration the impact on the performance of the roof. Presented also will be leading edge technology in roof joints that use a flat type of expansion joint which accommodates tri-dimensional movements of the roof and roof membrane while remaining waterproof. An actual case study of an installation with a flat expansion joint will be examined. The advantages and disadvantages of this type of expansion and control joint will be reviewed.

Building Expansion Joints

Buildings readily move by contraction and expansion of components resulting from changes in temperature. The degree of this movement is dependent upon the type of material from which they are constructed. The extent of movement is dependent upon building dimensions and the ambient temperature (variation) change.

In order for a building and its components to accommodate these movements, the extent of this contraction/expansion is usually limited to a maximum of 2" (50 mm). Any movement that is greater than 2" (50 mm) within a building can result in damage to the building and its external finishes (cracking, dislodgement of exterior panels). In order to limit the expansion and contraction of the building, the building's designer (architect or structural engineer) incorporates a periodic and intentional break in the building structure. These breaks or gaps are usually referred to as expansion joints. An expansion joint is in essence a joint that passes through the entire building's cross section as if slicing through it. The idea is to provide a gap or space for the building to move. To further clarify this terminology, when reference is made to an expansion joint, this refers to the actual gap in the building struc-

ture. This paper is concerned with waterproofing the expansion joint gap.

The presence of an expansion joint poses some very unique problems in the building envelope design as such joints are not always straight and yet must keep out the elements, air, water, moisture, dust, etc., while allowing for the building's movement. The primary concern is water and moisture, as this causes the most damage to a building's interior and roof components. Water can enter the building's interior through the expansion joint at either below or above grade. Many remedies to this problem have been sought. Each method has had its drawbacks or problems. A properly designed expansion joint ideally should remain waterproof and weather tight.

Location of Expansion Joints

Expansion joints are usually found in the following places: on a roof, within a building's wall, above and below grade. Reasons for their requirement at these locations can include the following:

- Changes in deck direction.
- Changes in deck type, e.g., a concrete deck abutting

a steel deck.

- Re-entrant building corners.
- Long buildings exceeding 200 feet (61 m) or more in length.
- Additions built next to existing structures.
- Areas requiring isolation from vibration.
- Buildings that experience extreme thermal movement, i.e., freezer buildings.

Roof Control Joints

Expansion joints are considered to be the main type of joint in a building and they are deliberately installed to accommodate movement. Another type of joint that is introduced to provide room for movement is a roof control joint. These roof control joints can be thought of as expansion joints within the roof assembly. Their function is to provide room for the movement of the roof membrane material and relieve stress that may build up. This is especially critical on very large roofs.

The reasoning behind this is that roof membranes are materials that have the physical ability to contract and expand just like any other material (a fundamental law of natural physics). The degree of expansion and contraction is measured through what is known as the coefficient of thermal contraction or expansion. The coefficient of thermal contraction or expansion is described as unit change in length per degree change in temperature. For example, concrete has a coefficient of thermal expansion of 5.5×10^{-5} in/in[°]F (10×10^{-5} m/m[°]C). For the purposes of this discussion, material contraction and expansion are synonymous as they describe movement due to temperature change.

Another need for roof control joints in a roof assembly may also be as a result of the roof membrane being laid down on a substrate that has a different coefficient of expansion than that of the roof membrane itself, i.e. insulation boards. As the air temperature changes, these two materials, which are in direct contact, undergo a dimensional change which is not uniform. The membrane may dimensionally change more than the substrate to which it is attached or adhered.

It should also be noted that a surface area of a roof will change dimensionally in the two principal plane directions. The roof surface movement can be established through a thermal coefficient known as the coefficient of thermal surface expansion. The coefficient is approximately twice that of the coefficient of linear expansion. To accommodate surface movements on large roofs it is common to introduce roof control joints in the roof membrane, in both directions. The joints are usually perpendicular to each other.

Design Methodology of Expansion and Control Joints

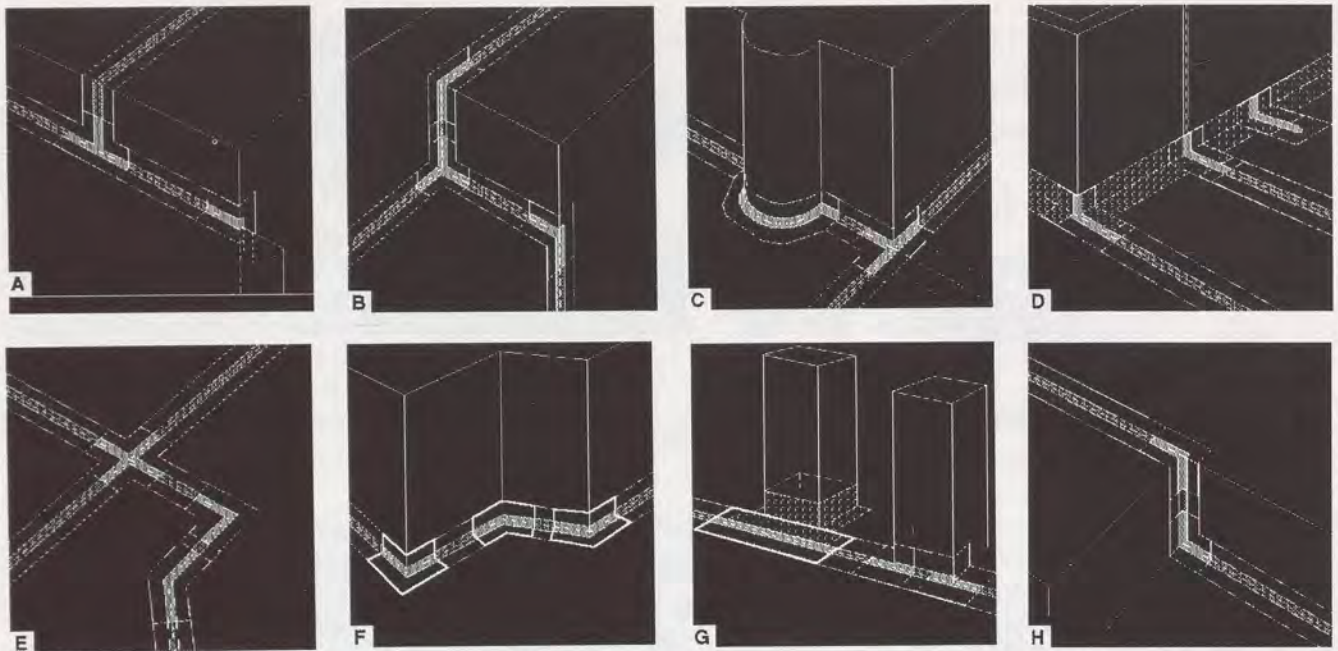
Expansion joints, as mentioned, by their own very nature interrupt the building's envelope and compromise the waterproofing integrity of the roof. Frequently, expansion joints are overlooked in the design process and are considered to be an appendage listed in specifications as "to suit site conditions" or at worst, an afterthought during the installation of the roof. The fact is that expansion joints in roof assemblies are a leading cause of water infiltration and leakage. Lack of proper consideration and detail will result in compromising the roof's waterproofing integrity, either immediately after installation or during the service life of the roof.

Approaches to the design of expansion joints are many, ranging from the crude to the sophisticated. The most simple approach is to provide additional roof membrane material at the expansion joint location specifically to accommodate the movement. There are a number of "off the shelf" expansion joint solutions. These usually comprise a variety of rigid plastic membrane sheets preformed into a bellows type shape (the bellows allowing for material movement). The more sophisticated systems in place are also bellows types manufactured to site specific conditions to accommodate predetermined movements. The various solutions require that these expandable materials be raised above the roof level on a curb. Once the expansion joint is elevated above the roof level, the roof membrane is then flashed around the base of the curb and the waterproofing expansion joint material spans the gap. The entire expansion joint detail is usually capped with metal flashing as a protection from the elements and mechanical damage.

The approach described above has been used in roofing for a long time; in fact, if one were to look back at a building roofed in the 1940s, this was the "modus operandi." This approach, although elevating the expansion joint assembly above the roof membrane, has a number of disadvantages which can be detrimental to the roof membrane and the roof assembly. Outlined are some of the factors that may be considered to have a negative impact on the roof itself.

Primarily, the elevated curb obstructs water flow across the roof, and, in fact, has a damming effect. Water cannot flow to a drain, which may be located on the other side of the expansion joint. The roof owner is then left to make modifications to the expansion joint by installing scuppers through the expansion joint to allow water flow.

Ponded water on a roof, as conventional wisdom dictates, is not a good thing and every effort has to be made to remove standing water from the roof. In addition, a raised expansion joint on a curb is exposed to roof traffic and damage. This is an important consideration, especially when there is no metal coping or cap on the expansion joint curb. Another problem associated with expansion



Typical conditions encountered with expansion joints:

The above diagrams describe some very typical expansion joint conditions. Fig. A: Two expansion joints coming from two different elevations joined together at a point. Fig. B: Three expansion joints, from three different elevations, coming together to a point. Fig. C: An expansion joint going around a circular column. Fig. D: An expansion joint condition at the base of a parapet wall. Fig. E: A four-way expansion joint junction. Fig. F: An expansion joint following the contours of an irregular exterior wall. Fig. G: An expansion joint bordering with square columns. This is a fairly typical condition when an expansion joint abuts a roof curb or column. Fig. H: Changes in elevation of a continuous expansion joint, a common condition found on multilevel roofs or in transition of plane surfaces from the horizontal to the vertical

That is even more fundamental to their function is that of expansion and contraction. The materials used to waterproof expansion joints today are rigid or allow very little material elongation. The movement of these materials is accomplished through the provision of extra material (e.g. bellows, folds). This in itself has disadvantages. The material does not always return to its original shape and position, and the material can also suffer physical damage during the movement. An even more critical aspect is the material's ability to be joined or seamed together. Even straight expansion joint runs cannot be manufactured from one piece of material; two or more pieces have to be joined together to make up the length required. The two most common methods used for joining material pieces are adhesives or hot air welding/fusing. Though initially providing a watertight connection, the material at the actual joint does not always exhibit the same mechanical properties (elongation, tensile) as the rest of the expansion joint material. These issues can be of critical significance as to the performance of an expansion joint, especially when a complex shape or configuration is required, examples of which are shown below.

A Different Approach to Expansion Joints

As described above, traditional expansion joints rely on

the advantage of being raised above the roof level. Though this is a logical precaution, there are other approaches. In other countries, the philosophy is to protect and make integral any roof protrusions or projections on a roof by not exposing them to the elements or roof traffic. This is to prevent unnecessary damage. This thinking has found its way to roof expansion joint design, too. The approach to designing such waterproofed expansion joints is to make them as level as possible with the roof membranes. This has evolved a new concept of the flat waterproofed expansion joint — an idea that has found application in parking garages and blind-side waterproofing for the last three decades.

A Case Study

In September of 1996, a unique problem was encountered on a reroofing project. The owner of an eight floor building decided to reroof. The existing roof was an inverted BUR Protected Membrane Roof Assembly. On the roof were eight skylights which allowed light into the building's central atrium. An expansion joint ran across the building adjacent to the skylights (see Figure 1). The expansion joint had been repaired at least three times and was a source of continual water leakage and aggravation to the building's occupants. (see Figure 2).

Particular areas of failure were at the corners of the



Fig.: 1 View of roof with skylights and expansion joint.

skylight curb where the expansion joint butted the skylight curb (see Figure 3). In addition, the roof was drained at the perimeter, thus water flow was being obstructed by the raised existing expansion joint detail. The roof consultant and roofing contractor were faced with a significant dilemma—how to provide an expansion joint that did



Fig.: 3 Close up of existing expansion joint at skylight curb corner.

two things: 1) reliably waterproof the corner of the skylight curb; and, 2) allow the flow of water across the roof. This all had to be accomplished in an economical and cost effective manner.

The determination was made to try a flat “zero profile” expansion joint waterproof material. Although this may be thought of as an unorthodox approach to the problem, it seemed to fit the bill. The total length of the expansion

joint was 210 feet (61 m), terminating at a vertical expansion joint down the building’s side elevation.

Product Description

The system is comprised of 10” (250 mm) or 13” (325 mm) wide material strips which are compounded out of a specially formulated EPDM elastomer with polyester fleece embedded in flaps on either side. The expansion



Fig.: 2 Close up of existing expansion joint.

joint material is manufactured by an extrusion process from an EPDM elastomer. During the manufacturing process, the polyester fleece is embedded into the gelling EPDM matrix on both sides, top and bottom, of the material. The intent is for the fleece to engage the plies of the bitumen roof membrane. The joint material has no fleece material attached over the actual expanding joint part. The EPDM elastomer used in the formulation is very unique, as it has a number of specific chemical properties suited to this application. The EPDM elastomer used is an Ethylene-Propylene-Diene-Methylene with a saturated polymethylene chain. The saturated polymethylene chain in the elastomer renders it inert by not allowing for chemical reactions to occur. The material is resistant to the effects of UV, ozone, high temperatures, chemicals such as alkalis, acids, saline solutions, alcohol and ketones. The high quality and purity of the EPDM elastomer also make vulcanization of expansion joint pieces possible. This makes the construction of details around unique shapes possible and watertight without the use of glues or tapes.

Technical Data as Manufactured

Appearance:

Color: Orange red with white fleece on the side flaps

Physical Properties:

Bonding Medium: 1.20 oz/ft² (400 g/m²) polyester fleece
 Elongation: > 500 % at -40°F (-40°C)
 Tensile Strength: 725 psi (5 N/mm²)
 Hardness: 45 ± 5 Shore A
 Long term Operating Temperature: -40°F (-40°C) to +194°F (+90°C)

Geometry

Width	Thickness	A	B	C
13 1/4" (340 mm)	87 mils (2.2 mm)	±1 3/4" (±40 mm)	±13/16" (±20 mm)	±1 3/16" (±30 mm)

Installation

Material for the entire 210-foot (61 m) expansion joint was installed in two hours. The installation procedure is described in brief as follows. The expansion joint material is shipped to the job site in a roll. Installation takes place as roofing progresses (see Figure 5). The material



Fig. 5: The building expansion joint being prepared for roof expansion joint installation.

is laid down in a flood coat of asphalt/bitumen (see Figure 6). The asphalt/bitumen should be at its EVT when being applied to the fleece. Both the fleece and the roof ply surface must be covered in asphalt/bitumen. The

asphalt/bitumen must totally encapsulate and impregnate the fleece with a bleed out visible along the ply's edge. The next step is to strip in the top ply of the roof membrane over the expansion joint material (see Figure 7). The top ply should be installed in a flood coat of asphalt/bitumen as well. It is important that the asphalt/bitumen be at the correct temperature at the point of application. The asphalt/bitumen flood coat must impregnate the entire polyester fleece material; only the top fleece surface needs to be flood coated. It does not matter if the entire joint is covered in asphalt/bitumen. Particular attention is paid to the sky-

light corner curb detail (see Figure 8). It should be noted that the asphalt/bitumen will not stick to the material that has no fleece. The installation is finally complete once the parapet flashings are installed (see Figure 9). The Protected Roof Membrane is then given a glaze coat of asphalt and insulation, slip sheet and ballast are installed and placed on the roof (see Figure 10).

