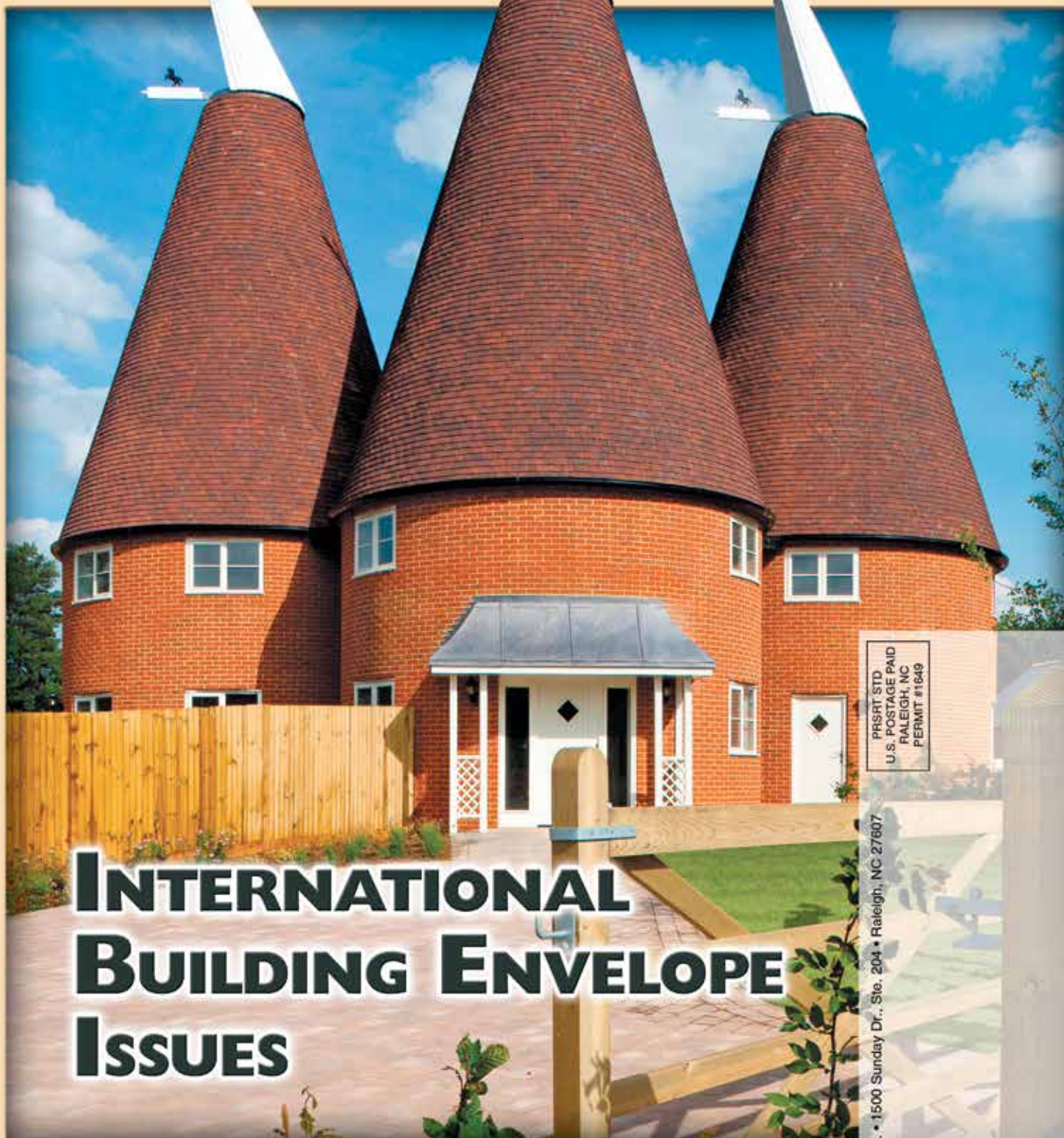




The Journal of RCI

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RCI was chartered, in part, to bridge the gap between the seemingly disparate elements of the roofing profession. It later expanded to include issues of waterproofing and of the entire building envelope. The goal of *Interface* is to connect these elements, educate and inform about related topics, establish a common ground for discussion, promote Association programs, and reach out to the industry at large. The articles contained in this publication are intended to provide information that may be useful to readers of *Interface*. 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, Inc.



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In This Issue: We explore various aspects of roofing and waterproofing "on the other side of the pond," with contributions from Germany, Great Britain, and the United Arab Emirates.

On the Cover: This new home, built on the site of a former oast, mimics the historic oasts common in the Sussex area of England. This structure is made of Alban clay tile in Sussex Blend by Sandtoft Roof Tiles. Photo courtesy of Sandtoft. See article, page 34, on oasts.



A handwritten signature in black ink that reads "Arthur P. Ward III".

Arthur P. "Chip" Ward, RRC
President

2012

in Review

I thought it would be good to look back over 2012 and recap some of the things that highlighted the year at RCI. We started out with a bang by developing and releasing a new Strategic Plan for the next five years. We