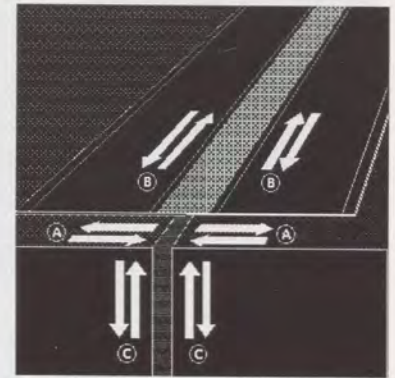


Fig. 4: An illustration showing the three principal movement directions with a flat expansion joint. Direction A is horizontal, Direction B is transverse (shear) and Direction C is vertical.

Advantages and Disadvantages of Flat Expansion Joint Systems

One of the key advantages of the flat waterproof expansion joint systems is that it can be tailored to specific site conditions. This makes the waterproofing of difficult joint details easy, (i.e., curved joints, inside/outside corners, changes in joint elevations and planes.) The case study project described above showed that the installation of the flat expansion joint is simple and can provide a solution to a specific situation.

The flat expansion joint system has a number of advantages. These can be grouped broadly into two categories, technical and economic advantages. These are as follows:



(Left): Fig. 6: The roof expansion joint being installed in a flood coat of asphalt.

(Above): Fig. 7: The roof expansion joint being stripped in with flashing plies.



Fig. 8: The roof expansion joint detail at the skylight curb corner.



Fig. 9: The completed installation of the flat roof expansion joint. Note the vertical flashings.



Fig. 10: The completed roof with roof expansion joint installed.

Technical

1. Provides a flat, "zero profile" waterproofed joint without obstructing the flow of water.
2. The system is tailored to specific site conditions. This includes such difficult roof areas to detail and waterproof as inside and outside corners, "T" joints, joint intersections, curved joints, multilevel joints, etc.
3. The flat expansion joint system has the capacity to

move in all three planes simultaneously, i.e. horizontally (side ways), vertically (up and down) and transversely (shear), while remaining flat.

4. There are no complicated calculations or "guesstimates" to be done, since the joint is flat and in the plane of the expansion joint. The only measurements required are clear distances between fixed points.
5. The flat expansion joint material is installed between the roofing plies of BUR and Modified Bitumen in a flood coat of asphalt. The result is that the waterproofed joint is an extension of the actual roof membrane, with no flashing plies or special detailing required.
6. The flat expansion joint system forms a continuous, uninterrupted waterproofing solution from the start of the expansion joint to its termination, which can be in a different part of a building — for example, underground. The "zero profile" of the tape allows it to traverse any building surface, from inside to outside, above or below ground.
7. The expansion joint can be made continuous with the same expansion capability along its entire length. Any seams that are in the tape are as flexible and have the same elongation as the expansion joint material itself.
8. The seams found in the expansion joint system are all vulcanized under factory-controlled conditions (although site seaming is possible through the use of a special portable vulcanizing press system). Since there is no site seaming, this prevents any weak seams that can result from being done in adverse weather or poor site conditions.
9. Being flat, the expansion joint end termination can accommodate movement in all three directions. There is no warping or wrinkling at the joint termination.
10. The flat expansion joint is laid down at the roof membrane level over insulation, leaving no void space where condensation can form.
11. There are no metal fasteners used in the installation of the flat expansion joint; thus, there is no possibility of thermal bridging or additional thermal heat loss.
12. The expansion joint's "zero profile" forms no trip hazard on the roof, nor is it affected by normal roof traffic.

Economic

1. Eliminates the need for expensive wood curbs and roof membrane and metal flashings.
2. The expansion joint system can be laid down and installed in minutes, with minimum preparation time and skill required, resulting in significant labor savings to the contractor.
3. The expansion joint is supplied in one piece for the

entire project; it is rolled and ready to be installed immediately.

Conclusion

The case study project offered an insight into a different way of tackling an old problem. At last report, the flat expansion joint is performing well. The roof now has proper drainage and ponding water has been eliminated. The difficult skylight corners which seemed to defy flashing and waterproofing have remained watertight. An added benefit is that the expansion joint is hidden from roof traffic and does not require any maintenance. The opinion of the author is that, though every application has its own solution, it would appear that flat expansion joints demonstrate a place in roofing and provide a fresh and innovative approach to an old problem.

Acknowledgments

I would like to acknowledge the contribution to this paper of the following individuals and companies:

- Marc Allaire, Industrial Roof Consultants Group Inc., Mississauga, Ontario

- Doug Fishburn, Fishburn Building Sciences Group, Hornby, Ontario
- Chris Love, Halsall Associates, Burlington, Ontario
- Roof Consultants Institute 12th International Convention and Trade Show, March 22/27, 1997



About The Author

Kris Zielonka is a professional engineer who has been involved in roofing and building since 1986.

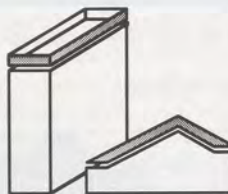
He is a specialist in waterproofing of above- and below-grade structures. Zielonka is a director of CRCA and an active member of its National Technical Committee, as well as a member of both the Canadian and American Association(s) of Civil Engineers. This paper was presented at RCI's 12th Annual Convention and Trade Show in Anaheim.

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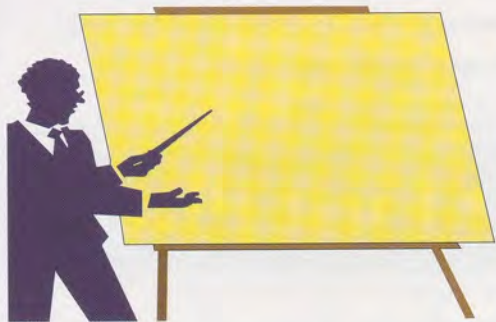
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Document Competition Winners

Every year, RCI holds a Document Competition open to all RCI Professional members. A select panel of RCI volunteers judges the entries for excellence in regard to completeness, organization, format, clarity and appearance. Categories include: Large Roofing and Waterproofing projects (over \$100,000 construction costs); Small Roofing/Waterproofing projects (over \$100,000 construction costs); and Roof Reports.

Judging takes place at the annual convention, where all entries are displayed. Next year's entries must be dated after Jan. 1, 1997, and notice of intent to compete received at RCI Headquarters by Feb. 15, 1998. Entry fee is \$30. Winners receive international recognition by being listed in *Interface*.

Large Roofing Project • First Place

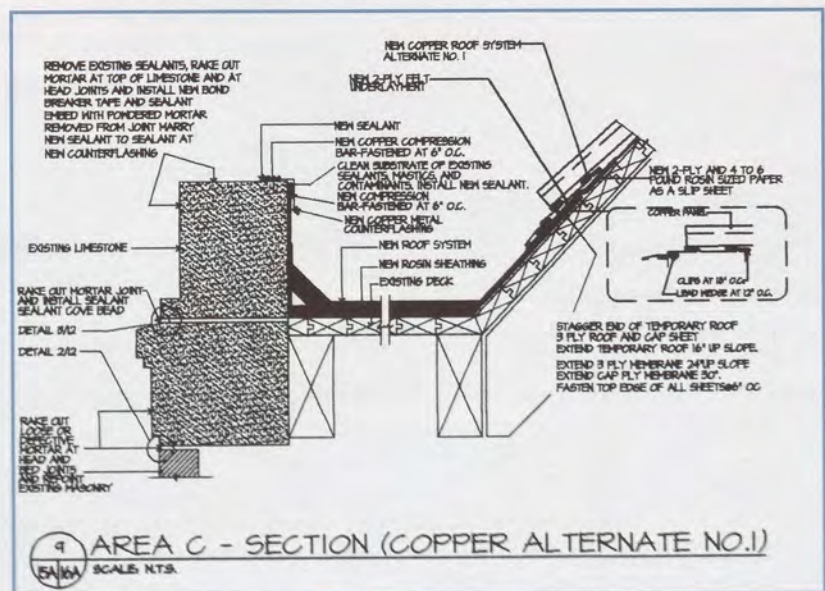
Conley Design Group Inc. • Carrollton, Texas *United States Federal Building, Tulsa, Oklahoma*

The project involved the design of roof replacement and masonry restoration on the U. S. Federal Building located in Tulsa, Oklahoma. The facility is a five-story, cast-in-place concrete structure which was originally constructed in the early 1930s. The building is a designated historical site which impacts design and renovation options, and dictates special project requirements. In addition, the sensitive tenant operations and downtown site posed significant restrictions on site access and working hours which had to be incorporated into the construction plan.

The building exterior is comprised of approximately 98,200 square feet of cut limestone, and masonry veneer with extensive beltcourse, columnar and decorative terra cotta architectural features. The renovation design involved extensive restoration of deteriorated terra cotta, repair of damaged stone and column units, and replacement of deteriorated mortar and sealant components. In addition, the design included cleaning and dampproofing of the exterior surfaces. The specified restoration materials and repair procedures were selected to meet the requirements of the U. S. Department of the Interior Preservation Standards.

The roof project involved the replacement of 23,200 square feet of low-slope, built-up roofing, and 12,840 square feet of sloped shingle roofing replaced with a standing seam copper roofing system. The design included removal of obsolete penetrations, replacement of deteriorated wood decking, renovation of roof drainage systems, abatement of RACM flashings, modification of A/C units, and installation of new access stairs and ladders. All replacement materials and installation procedures incorporated into the project were selected to meet Preservation Standard requirements.

Total Estimated Construction Cost: \$732,190.



THRU WALL SCUPPER

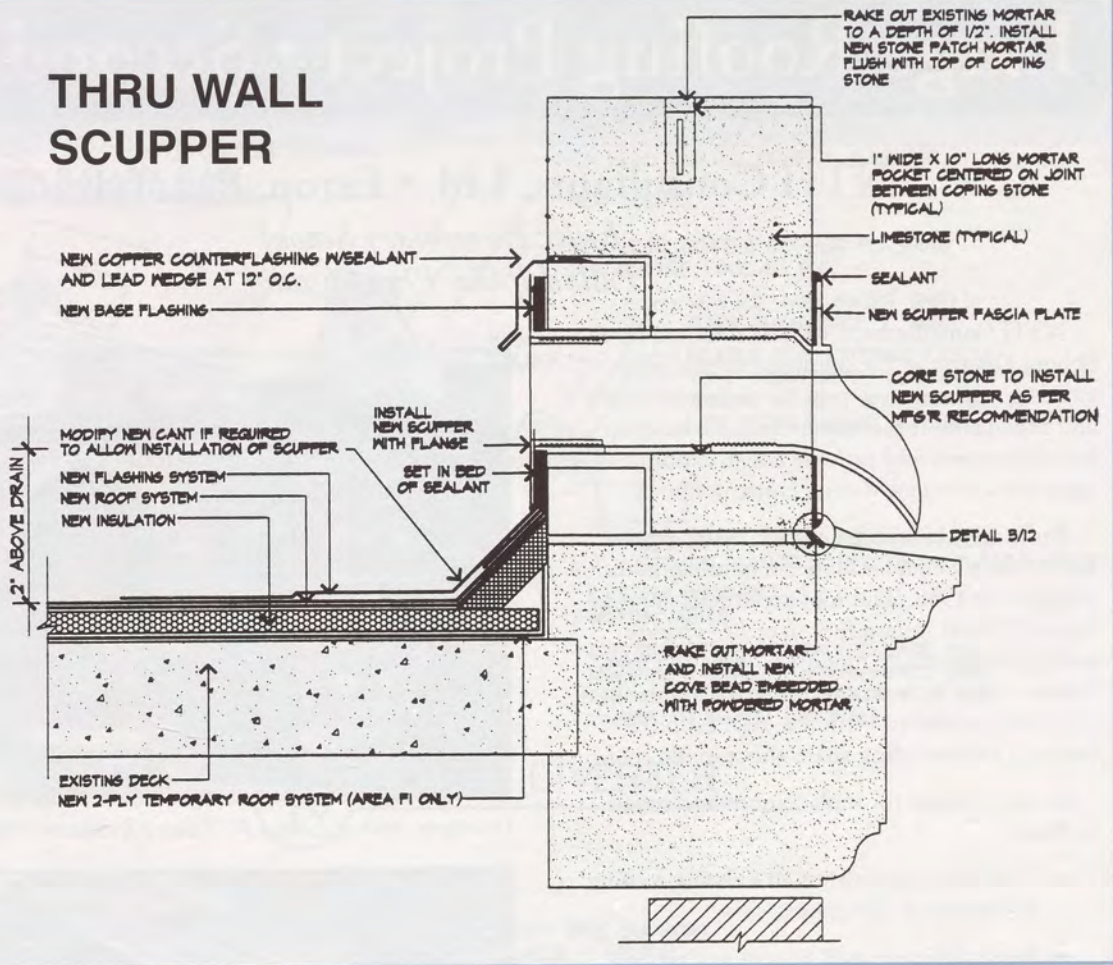
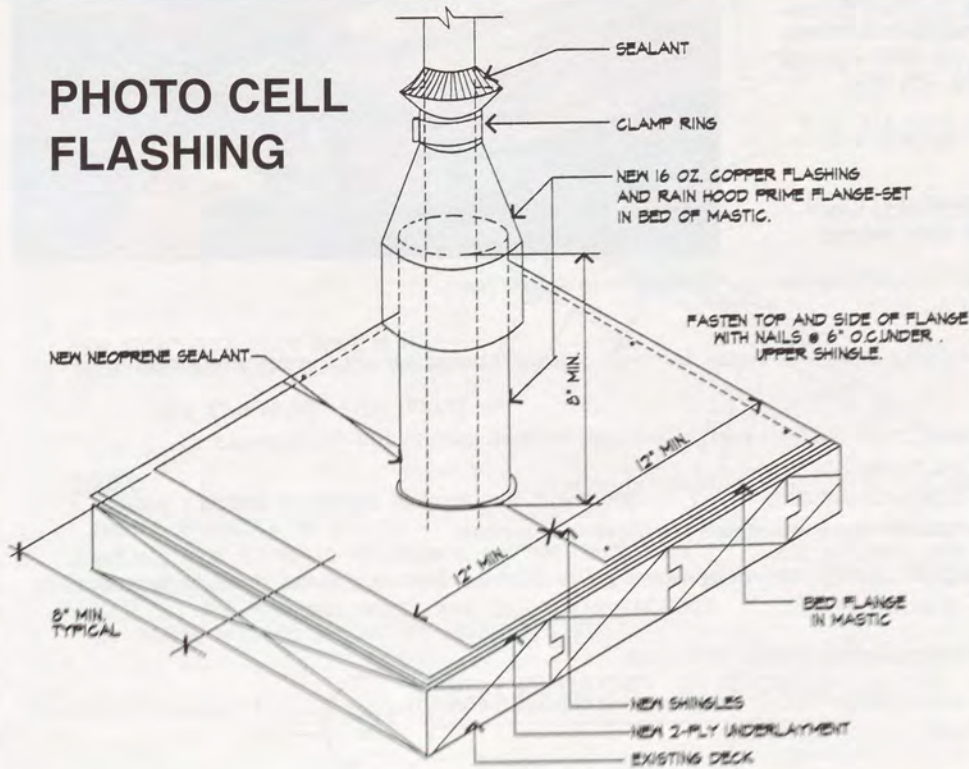


PHOTO CELL FLASHING



Large Roofing Project • Second Place

NTH Consultants, Ltd. • Exton, Pennsylvania

Fitler Elementary School Philadelphia, Pennsylvania

NTH Consultants, Ltd. was retained by the School District of Philadelphia to evaluate existing roof systems, provide remedial repair and replacement recommendations, develop bid documents and provide construction management assistance during construction

Built in 1915, the Edwin H. Fitler Elementary School includes a modular addition attached in 1958. The roof area totals approximately 15,000 square feet over 12 separate steep and low-slope roof areas. Existing roof system types include organic mat asphalt shingles, APP modified bitumen, coal tar pitch built-up and standing seam sheet metal roofing.

Scope of work for replacement and repair included:

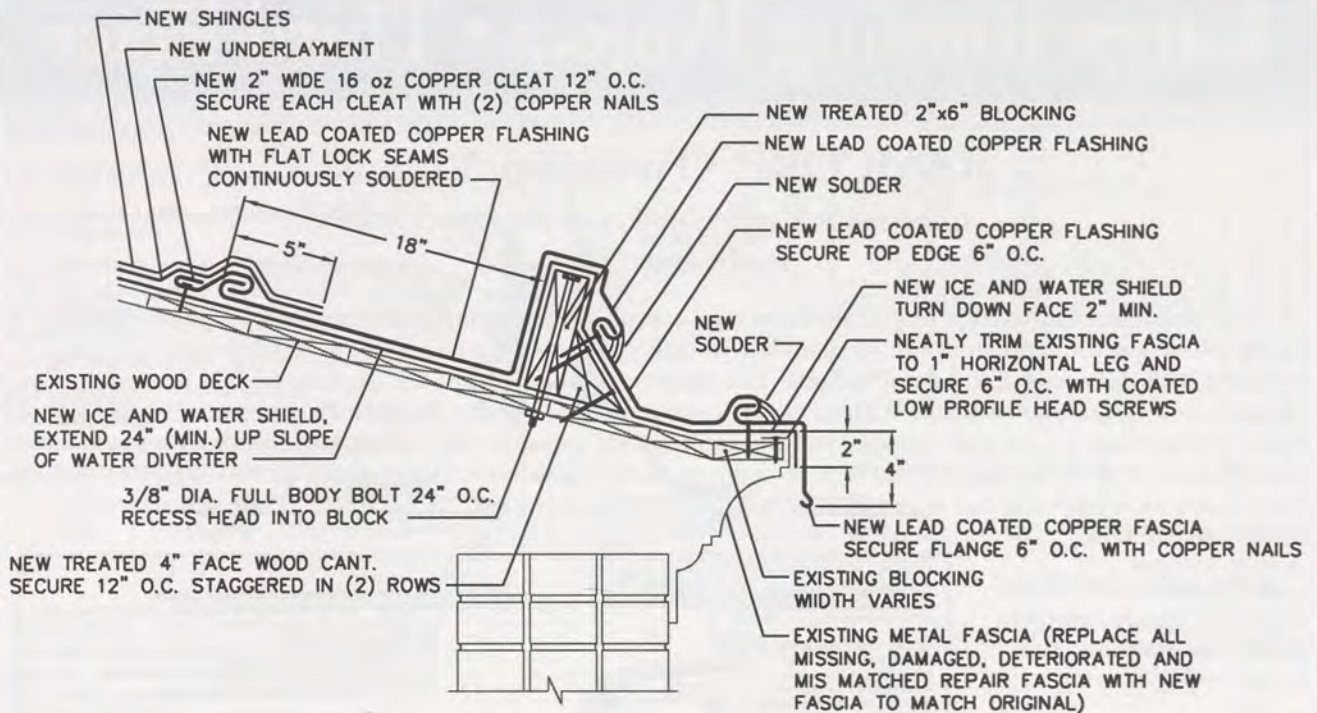
- Complete removal of all existing roofing to roof deck substrates.
- Nine different roof system assemblies, including: asphalt shingles with ice dam protection, 2-ply FR granule-surfaced SBS modified bitumen, foil-faced bitumen and lead-coated copper over various combinations of insulation and deck types over slopes varying from 1/4" to 8" per foot.
- Removal and replacement of 300 lineal feet of 3x10 deteriorated wood joists.
- Removal and replacement of 1,000 square feet of deteriorated wood deck.
- Removal of asbestos-containing asphalt shingles, built-up roof membranes, roof cements and bituminous coatings.
- Removal and replacement of existing sheet metal flashings, built-in gutters and downspouts.
- Repointing of 9,000 square feet of masonry walls and chimneys.
- Use of fume recovery system during heating and application of asphalt.
- Preparation and repointing of 1,200 lineal feet of ornate galvanized steel cornice. Lead abatement procedures required during removal of existing paint.
- New soffit and rooftop venting below shingle roof areas.
- Forty-eight flashing and construction details to address all flashing, construction and roof system termination conditions to be encountered during reroofing.



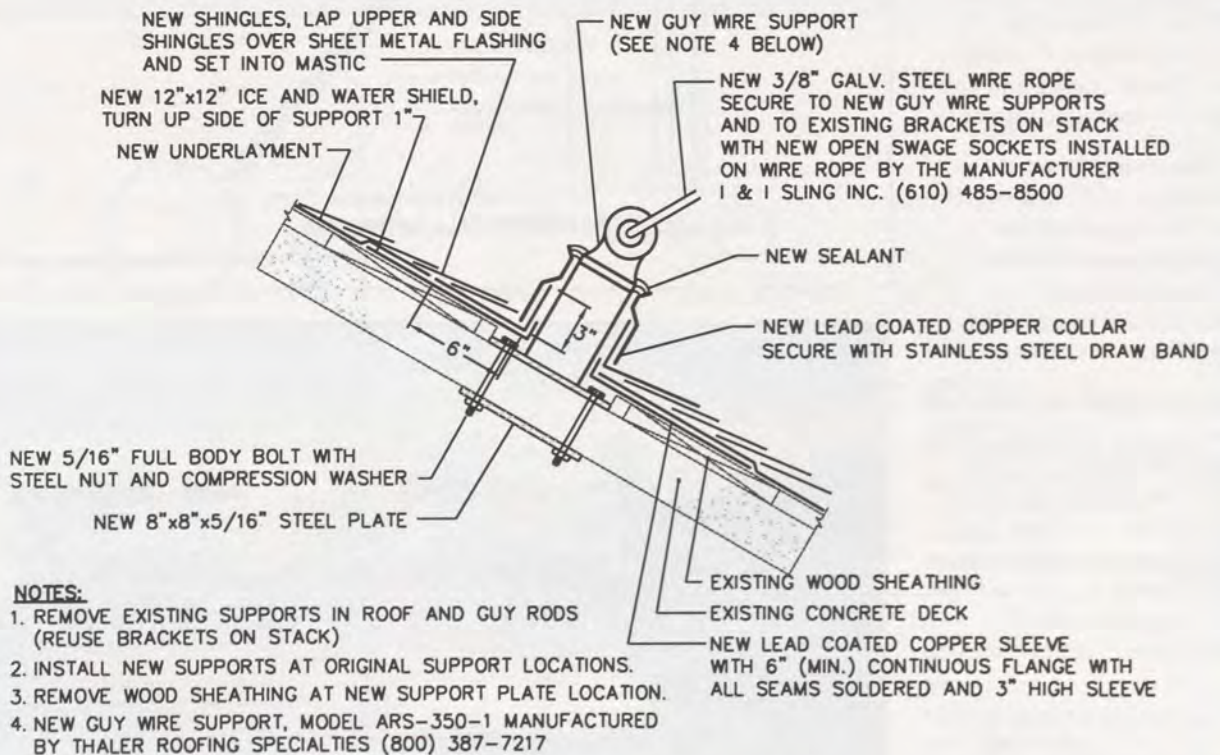
Overview, rear of Edwin H. Fitler Elementary School.



Water damaged wood joists.



19 WATER DIVERTER



21 GUY WIRE SUPPORT

Large Roofing Project • Third Place

RAMCORP • Powhatan, Virginia Continental Cablevision New Regional Office Richmond, Virginia

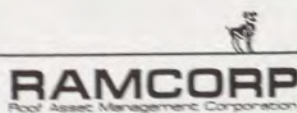
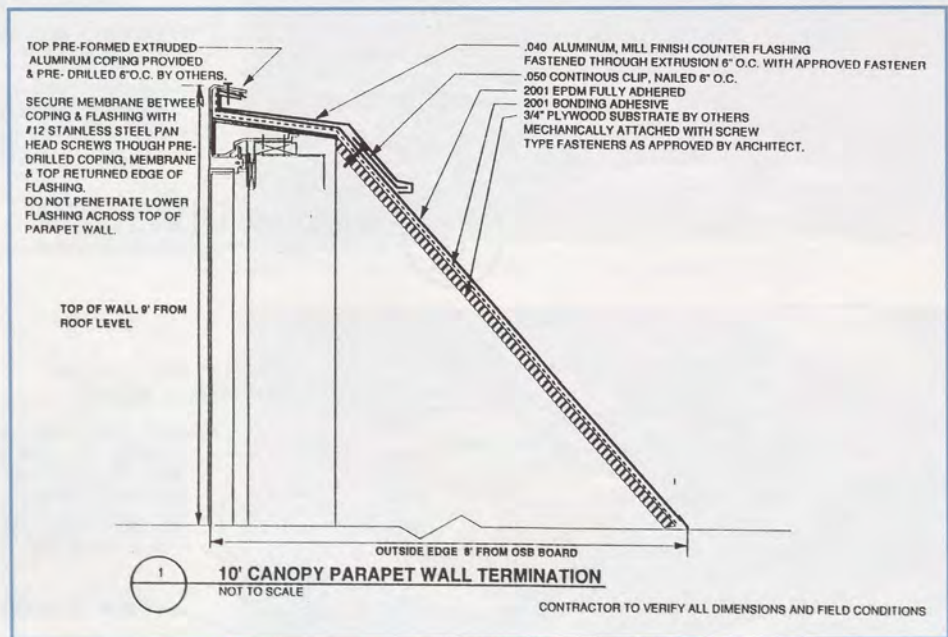
The Continental Cablevision project involved total consulting, architectural and inspection services. RAMCORP (Roof Asset Management Corporation) was initially commissioned to provide a detailed feasibility study complete with numerous options and budgets. The options included asphalt B.U.R., coat tar B.U.R. modified bitumen, and EPDM roof systems. With all factors considered, the owner selected a 2001 vented .060 EPDM roof system. In addition to a 15-year warranty and 96-mph blow off guaranty, this system proved to be very light and cost-effective. The owner also elected to have major remedial repair work implemented on two large roof sections. The repairs were practical, due to the sound condition of the existing coal tar pitch roof. Total roof size was 124,000 square feet.

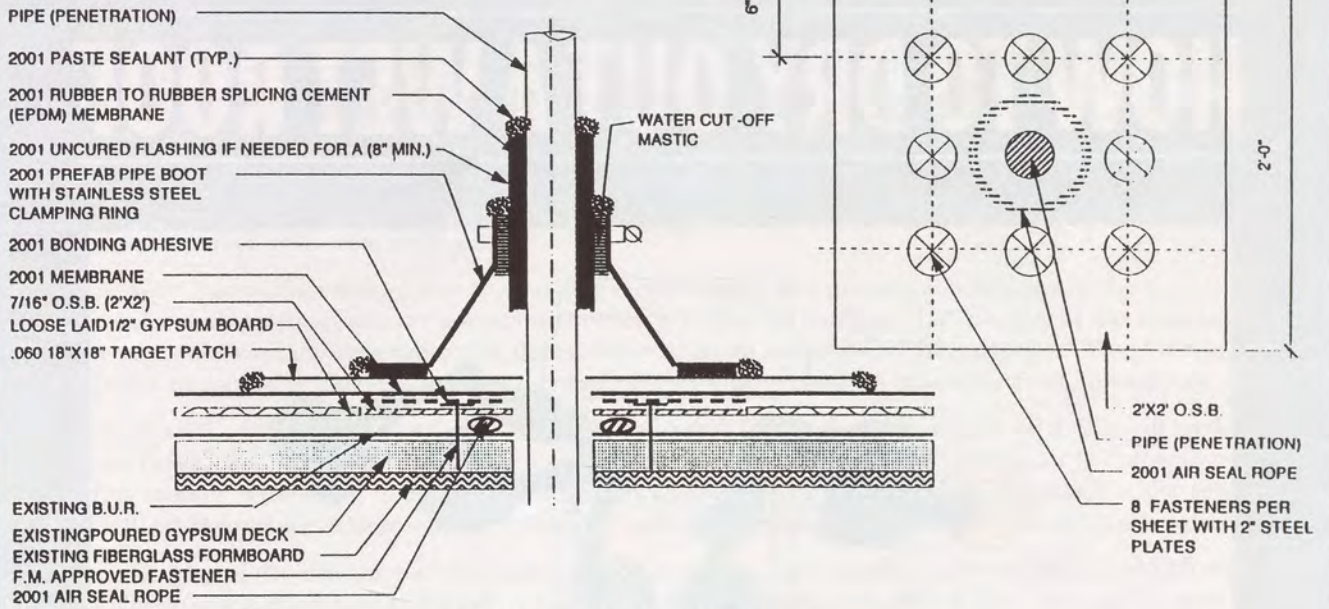
RAMCORP was commissioned to provide complete design and administration for all roofing activity.

The repairs and reroofing were separated as Phase One and Phase Two to facilitate the ongoing demolition and general construction. Each phase was designed and bid competitively on the open market to attain the highest quality and cost-effective roofing contract.

The contracts were awarded to different contractors. Each contract was negotiated and awarded within the budget. Construction cost totaled \$255,900.

RAMCORP provided full-time quality assurance observation on Phase One and part-time quality assurance observation on Phase Two. This inspection approach was tailored to meet the specific requirements of Continental Cablevision Inc.



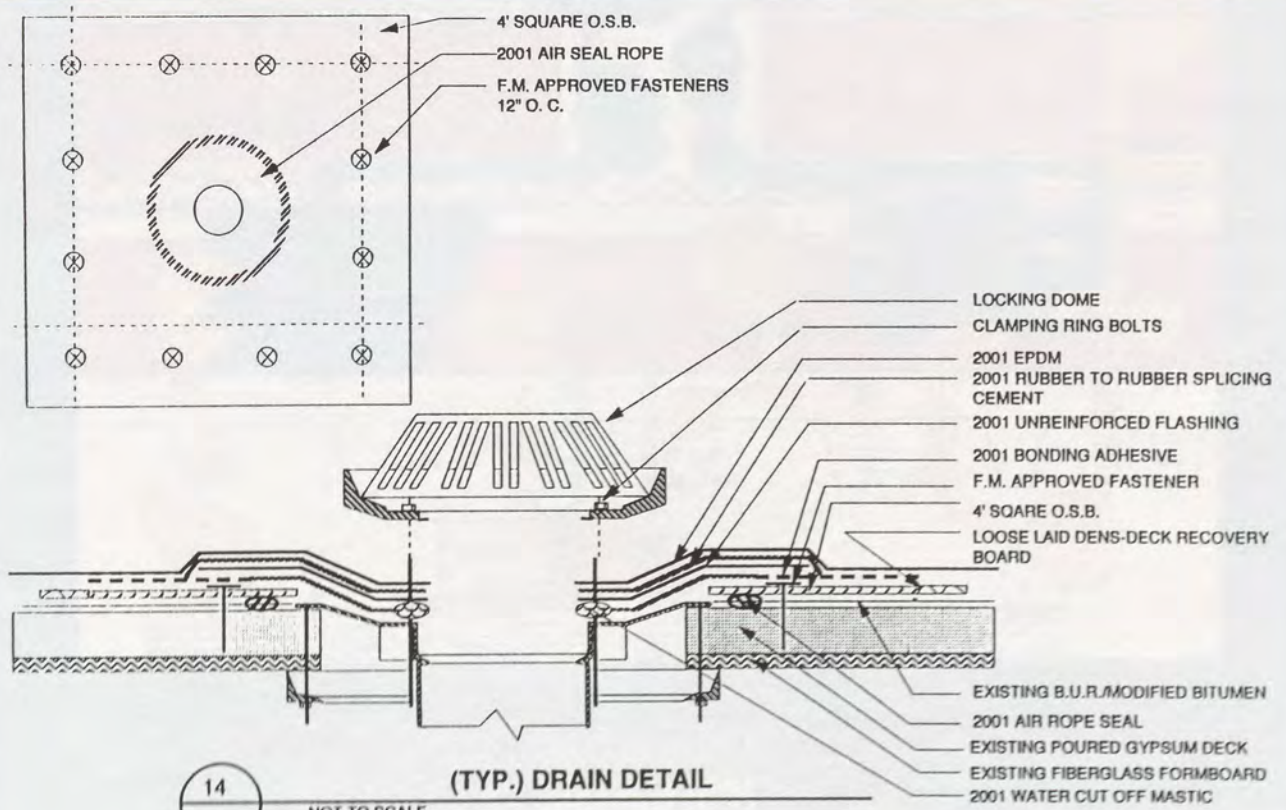


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(TYP.) SOIL STACK DETAIL

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CONTRACTOR TO VERIFY ALL DIMENSIONS AND FIELD CONDITIONS



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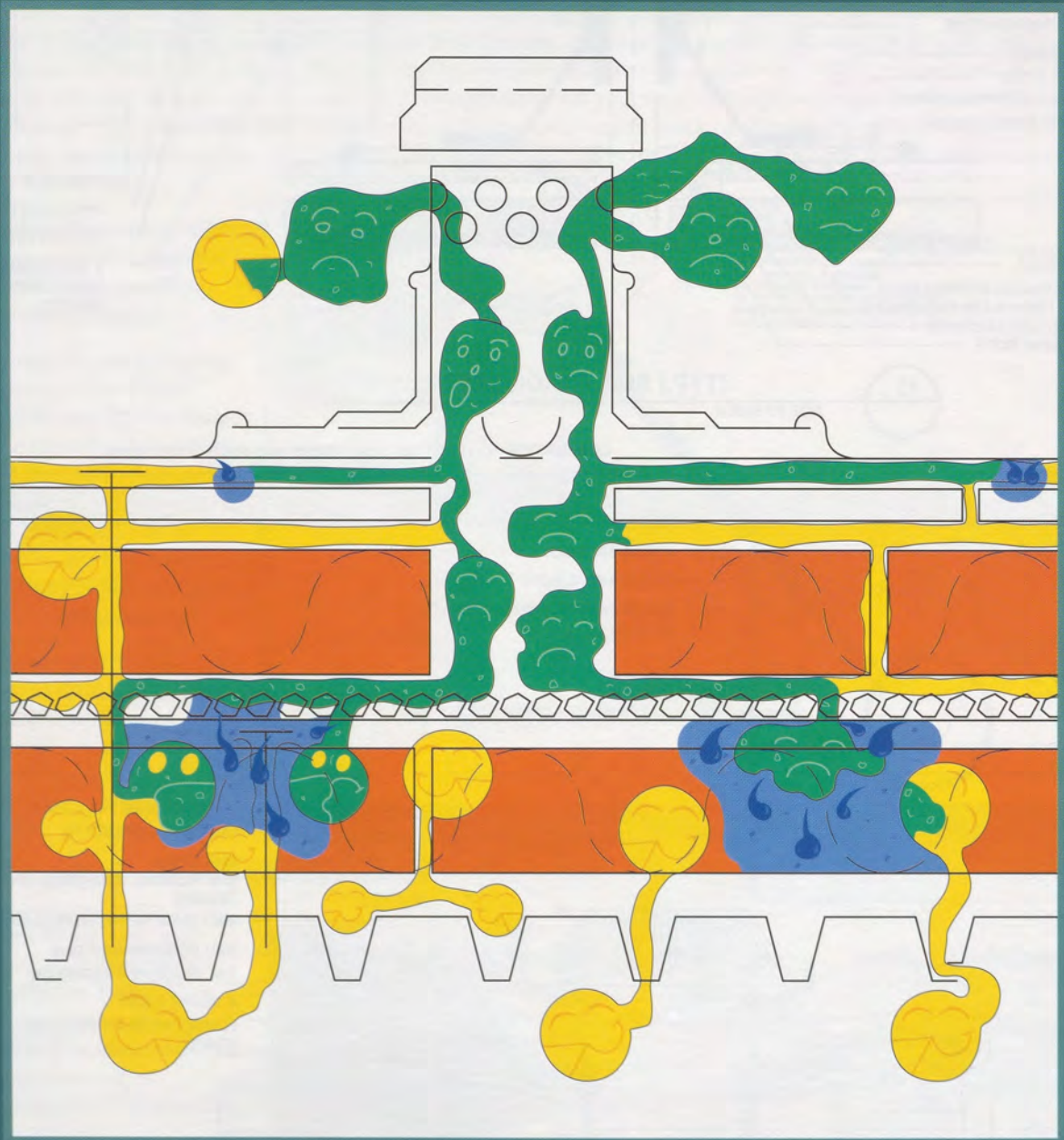
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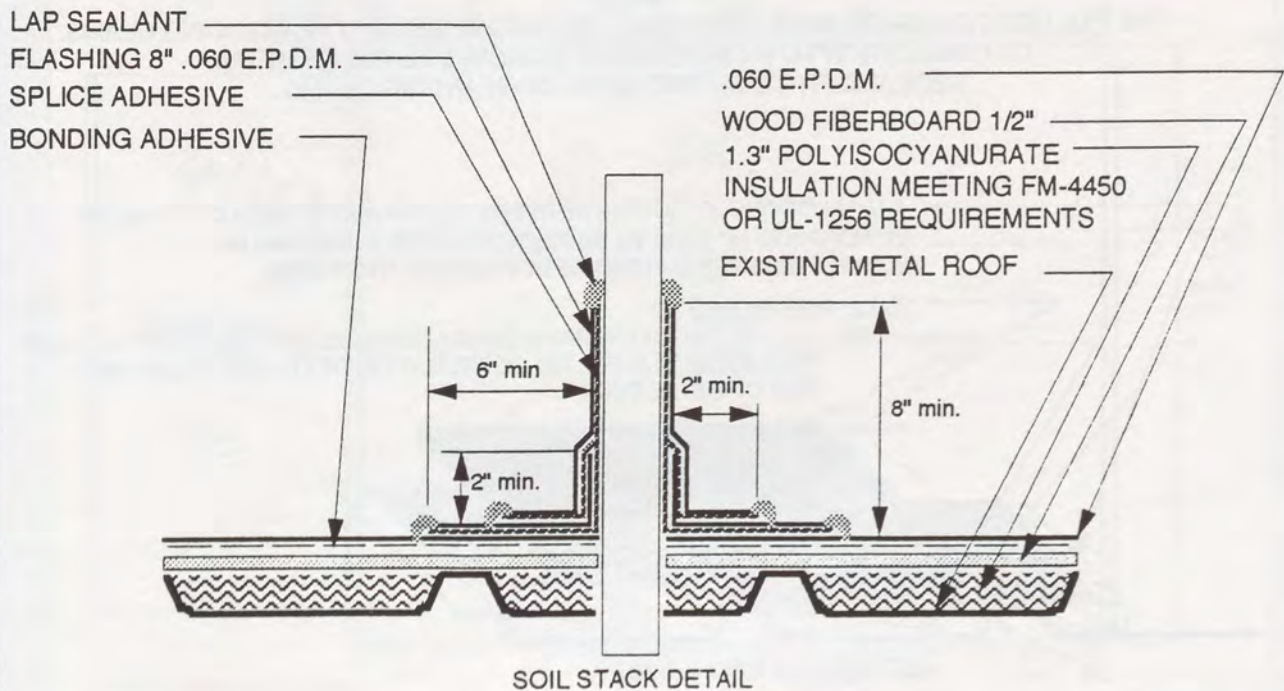
Three separate roof areas were addressed:

Roof A: Wire brush removal of rust on the existing metal roofing, and priming and painting of the areas brushed prior to overlay with polyisocyanurate insulation between standing seams/flutes. 1/2" fiberboard was then laid over the entire roof, mechanically fastened to the flutes, followed by an adhered EPDM membrane. Wood blocking and plywood edge treatment as detailed. Re-alignment of existing gutters; baskets or screens at all downspouts.

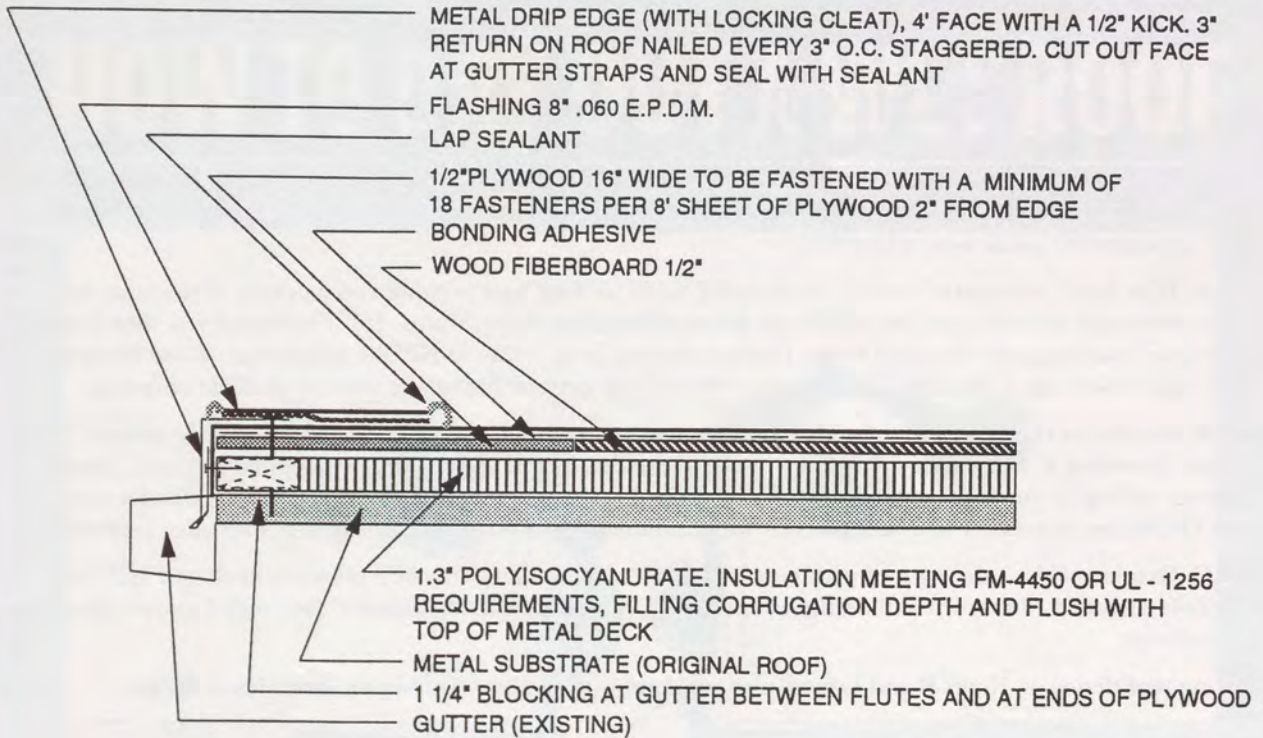
Roof B: Overlay of the existing roof with 1/2" thick mechanically-attached fiberboard and a fully-adhered EPDM membrane. Provided 4" face metal gravel stop over the existing gravel stop. On the triangular B-1 area, removal of the existing roofing to the deck, to be replaced with a mechanically-attached 1/2" thick fiberboard and a new, fully-adhered EPDM membrane. A new scupper was added to the edge through the new gravel stop edge treatment.

Roof C: Overlay of the existing roof with new 1/2" thick mechanically-attached plywood deck and 1/2" thick mechanically-attached fiberboard and a fully-adhered EPDM membrane. Provided 4" face metal gravel stop over the existing one.

Existing roof drains on Roofs B and C were also replaced with U-Flow Aluminum Hercules-A drains.



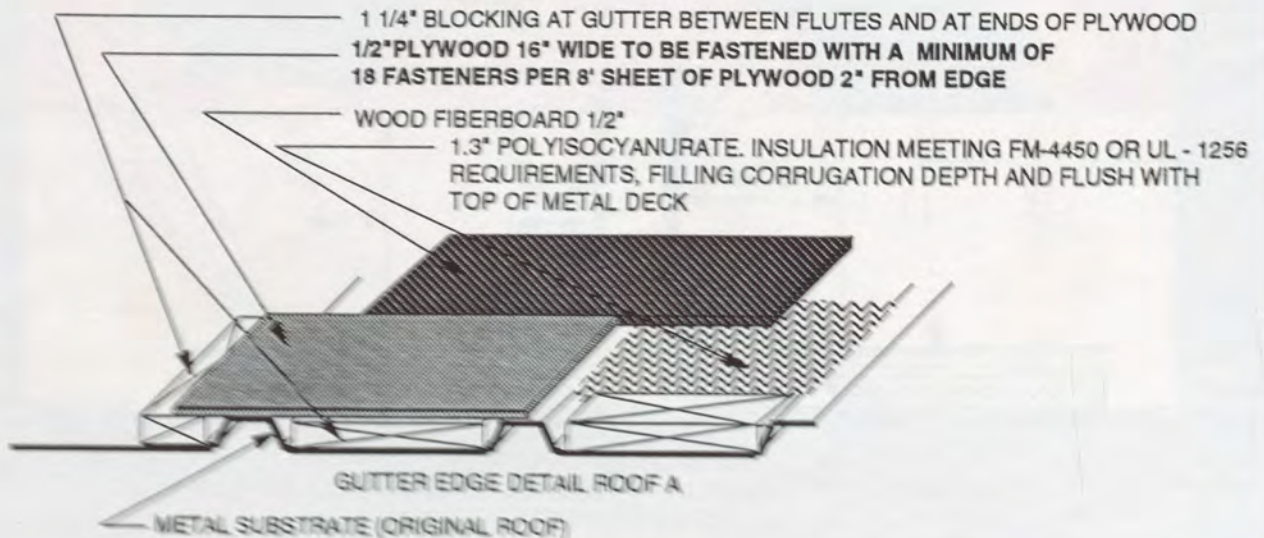
CONTRACTOR TO VERIFY ALL DIMENSIONS AND FIELD CONDITIONS



DETAIL 1
GUTTER EDGE DETAIL ROOF A

NOTE:

THE POLYISOCYANURATE INSULATION SHALL BE THE HEIGHT OF THE STANDING SEAMS. CUT INSULATION TO FIT IN BETWEEN STANDING SEAMS OF METAL DECK AND FIT TO SLOPED SIDES OF STANDING SEAMS.



Small Roofing Project • Second Place

Austin-Dillon-Cook • Hanahan, South Carolina

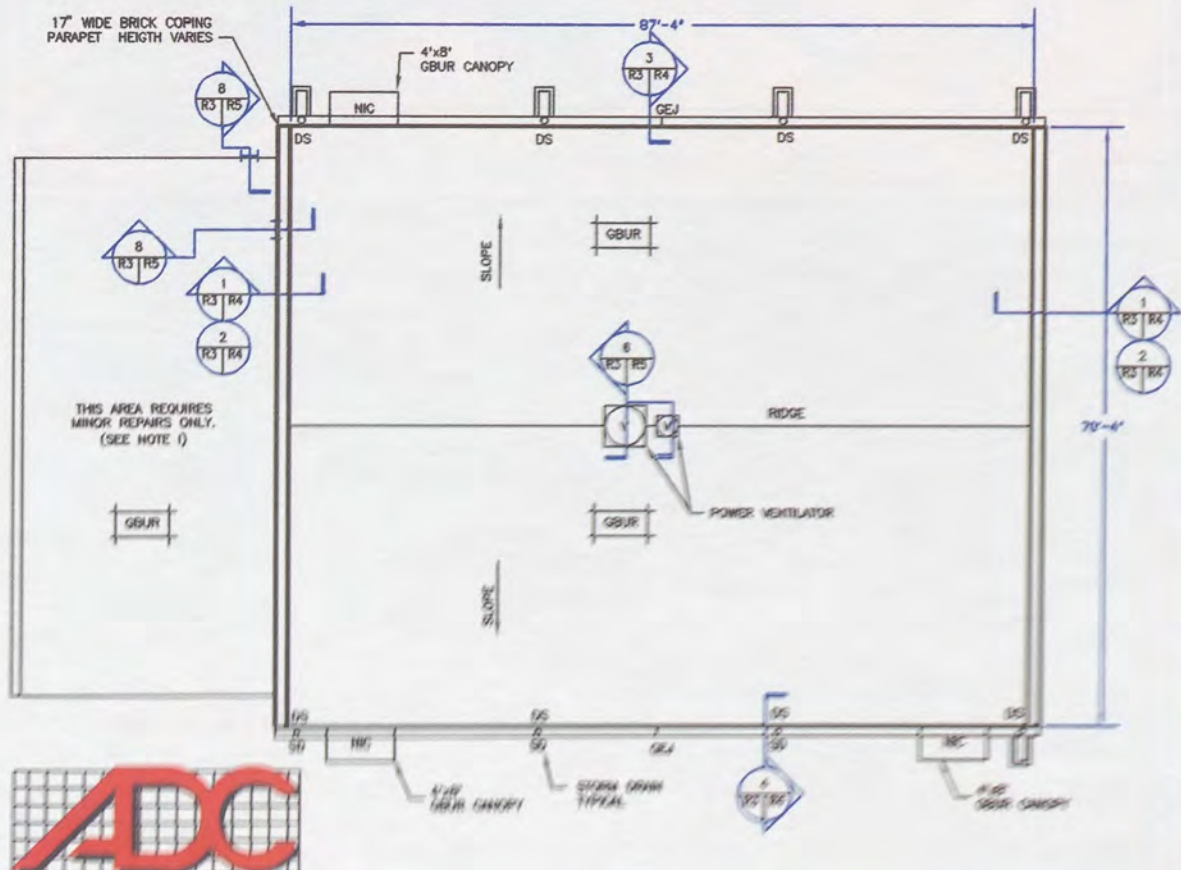
*Morningside Elementary School
Charleston, South Carolina*

This project was completed for the Charleston County School District, Charleston, S.C. The facility is an independent structure with two roof levels, connected to the campus academic buildings via a canopy-covered walkway. The roofing system had been damaged in 1989 by Hurricane Hugo. Temporary repairs had been made, with roof replacement deferred until 1996.

Austin-Dillon-Cook Engineering was contracted to perform a full investigation and to provide comprehensive design documents, including drawings and specifications, for the repairs and/or roof replacement, as needed.

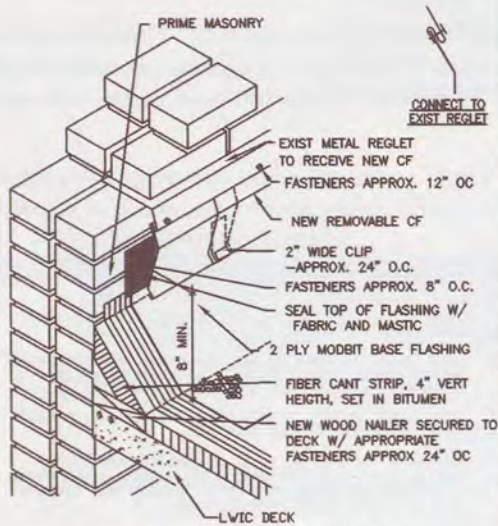
GENERAL NOTES

1. CONSTRUCTION:
 - A. NO MORE ROOFING SHALL BE REMOVED THAN CAN BE INSTALLED WITH THE COMPLETE NEW ROOF SYSTEM, LESS THE AGGREGATE EACH DAY.
 - B. ANY SHEETMETAL WORK/PENETRATIONS SHALL BE IN STRICT COMPLIANCE WITH CONTRACT. ANY CLARIFICATIONS SHALL BE IN ACCORDANCE WITH GUIDE LINES SET FORTH IN THE NRCA CONSTRUCTION DETAILS (3RD EDITION) AND SMACNA ARCHITECTURAL SHEET METAL MANUAL (5TH EDITION)
 - E. EXTEND/RAISE ALL MECHANICAL/EQUIPMENT/SKYLIGHT/ETC. CURBS TO A MINIMUM OF 8" ABOVE THE FINISHED ROOF SURFACE.
 - F. ALL PENETRATIONS (VTR, AC, EXPANSION JOINTS, ETC.) SHALL BE RAISED/EXTENDED TO A MINIMUM OF 8" ABOVE THE FINISHED ROOF MEMBRANE. PROVIDE FOR EXTENSION OF ELECTRICAL SERVICES & ALL OTHER SUPPORTING UTILITY SERVICES.
- G. THREE (3) OF THE EIGHT (8) NEW DOWNSPOUTS WILL TIE INTO THE EXISTING STORM DRAINAGE SYSTEM. THE REMAINING FIVE (5) DOWNSPOUTS WILL HAVE NEW CONCRETE SPLASHBLOCKS.
- H. DECK TYPES MAY VARY BY EACH DETAIL PROVIDED, BUT FLASHING DETAIL APPLIES TO ALL DECK CONDITIONS.
- I. INCLUDE IN THE BASE BID 20 SF OF BASE FLASHING REPAIRS AND THE ADDITION OF ONE SHEET METAL UMBRELLA OVER EXISTING PITCH POCKET AT LOWER ROOF LEVEL. EXISTING BASE FLASHING IS A FOIL FACED MODIFIED BITUMEN SHEET.

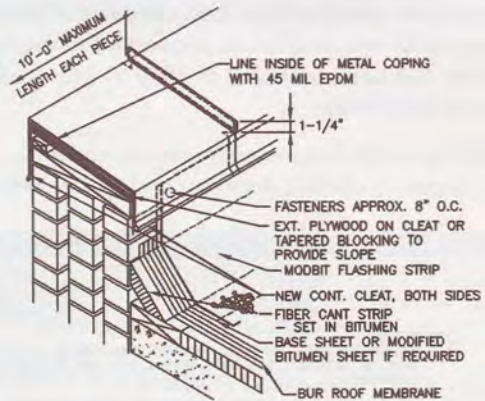


Roof replacement of the upper roof of the main building and repairs to the lower roof included new metal copings, gutters and down spouts. Quantities and unit prices for the anticipated damaged wood nailers, lightweight insulating concrete deck repairs and gutter systems were included.

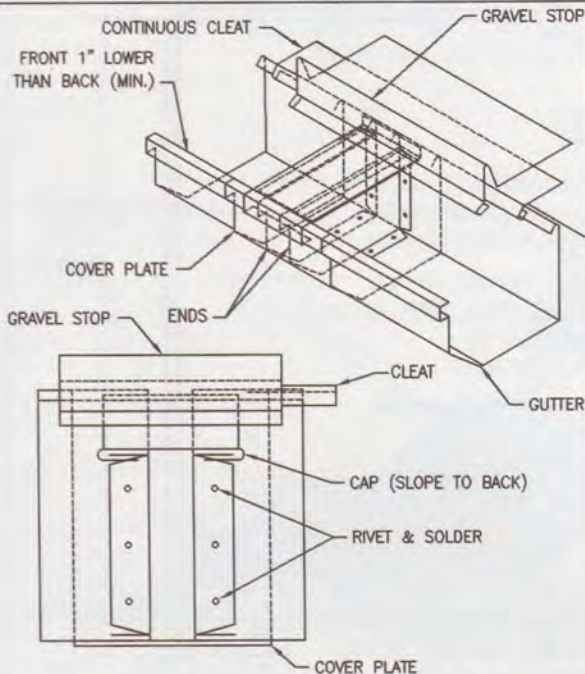
The project was competitively bid among pre-qualified contractors. All bidders were required to attend a pre bid-meeting as outlined.



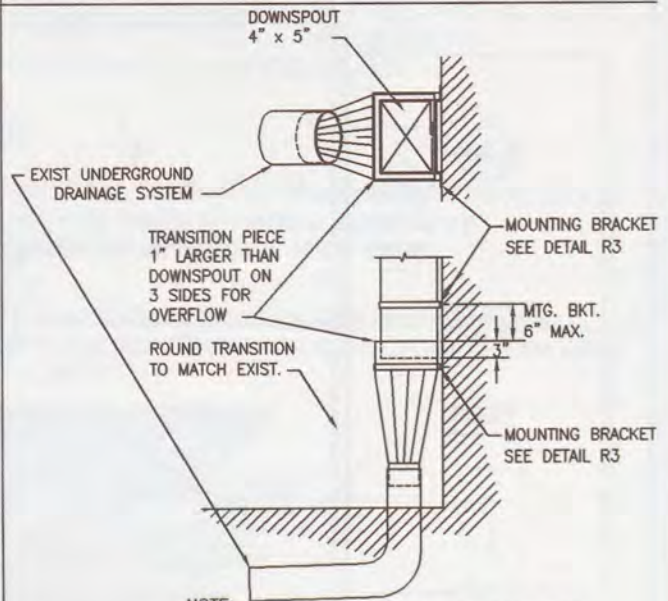
1
R3/R4
NOT TO SCALE
BASE FLASHING FOR WALL SUPPORTED DECK



2
R3/R4
NOT TO SCALE
NEW PARAPET COPING DETAIL



3
R3/R4
NOT TO SCALE
GUTTER EXPANSION JOINT



NOTE:
1. DOWNSPOUT SIZE TO BE 12" x 10".
4
R3/R4
NOT TO SCALE
GUTTER/DOWNSPOUT CONNECTION DETAILS

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materials and can only be installed by American's exclusive network of highly trained Preferred Roofers. American offers a complete line of standing seam roofs; including Standing Seam II; Loc-Seam, an architecturally and aesthetically pleasing system for high pitched roofs and our new 360 degree roll-

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Roof Report • First Place

Austin-Dillon-Cook • Hanahan, South Carolina

The Citadel, Charleston, South Carolina

The purpose of this report was to develop a "Campus Roof Management Plan" for The Citadel. A complete, extensive field investigation of the roof systems and a cursory review of the exterior walls were done to provide a database of current facilities and their conditions. All data provided in the report were based on these investigations. Field measuring, core sampling of base flashing and roofing systems and photographic/video summaries were completed. As-built records, warranties, correspondence and maintenance records were researched for information.

CAD drawings were provided as roof plans, showing all penetrations, terminations and core sample locations.

A two-tiered matrix chart was developed, showing actual components, materials, and deficiencies.

A photographic summary with notes and an asbestos summary for core/flashing samples was done for each building.

For submission of funding and planning purposes, an executive summary was provided. Finally, a five year cost summary chart for each building was prepared.



*Coward Hall
roof, showing
ponding and
debris on roof.*

*Alumni Building
Apartments.*





5 YEAR BUDGET PLAN

BUILDING		1997	1998	1999	2000	2001	ROOF PLAN SHT. MATRIX SHT.
ALUMNI BLDG APARTMENTS	REPAIRS	\$14,000.00					R1
	MAINTENANCE	240.00	\$240.00	\$240.00	\$240.00	\$240.00	M1
	REPLACEMENT			91,950.00			
ALUMNI HALL (GRIMSLEY)	REPAIRS	5,000.00					R2
	MAINTENANCE	597.70	597.70	597.70	597.70	597.70	M2
	REPLACEMENT						
BOILER ROOM	REPAIRS	3,000.00					R3
	MAINTENANCE	88.00	88.00	88.00	88.00	88.00	M3
	REPLACEMENT						
BOND HALL	REPAIRS	11,600.00					R4
	MAINTENANCE	1,024.50	1,024.50	1,024.50	1,024.50	1,024.50	M4
	REPLACEMENT			50250.00			
BYRD HALL	REPAIRS	2,000.00					R5
	MAINTENANCE	512.00	512.00	512.00	512.00	512.00	M5
	REPLACEMENT	93,000.00					
CADET SERVICES	REPAIRS						R6
	MAINTENANCE	430.00	430.00	430.00	430.00	430.00	M6
	REPLACEMENT						
CAPERS HALL	REPAIRS	3,500.00					R7A & B
	MAINTENANCE	588.00	588.00	588.00	588.00	588.00	M7
	REPLACEMENT	98,250.00				48,750.00	
COWARD HALL	REPAIRS	35,000.00					R8
	MAINTENANCE	818.00	818.00	818.00	818.00	818.00	M8
	REPLACEMENT						
DANIEL LIBRARY/ MUSEUM	REPAIRS						R9
	MAINTENANCE	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	M9
	REPLACEMENT	170,090.00					
DEAS HALL	REPAIRS						R10
	MAINTENANCE	2,468.00	2,468.00	2,468.00	2,468.00	2,468.00	M10
	REPLACEMENT	401,050.00					
DUCKETT HALL	REPAIRS	7,000.00					R11
	MAINTENANCE	231.00	231.00	231.00	231.00	231.00	M11
	REPLACEMENT	650.00					
JENKINS HALL	REPAIRS						R12
	MAINTENANCE	468.00	468.00	468.00	468.00	468.00	M12
	REPLACEMENT	101,400.00					
LAUNDRY BLDG.	REPAIRS						R13
	MAINTENANCE	596.00	596.00	596.00	596.00	596.00	M13
	REPLACEMENT	119,200.00					
LAUNDROMAT	REPAIRS						R14
	MAINTENANCE	48.00	48.00	48.00	48.00	48.00	M14
	REPLACEMENT	7,200.00					
LAW BARRACKS	REPAIRS	\$15,000.00					R15
	MAINTENANCE	618.00	618.00	618.00	618.00	618.00	M15
	REPLACEMENT					154,500.00	
LETELLIER HALL	REPAIRS	350.00					R16
	MAINTENANCE	162.00	162.00	162.00	162.00	162.00	M16
	REPLACEMENT						
McALISTER FIELD HOUSE	REPAIRS						R17
	MAINTENANCE	1,174.00	1,174.00	1,174.00	1,174.00	1,174.00	M17
	REPLACEMENT						

REMARKS:

- REPAIR COSTS ARE FOR REPAIRS WHICH ADC ENGINEERING FEELS ARE CRITICAL TO MAXIMIZING LIFE EXPECTANCY OF THE ROOFING SYSTEMS.
- MAINTENANCE COSTS ARE COSTS WHICH NEED TO BE INCLUDED IN THE BUDGET FOR ANNUAL MAINTENANCE.
- REPLACEMENT COSTS LISTED MAY BE FOR ONE OR MORE ROOF AREAS OF A PARTICULAR BUILDING. REFER TO SPECIFIC MATRIX CHART FOR ADDITIONAL INFORMATION.
- ALL COSTS LISTED REPRESENT COSTS IN TODAY'S (1996) DOLLARS.
- WATTS BARRACKS IS RECENTLY COMPLETED (1996), NOT SURVEYED, BUT INCORPORATED INTO MAINTENANCE BUDGET.

Roof Report • Second Place

Conley Design Group Inc. • Carrollton, Texas

General Motors Ramos Arizpe Engine and Assembly Plants Saltillo, Mexico

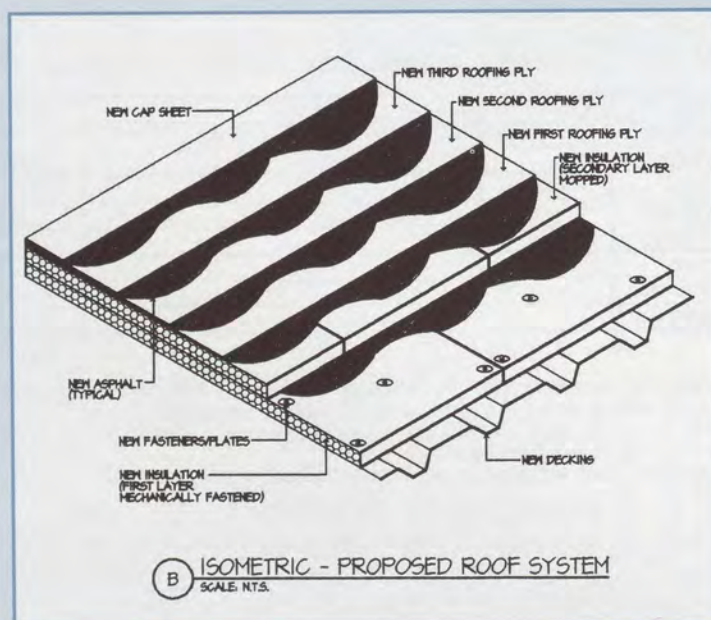
The project involved the inspection and evaluation of 166,125 square meters (1,751,288 square feet) of built-up and standing seam roofing systems on General Motors' Engine Manufacturing and Car Assembly Complex near Saltillo, Mexico.

The facilities were constructed in 1980-1982 and had experienced chronic roof leakage problems during the past ten (10) years. The complex consists of seven (7) buildings which house the engine manufacturing, assembly plant, paint shop and related cafeteria, clinic and administration operations. Most buildings are conventional automotive manufacturing facilities with structural steel framing systems, concrete floor slabs, steel roof decks and sloped standing seam metal roof systems. The design incorporates a wide span, 16m x 16m bay size with sloped structure and interior drainage gutters at alternating column lines.

The existing metal roof system is a non-traditional design utilizing 28 gauge galvanized metal panels of 825mm (32.48") panel width, and 32m (104') panel length with continuous runs from gutter to gutter without expansion provision. Analysis of the existing construction indicated substandard panel, gauge, attachment, thermal expansion and flashing conditions. The interior gutter system and drain piping were determined to be of adequate capacity, but improperly installed without adequate flashing or expansion provisions. In summary, the existing system was determined to be a substandard system with design and installation problems which could not be corrected on a cost-effective basis.

Alternative roof replacement strategies were analyzed to meet General Motors' investment plans for these facilities. Built-up, single ply, modified bitumen and elastomeric coating system options were analyzed on the basis of performance suitability for the existing structure, construction cost and life cycle cost over a 30 year investment life. In addition, the analysis considered construction cost, contractor capabilities and warranty response for use by both U.S. and Mexican contractors.

Removal and replacement of the existing system with a four-ply built-up roof system using fiberglass plies and asphalt bitumen were recommended as the most cost-effective, long-term solution for these facilities. The proposed design included decking of the existing gutters, and installation of internal roof drains and a piping system. Total program cost for the replacement project was estimated at \$10,041,700.





**GM de Mexico Ramos Arizpe
Roof System Investment Strategy Summary**

Year	Strategy One Two Year Program Replacement with Built-up Roof System (1996-1997)		Strategy Two Six Year Program Phased Replacement with Built-up Roof System (1996-2001)		Strategy Three Six Year Program Interim Coating Application (1996) with Phased Replacement in 1999-2001 with Built-up Roof System		Strategy Four Eight Year Service Life Finish Coating Application (1996) and Replacement of All Areas in 2003/2004 with Built-up Roof System		Strategy Five Ten Year Service Life Finish Coating Application (1996) and Replacement of all areas in 2005/2006 with Built-up Roof system	
	Cumulative Project Cost	Cumulative Net Present Value	Cumulative Project Cost	Cumulative Net Present Value	Cumulative Project Cost	Cumulative Net Present Value	Cumulative Project Cost	Cumulative Net Present Value	Cumulative Project Cost	Cumulative Net Present Value
1 1996	\$ 4,358,900	\$ 4,358,900	\$ 3,333,400	\$ 3,333,400	\$ 2,842,900	\$ 2,842,900	\$ 2,842,900	\$ 2,842,900	\$ 2,842,900	\$ 2,842,900
5 2000	\$ 10,041,700	\$ 9,570,028	\$ 9,251,800	\$ 8,311,055	\$ 5,370,000	\$ 4,806,232	\$ 3,266,500	\$ 3,178,999	\$ 3,288,000	\$ 3,191,505
10 2005	\$ 10,041,700	\$ 9,570,028	\$ 11,156,200	\$ 9,548,725	\$ 15,589,100	\$ 11,447,626	\$ 14,505,600	\$ 9,078,140	\$ 6,897,600	\$ 4,931,132
15 2010	\$ 10,286,700	\$ 9,658,389	\$ 11,401,200	\$ 9,637,086	\$ 15,629,100	\$ 11,459,594	\$ 14,505,600	\$ 9,078,140	\$ 18,744,400	\$ 9,935,220
20 2015	\$ 10,416,700	\$ 9,694,074	\$ 11,531,200	\$ 9,672,771	\$ 16,219,100	\$ 11,595,915	\$ 14,985,600	\$ 9,175,760	\$ 18,744,400	\$ 9,935,220
25 2020	\$ 11,031,700	\$ 9,776,554	\$ 12,106,200	\$ 9,753,076	\$ 16,219,100	\$ 11,595,915	\$ 15,410,600	\$ 9,246,792	\$ 19,184,400	\$ 10,001,776
30 2025	\$ 29,231,700	\$ 11,816,334	\$ 30,746,200	\$ 11,714,783	\$ 23,034,100	\$ 12,163,929	\$ 22,385,600	\$ 9,830,886	\$ 19,979,400	\$ 10,092,716
Remaining Roof Service Life (2025)	21-23 Years		21-23 Years		23-25 Years		24-25 Years		22-25 Years	
Interim Risks: Leakage Wind Damage Traffic Damage	Low Low Low		Low Low Low		Moderate High High		High High High		High High High	

Roof Report • Third Place

RAMCORP • Powhatan, Virginia

Medical College of Virginia, Richmond, Virginia

The roofs on the Medical College of Virginia in Richmond were reviewed and a report made by RAMCORP for the college. Several roofs were involved and were composed of a 4-ply coal tar pitch membrane with gravel surfacing over concrete decking. Some ponding had occurred, but was not considered detrimental. Depressed pitched pockets were filled and crowned with plastic roof cement. Copper roofing nails had been used to fasten aluminum coping into place on the parapet walls; these were replaced with aluminum or stainless steel screws with gaskets.

Some base flashing deficiencies were sealed with plastic roof cement and mesh, if large enough to require support. All rusted rooftop equipment was wire brushed and painted, and loose counterflashing was sealed and refastened. Coping which was poorly sealed at its intersection with rising masonry walls was pointed up or sealed.

A window wall above roof area B was cracking, and was sealed and painted with a waterproof coating. Gravel stop flashing, which was cracking at points and becoming denuded of gravel, was repaired and sealed with roof cement, mesh, and coating. Roof membrane protection was installed below roof-mounted antennas which had been strapped to the soil stack collars without protective pads to isolate the posts from the roof.



Roof Area A. Rust and corrosion on support and piping.



Roof Area B. Note loose flashing and low flashing profile below windows.



Overview Roof Area B.



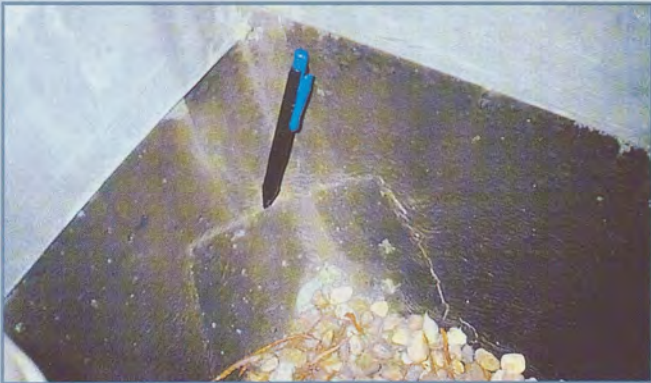
McCrae Hall. Large pitch pocket.



Rudd Hall. Deteriorated caulking behind chimney.



Rudd Hall. Poor waterproof seal on chimney.



Rudd Hall: Flashing opening.



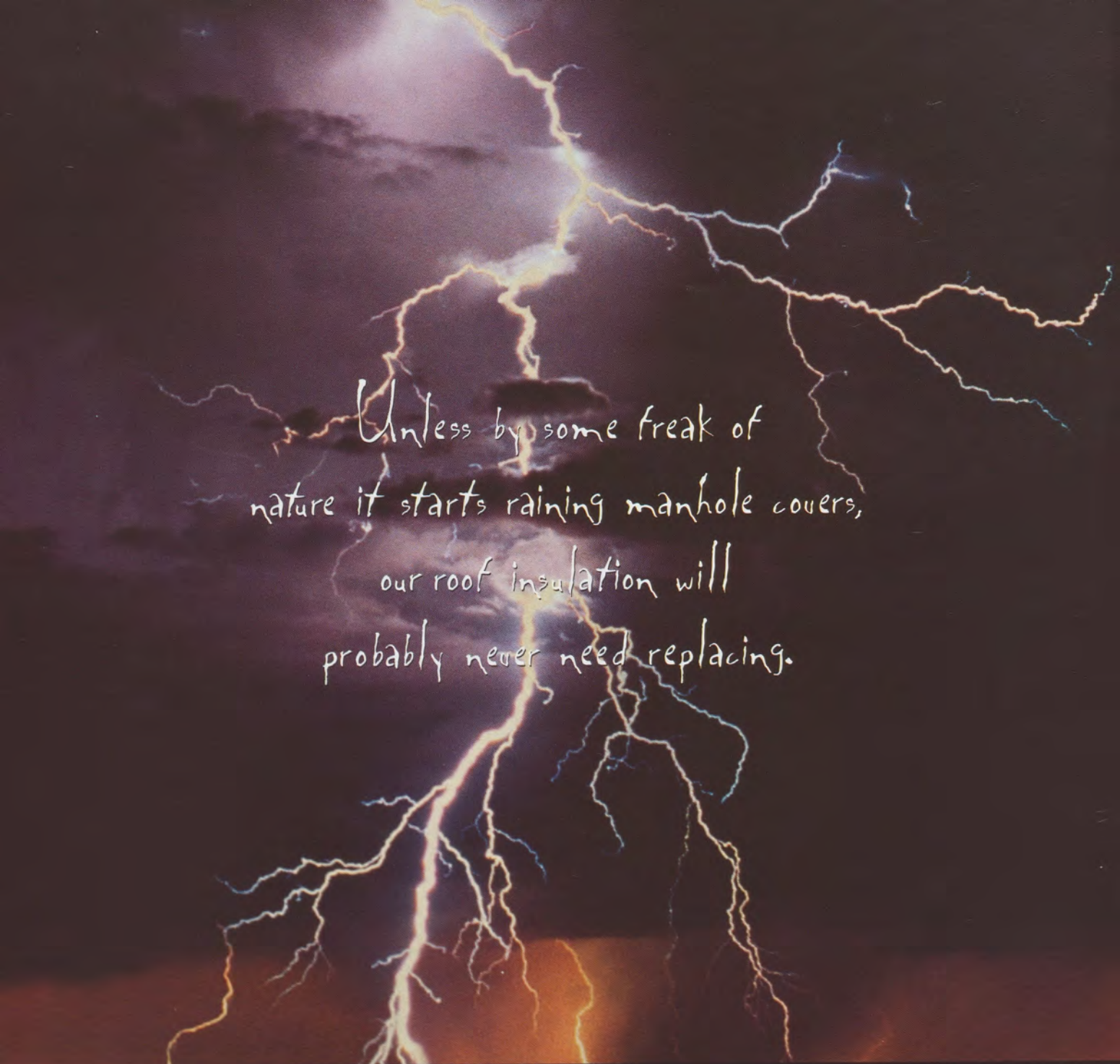
Rudd Hall. Missing fasteners in PRV.



Masonry joint deterioration, typical.



Bear Hall. Cracking roof cement base flashing joint cover.



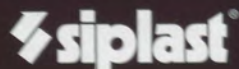
Unless by some freak of
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Roof Consultants and Expert Witness Testimony

By Sy Elakman, RRC

Roof consultants are often asked to provide their opinion in the form of expert witness testimony. Many consultants seek this type of work, while others try to avoid becoming involved. Often, consultants are involved without warning following an unfavorable inspection report.

There is no reason for a knowledgeable consultant to avoid this involvement out of fear. Confrontation or hostile arguments between aggrieved and damaged parties should not enter into the performance of the professional witness.

It is the responsibility of the expert witness to assemble the facts of the case, carefully inspect, research and document the problems found, and, with notes, photos, tests, samples, etc., as required, solidify his or her opinion. When called upon to provide expert testimony in deposition or trial, it is the expert's job to clearly explain the situation, render an opinion, and back it up with facts, quotes from applicable code, manufacturers' installation literature, or recognized standards or publications.

To Testify or Not?

When given the opportunity, it is advisable to meet with the prospective client and/or his attorney to review the case before accepting it. The opinion of the client or his attorney may be contrary to your convictions, and you may not be able to help him. Your convictions, standards and personal values should not be compromised. If a conflict appears probable, it is best to decline the work.

Preparation

Preparation for expert testimony should not be taken lightly. Talk to the attorney you are working with to ask his or her advice on your testimony and to fully inform and educate him on your opinion of the problem and possible conflicting opinions. Prepare and organize your file for ease in finding the information you will need. Have the attorney look through your file before bringing it to the deposition or courtroom. It may contain information that is considered

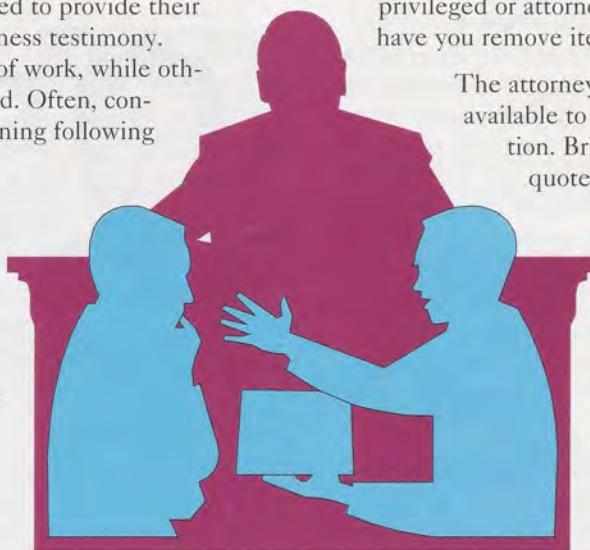
privileged or attorney's work product, and he may have you remove items.

The attorney may ask you to have your resume available to present to the court or at deposition. Bring any publications that you quote, if possible. Also, copy the pages or sections quoted to simplify presenting the information to the court or opposing attorney. Prepare or have prepared drawings, diagrams, details, and photographs as needed to clearly explain the problems you wish to describe. Enlarged photographs and large, clear drawings often assist the judge and/or jury to more clearly understand your testimony. Study your file and all pertinent information until you

are completely satisfied that you know it well. As an expert witness, precise answers add to your professional appearance and credibility.

Expert testimony in a deposition can vary greatly with that of a trial. Everything depends on the style, knowledge and attitude of the opposing attorney. In depositions, which are generally conducted in a relatively relaxed atmosphere, the opposing attorney generally tries to get as much information as possible. Be prepared to answer questions about your education, experience, credentials, and background. Keep a copy of your resume, or typed notes listing your experience, past testimony, education, licenses and registration numbers, etc., with dates and other pertinent information as a reference to glance at before answering.

Often, opposing attorneys word their questions to try to get you to answer in a manner that is favorable to their client or that is vague enough to use to discredit you later in court. An experienced expert witness listens carefully to each question and takes a few seconds before answering, and, if necessary, refers to his notes, report, photos, etc. This allows the attorney with whom you are working time to object to the question, if necessary. Those few seconds also give you time to think about the question and your answer. Remember, we are talking about a few seconds to think. A longer wait between the question and answer makes you appear hesitant or unsure of your answers. This



may not be very important in deposition, but it could severely affect the weight of your testimony to a judge and jury. Some attorneys in trial situations will try to excite or anger you or twist your words in an attempt to make you lose control. Stay calm, smile, and attempt to explain, "No, sir, I think you may have misunderstood my statement..." Stay in control of your emotions. Showing anger, contempt or displeasure with the method of questioning or questions in deposition is inadvisable; during a trial, it is unthinkable.

An expert witness must be consistent. It would not be prudent to state on record that slope-to-drain is a primary cause of premature roof failure when retained by a building owner, and then to say it is unimportant when retained by a defendant contractor in another case. Some bright attorneys may research your past testimony and hold up a copy of past contrary testimony, proving you a liar in court. This could end your career as a useful expert witness. There are many opinions about many facets of roofing, but there are many basics that are relatively indisputable and well-covered in published literature. A roof consultant expert witness must make every effort to research and report the truth and to present reasonable opinions. Knowledge is very important, but the credibility of the expert witness is a large measure of his value.

Make every effort to add to your credibility. Speak clearly, try to use words that are understandable to those not versed in construction terminology, and make an effort to explain yourself when necessary. Dress as a professional,

act as a professional, and express professional opinions and not personal animosity. Keep up-to-date with continuing education and credentials. Maintain records of classes, seminars and symposia attended. Strive for credentials. Even architects and engineers will be asked about the number of hours in roofing credits they received in school. Attaining certification and designation as a Registered Roof Consultant is positive proof of an advanced level of competence in roofing technology. Licensing as a roofing or general contractor in your area of operation may be helpful and add credibility to your testimony.



About The Author

Sy Elakman has been involved in the construction industry for 30 years and as a roof consultant for over 15. He has testified as an expert witness in Florida, Georgia and South Carolina cases. In 1987, he formed Elakman & Associates Inc., a construction consulting firm specializing in roofing and waterproofing. Mr. Elakman is an RRC, an SBCCI certified building inspector, a CABO certified building official, a registered general and roofing contractor in the state of Florida, and a member of the Standard Building Code ad hoc roofing committee.



BUILDING CODES & STANDARDS

ROOFING REFERENCE GUIDE

The Roof Consultants Institute developed its Building Codes and Standards Reference Guide under the authority of the RCI Board of Directors. Its purpose is to provide a resource center for roofing information and technology as it relates to building codes and standards. It provides a basic understanding of the building code promulgation process, the guidelines for the submittal of a proposed change to a standard or model building code, information for obtaining product-specific evaluation reports and a look into the future of the national and international building codes. A Roofing Chapter from each of the code groups is inserted at the end of each code chapter, intended as a guideline for referencing specific areas in each of the model codes.

Purchase your copy now!

Cost: \$75, members; \$100, non-members. Negotiated volume discounts.

Coal Tar... Anytime, Anyplace!

If you choose a roofing system other than coal tar because you truly believe that system is better, that's OK with us. But if you know coal tar is best and don't use it because you think you "can't," that's a shame.

Over the years a lot of misconceptions have grown up around coal tar. There are people who believe it's "outlawed" in some states, or that it "can't be used on schools." Others will tell you they know it's the best roof, but that it's "too expensive."

None of that is true, of course. Coal tar pitch is 100% legal and approved for use by local contractors in all fifty states. And we've got the jobs to prove it.

As for expense, coal tar compares favorably with

all other systems. On roofing jobs requiring expensive tapered insulation, it can save you significant dollars.

AlliedSignal warrants its coal tar roofs for up to 25 years and they often last twice that long. Imagine the savings from a roof that gives service like that.

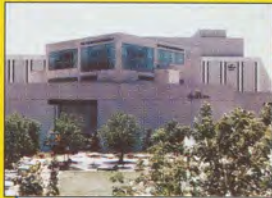
If you've got a low slope or dead level commercial roof to cover, you can't buy a better system than coal tar. And if somebody says you can't use it, tell them, "Yes, I can! Anytime. Anyplace."

Commercial Roofing Systems is a business unit of AlliedSignal Inc., a \$14 billion, Fortune 50 corporation.

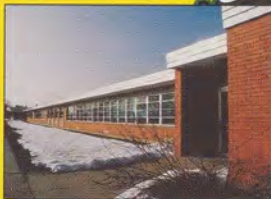
Coal tar. For flat or low-sloped roofs everywhere.



AT&T
San Francisco, CA



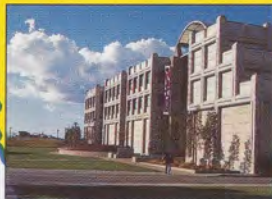
Hallmark Crown Center
Kansas City, MO



McTigue Jr. High School
Toledo, OH



Hilton Hotel
New York, NY



Loyola Marymount Univ.
Los Angeles, CA



Southwestern Bell
Houston, TX



Toyota Plant
Georgetown, KY



Erie Lackawanna Ferry
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(800) 221-6490 FAX (919) 461-4720 World Wide Web site- <http://www.alliedroof.com>

RICOWI Elects New Officers

By Philip D. Dregger, PE, RRC, FRCI
Technical Roof Services, Pleasant Hill, CA

The Roofing Industry Committee on Wind Issues (RICOWI) met in conjunction with RCI's recent convention in Anaheim. Activities included adoption of new bylaws, election of officers, and a final planning session for the ambitious Wind Investigation Program (WIP).

Newly-elected RICOWI officers are: David Roodvoets, chairman; Bas Baskaran, vice chairman; André Desjarlais, secretary/treasurer.

As part of final WIP preparation, representatives of the 15 sponsoring organizations participated via slides in several "mock investigations" of wind-damaged structures to fine tune data collection forms and to discuss reporting formats. The final RICOWI WIP report will emphasize objective descriptions of damage conditions and comparisons of observed construction conditions to current code, manufacturer and industry recommendations.

The following are some highlights from Board of Director reports, other reports, and general discussion:

Bas Baskaran, National Research Council, Canada— Static and dynamic tests were recently conducted on a typical PVC roof assembly. Loads were simulated in accordance with FMRC (Factory Mutual Research Corporation) Approval Standard 4470, the UEATc (European Technical Construction Agreement) test procedure and the SIGDERS (Special Interest Group for Dynamic Evaluation of Roofing Systems) dynamic test protocol. Comparisons of "design parameters," although limited to the tested roof assembly, clearly indicated that they were overestimated under the FMRC loading sequence. In addition, the failure mode observed during the FMRC tests was primarily fastener pullout with little seam damage, whereas during the UEATc and SIGDERS testing, membrane tearing and cohesive peeling failure of the membrane occurred at the seams.

André Desjarlais, Oak Ridge National Laboratory—The "top" side facer of isocyanurate insulation boards usually has less "peel" resistance than the "bottom" side facers.

David Roodvoets, SPRI—The ANSI canvass is now complete for RP-4, "Wind Design Standard for Ballasted Single Ply Roofs." The standard is now in mandatory language, uses Standard ASCE 7-95, "Minimum Design Loads for Building and Other Structures" as the key reference for design wind speed, and should be available by Fall 1997. SPRI has also published FX-1 "Standard Test Method for Roof Fastener Pull Out." The fastener standard can be ordered from SPRI. (During a later discussion, Roodvoets commented that for ballasted single ply roofs, wind tunnel tests indicate that wind forces tend to move roof ballast stones as a "group," regardless of whether different stone sizes are present. Wind forces do not tend to "sort" the stone by size.)

James MacDonald, Texas Tech University (TTU)—The final report of the TTU Roof Edge Metal research project is complete. Copies will be sent to each sponsoring organization shortly. RCI is proud to be a sponsor of this TTU research project.

The RICOWI meeting previously scheduled for Sept. 19 in Gaithersburg, MD, has been postponed indefinitely in anticipation of a meeting as part of a WIP response to the next major hurricane event.



Philip D. Dregger

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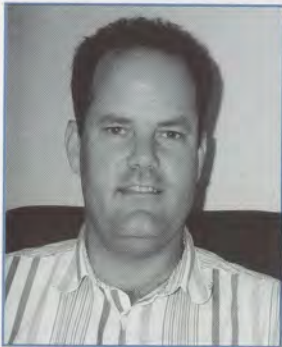
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Neuhaus New Region V Director



Daniel Neuhaus, RRC

Daniel Neuhaus was unanimously elected as Director of Region V at the April 25 meeting at the Hyatt Regency in Denver. Dan replaces outgoing director Nick Lovato.

A member since 1990, Neuhaus earned his RRC certification in 1992. He previously served a two-year term as Region V Director, from 1992 to 1994, and currently sits on the Credentials Committee. Dan is employed

by TechniScan Inc., as a project manager in Denver, CO.

Dan's goal for the upcoming term is to "increase awareness of RCI and the benefits it can provide to its members...I hope to increase participation by existing members as well as expand membership. I plan to hold quarterly membership meetings as well as periodic breakfast/luncheon meetings to discuss issues of concern and

interest to the local roofing community. As a part of the quarterly meetings, I will hold problem solving sessions to prepare more members for the RRC and/or RRO examination, and to increase the number of members recognized in this region as RRCs and RROs during my term.

"I have truly received benefit from RCI through active participation and involvement and will challenge members in our region to get involved."

Sarnafil Makes Presentation

The April regional meeting was sponsored by Sarnafil. Speakers were Ken Flickinger, Sarnafil, who spoke on PVC systems; Lars Walberg and Neil Dehne of Boulder Creek Sales, Pat O'Connor, Sarnafil, who discussed polyolefin roofing systems; and Dave Foler, Sarnafil, waterproofing systems.

Approximately 15 attended, and many expressed an interest in taking the Rooftop Quality Observation course scheduled for Nov. 6-7 in Denver.

Region III Hears About Single-Ply Restoration and Repair of Phenolic Insulation and Metal Decks

Thirty-one meeting attendees, speakers and table-top exhibitors from throughout the Midwest (and one from California!) participated in the Region III Spring Meeting Friday, May 16 at the Sheraton Four Points Hotel, Cedar Rapids, IA.

Jim Leonard, ER Systems

Opening speaker Jim Leonard, ER Systems, Plymouth, MN, reprised his previous talk at Region III, St. Louis, last year, this time addressing the topic, "Single-Ply Restoration and Preservation." Jim began by noting that in times past, the approach to existing roof systems treatment was one of repairing and maintaining. In this context, "repair" meant to put back together, replace broken parts, and restore to a healthy state. "Maintain" meant to keep in an existing state and protect

against danger. However, with the contemporary emphasis on sustainable roofing, Jim suggests that perhaps "restoration" and "preservation" need to be the new paradigms.

By elevating our thinking in this regard and redefining life expectancy of roof systems, "restore" means to put back into service; to bring back to a former state; to renew. "Preserve" means to keep safe and protect and to prevent deterioration.

This concept, Jim opines, can be effected for almost any type roof system by the following method:

1. Repair the inadequacies or limitation of the existing roof system to bring the roof into serviceable condition.
2. Restore by reinforcing weaknesses and improving

upon original shortcomings to position the system for longer service life.

3. Utilize coatings as a "sacrificial barrier" to protect the basic roof system from the effects of UV and moisture, and to slow the natural aging process.
4. Institute a formal and regular roof inspection and maintenance program and recondition the sacrificial barrier coating.

The aging process for various types of single-ply systems was then discussed through audience participation. Thermoset membranes, such as EPDM and CSPE, typically suffer from seam failure, shrinkage and tearing, flashing deterioration, and punctures; and chalking, surface crazing, thinning and pinholing, and algae/mildew, respectively. Thermoplastics, such as CPA, CPE, and PVC, are susceptible to plasticizer loss and membrane embrittlement and shrinkage, loss of impact resistance and shattering, and algae/mildew.

Modified bitumens, particularly APP and SBS, can be affected by weathering and loss of surface bitumen ("angel hair"), shrinkage and instability of reinforcement, open laps, slippage, and ridges/fishmouths.

The next segment of Leonard's presentation discussed roof coating products and repair scenarios. Coatings are composed of resin (the binder and the polymer), pigment, fillers, other processed material, and solvent (water or organic chemicals). Application can be by spray, roller, brush, or a combination (e.g., non-sag thixotropic coatings can be sprayed, but need to be back-rolled to ensure contact with irregular surface interstices). In-place curing of coatings is typically effected by solvent flash-off, by chemical catalyst, or by heat.

The characteristics of the coating which define its performance include: adhesion, elongation and elasticity, tensile strength, "toughness"—the function of elongation and tensile strength, low temperature flexibility, and weatherability. Generic types of coating which offer the best of these features include: aromatic polyurethanes for elongation, abrasion resistance and solids content; aliphatic polyurethanes for tensile; silicones for weathering and heat aging resistance; modified asphalts for water absorption; and, either aromatic or aliphatic polyurethanes for "toughness" (impact resistance).

The coating should be matched to the needs of the particular project: the type substrate, the performance level desired, and the environmental factors. Jim notes that certain rules of thumb should be used in evaluating coatings:

1. Consider the solids content by volume, not by weight.

2. Installed costs should be compared per dry mil thickness.

3. Adhesion to the substrate is the single most critical property. It follows, then, that substrate cleanliness is very important.

4. Coating elongation should match that of the sheet membrane to which applied.

5. Water absorption is an important factor to coating performance, especially in consideration of the roof slope (i.e., water insensitive coatings should be used on lower slopes).

Typical work to "restore" and "preserve" an aging EPDM membrane would typically include: trimming off curled lap edges and hardened lap sealant; cleaning, priming and stripping off all field seams using butyl seam tape; replacing field-wrapped flashings with preformed flashing boots; and coating all flashings. If the field of the membrane needs work, such as a chalked white EPDM, then power washing (and possibly scrubbing also), priming, and coating with an acrylic or urethane, could be done.

Treatment of chalking and thinning of CSPE would be handled similarly to that of a chalked white EPDM.

Butyl seam tape can also be used on thermoplastic sheets, if the basic integrity of the sheet membrane remains (unlikely for aged nonreinforced PVC).

Coating most membrane flashings is suggested, as the flashing membrane surface temperature is lowered and thus prolongs the serviceability of the underlying adhesive.

Rolf Snobeck, Anthony Roofing, Ltd.

Rolf Snobeck, RRC, Anthony Roofing, Ltd., Aurora, IL, spoke on "Phenolic Insulation/Metal Deck Damage, Repair," based upon his experience with reroofing phenolic insulated single-ply and built-up membranes and the associated metal deck repair work. He traced the development of phenolic insulation, with its perceived benefits: fire-rated with no separate thermal barrier; better "k" value and less expensive than urethane or polyiso; dimensional stability; use with either single-ply or built-up), and its geographic distribution—primarily in the Northeast.



Dennis McNeil,
RRC, CCS, RRO

Most of the construction community had no idea how phenolic would turn out until problems came to the fore. Many are still unaware ("That's not orange polyiso board.")

Rolf traced the events which occur once phenolic is discovered on a roof:

1. The owner or his consultant sends a file claim opener form to the insulation manufacturer or successor.
2. The manufacturer or successor then undertakes a roof investigation, usually conducted by an outside engineer or consultant.
3. The owner should retain a consultant to conduct an investigation, particularly with regard to how reroofing and deck repair/replacement will impact the building interior and the need for suitable protection.
4. The manufacturer or successor will require at least three bids for replacement of the roof in-kind and without "betterments." Also required is a bid spreadsheet to break out labor and material for deck work, demolition, insulation, roof membrane, and flashings/accessories.
5. Settlement offers by the manufacturer or successor will take into account the age of the present roof system and its estimated remaining service life, and will be pro-rated accordingly. The deck repair/replacement is usually settled without discount.
6. Once settlement has been finalized, the owner is free to use a different roof system or provide "betterments" at his own expense. However, the roof must be replaced. The owner cannot bank the settlement and reroof whenever he pleases.

Deck repair typically includes several treatments, depending upon conditions encountered. White rust on galvanized deck is wire-brushed and vacuumed. Red rust is scraped or brushed, vacuumed, and painted with a proprietary coating supplied by the insulation manufacturer or successor. Rusted-through but structurally intact deck is scraped/brushed/coated, and then overlaid with new decking, sealed into place, and fastened. And structurally unsound deck is removed and replaced. Actual deck samples representing each condition noted above are kept on-site for reference during the meeting.

Roll should review all data regarding actual deck repair and provide plan and "Phenolic-Free Quantitative Determination" for use in negotiating possible claims for phenolic remediation and deck repair.

Construction and Roof Litigation

After lunch, Ed Betker, RRC, Inspec, Inc., and Atty. Mike Taylor, of Leonard, Street and Deinard (both located in Minneapolis), discussed construction and roof litigation. Betker discussed the consultant as an expert witness and spoke about the various types of project climates encountered.

Taylor offered several suggestions to consultants to minimize typical business practice exposure:

1. Always use a written contract for any type roof consulting endeavor, regardless of how seemingly simple or low in fee.
2. Standardize report format to itemize the scope of the commission from client to consultant, when the various facets of the work were undertaken, which materials were provided and reviewed, and what was not available/provided/reviewed.
3. Beware of acting as the client's negotiator (in addition to being his technical expert) with adversaries. The potential risk for this exposure is seldom worth the additional fee, especially if not receiving additional compensation.
4. If faced with critical occupancy or use in a reroof situation (e.g., deck replacement over high-tech "clean room," healthcare, food/drug preparation, or uninterruptible production), strongly suggest to the client that he retain a specialty interior protection consultant for this phase of the design work and later during the construction phase. Also suggest that the consultant be contracted directly with the owner and not as a sub-consultant under the roofing consultant.

Other Issues

Also discussed were the possibility of forming an Illinois Chapter of RCI (brought up by immediate past president Chris English), and upcoming meetings, as follows:

- July 18, 1997: Summer Region III Meeting
Old Harbor Inn, South Haven, MI
- Nov. 7, 1997: Joint Region III/IV Meeting
at IRI/CA Convention, St. Louis, MO
- January, 1998: Winter Region III Meeting
Chicago, Illinois
- April, 1998: Spring Region III Meeting
San Antonio, Texas

INDUSTRY NEWS

PROGRAMS

■ Construction Code Inspectors Go Digital

Beginning in Feb. 1998, all certification exams under the National Certification Program for Construction Code Inspectors (NCPCCI) will be administered on the computer in testing locations throughout the U.S. Computer-based testing allows NCPCCI to offer greater testing flexibility, security and immediate score reporting. Candidates will be able to test, by appointment, during one week in the months of February, April, June, August, October and December at more than 200 test centers. For more information, contact BOCA International at 708-799-2300, ext. 334.

■ Property Maintenance Inspectors' Program Popular

Since its inception in August 1995, 334 candidates have become certified through the Building Officials & Code Administration (BOCA) International Inc.'s Property Maintenance and Housing Inspector (PMS&HI) certification program. For more information, phone 800-274-7176.

PEOPLE

■ GenFlex Promotes DeTorre

GenFlex Roofing Systems, Maumee, Ohio, has promoted Jeannemarie DeTorre to the position of quality/development engineer. GenFlex makes a full line of single-ply options.

■ GAF Promotes Emerson

GAF Materials Corp. announces it has promoted Kevin Emerson to general manager, Insulation Products, in the Commercial Roofing Products Division. He will direct operations at the BMCA/IPI plants in Wadsworth, OH; Florence, KY; and Ontario, CA.

PUBLICATIONS

■ ICC Releases Working Drafts of IBC

The International Code Council recently released its Working Draft of the International Building Code (IBC). A public comment forum on the draft has been scheduled for Aug. 18-27 in Denver, CO. For more information, visit BOCA on the World Wide Web at: <http://www.bocai.org>.

■ Book Tells Design Firms How to Promote

Promotion Strategies for Design and Construction Firms gives over 400 promotional ideas and techniques to improve sales and marketing programs of companies in the design and construction fields. The book, by Vilma Barr, is available by phoning 212-691-5871.

■ Life Cycle Costing Kit from Stevens

A new Life Cycle Costing Kit is available to building owners, architects and specifiers from Stevens Roofing Systems. Included in the kit is a worksheet for a true life cycle cost comparative analysis of roofing systems. Stevens manufactures hot-air weldable roofing membranes. For a free copy, call 800-860-3491, ext. 1079, or visit their home page at www.jpselestomerics.com.

Upcoming Themes in *Interface*:

August 1997: Maintenance

September 1997: Decks/Substrates/Structural Issues

October 1997: Flashings and Sheet Metal

November 1997: Environmental Issues/Chemical Contamination

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A Message to Members

This is the first part of what I hope will be a long series of communications with RCI members. I say the first part because communication is a two-way process. It involves a message sender and a receiver, and communication does not occur unless each has heard and acknowledged the other. Keep that thought in mind for a few minutes.

Before I accepted RCI's offer to become its new Executive Director, I did some research on the organization to find out more about its members, its activities, its goals, and where it seemed to be in its development. What I found intrigued and excited me.

RCI is a young organization. It's full of energy and enthusiasm, like an adolescent. Like most youngsters, it's growing rapidly, and as it grows, it reaps the benefits of that growth, but also encounters some problems. Some of its "clothes" may not fit well anymore; some of its relationships may be changing; its voice may change a little; and it will begin to look for new goals and challenges. At the recent annual meeting in Anaheim, I was asked what I was going to do to focus the energies of this adolescent organization to make sure that it applies itself, directs its energies, and doesn't get into trouble.

As I reflected on that question, I realized quickly that I wasn't going to do anything about that—nothing at all.

And that's because I'm not going to do it, we are going



Fran Acquaviva

to do it. You and I.

You, the volunteers, who give of your time, your wisdom, and your strength;

You the organizations that advertise and exhibit with us, who share with us your support and creativity;

And you, the members, for whom this organization really exists. RCI is your organization. It belongs to you. You are its investors and shareholders.

Our job on staff is to preserve and increase the value of your investment, and to be sure it works for you. To do that well, we need to know what you're thinking, what your needs are, and what you want from RCI.

And so we're back to communication. I am hereby sending you my message, and I need to hear your response. I urge you to call us (1-800-828-1902); write to us (RCI-7424 Chapel Hill Rd., Raleigh, NC, 27607) or e-mail us (RoofConsln@AOL.com.). Let us know what you want from your organization. Let us know what we're doing wrong, and what we're doing right. That's the only way that the association can continue to grow.

I'm looking forward to moving RCI ahead with president Robb Smith, other volunteers and our very competent staff... But mostly, I'm looking forward to managing an organization that responds to you and that you're proud to be part of. I have great confidence in our future.

What Do You Think?

RCI is considering making members' names and addresses available on its new Website. We would like your input on whether you would approve or oppose such a move, and why. Please respond by faxing this notice to 919-857-1328 or giving us a call at Headquarters, 1-800-828-1902. Look for our Website soon at a computer near you!

I am opposed

I am in favor

Because: _____

Name: _____

Phone Number: _____ Fax Number: _____

MEMBER NEWS

NEW MEMBERS FOR APRIL 1997

NAME	REGION	CATEGORY	NAME	REGION	CATEGORY
David Bieber	I	Industry	Marvin F. Henderson	II	Professional Affiliate
S. Scott Birch	II	Facility Manager	John P. Munday	VI	Facility Manager
Mark Curry	VI	Professional	David H. Northam	II	Associate
Robert C. Gallion	I	Facility Manager	Yvonne M. Poston	II	Industry
Mike Gardner	II	Professional	Ron Sheets	VI	Professional Affiliate
Aubry Gunderson	II	Facility Manager			



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EDUCATION REPORT

General Motors Site Managers Take RRO

Thirteen members of the consulting and engineering firms, Conley Design Group, Louis Berger & Assoc., Middough Assoc., Inc., and Wharry Engineering, took the RRO exam on Saturday, May 17 as part of a four-day site manager training course for the General Motors Corporate Roofing Program.

A refresher seminar on roofing and quality observation was presented by RCI member Don Mapes, a roof technician with Building Technology Associates (BTA). The RRO exam was then proctored by Dennis McNeil, RRC, CCS, RRO.

The GM site manager training includes sessions by ASCE in OSHA certification and Fall Hazard Training; and by BTA in reroofing specifications, construction reporting and enforcement, and administration and computer software.

Correction

Photos of new RRCs and RROs present at the convention were inadvertently switched on page 25 of the June 1997 issue of *Interface*.

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U.S. Department of State, Office of Foreign Buildings Operations, Operations and Post Support, Facilities Division has openings for Roofing Architects. Incumbent manages roofing and waterproofing on existing State Department facilities overseas.

Mandatory requirements: Applicants must be U.S. citizens to apply (provide proof of citizenship) with extensive knowledge of roofing and waterproofing systems, materials and structural performance, have a degree from an accredited university as an architect or engineer with at least 5 years experience directly related to roofing/waterproofing assessment and design; and certification as either a registered architect, professional engineer or registered roof consultant. Position is a one-year renewable personal services contract at the GS-12 through 14 equivalent depending on experience. Position requires frequent overseas travel. Submit applications to:

AFBO/RMO/MHR -#97-012,
P.O. Box 12249
Rosslyn Station
Arlington, VA 22219

QUESTIONS? SUGGESTIONS? PROBLEMS?

Contact RCI's staff at Headquarters. They work for you.

Francis B. Acquaviva
Executive Director



Joni Nelson
Secretary

Kris Ammerman
Interior and
Sales Administration

Michelle Samuels
Office Administration
and Reception

CALENDAR OF EVENTS

July 1997 	16-19 FRSA 75th Annual Convention • Orlando, Florida Info: (407) 671-3772 18 Region 3 Meeting  • South Haven, Michigan	7 Regions 3/4 Joint Meeting @ MRCA  • St. Louis, Missouri RRC exam given to  approved candidates 19 Region 6 Meeting  • San Diego, California 20-21 Building Envelope Symposium • San Diego, California	
Aug. 1997 	10-13 National Building Products Expo • Chicago, Illinois Info: (847) 605-1025		
Sept. 1997 	11 Region 4 Meeting  • Austin, Texas 17-19 4th Intern. Symposium on Roofing Tech. • Gaithersburg, Maryland Info: (847) 299-9070 20 Region 1/2 Joint Meeting  • Gaithersburg, Maryland RRC exam given to  approved candidates 25-26 Building Envelope Symposium • Dallas, Texas 25-27 ICAA Convention & Trade Show • Denver, Colorado Info: (703) 739-0356 29-2 BOCA Annual Conference Norfolk, Virginia Info: (708) 799-2300, Ext. 248	Dec. 1997 	4-5 Building Envelope Symposium • Hartford, CT 4-7 Advanced Roof Consulting Course Region 7 Meeting  • TBA RRC exam given to  approved candidates 12-13 Rooftop Quality Observation Course • Chicago, Illinois RRO exam given to  approved candidates 12 Region 1 Meeting  13-14 Basic Roof Consulting Course • Boston, Massachusetts
Oct. 1997 	10-11 Rooftop Quality Observation Course Region 2 Meeting  • Mobile, Alabama RRO exam given to  approved candidates 16-17 Restoration '97 • Chicago, Illinois 17-18 Basic Roof Consulting Course Region 7 Meeting  • TBA 28-30 Metalcon • Atlanta, GA Info: (617) 965-0055	Mar. 1998 	12-14 Restoration 98 • Boston, Massachusetts Info: (508) 664-6455
Nov. 1997 	6-7 Rooftop Quality Observation Course Region 5 Meeting  • Denver, CO RRO exam given to  approved candidates	Apr. 1998 	4-9 13th Annual RCI Convention & Trade Show • Dallas, Texas

 RRC/RRO Exams  Region Meetings

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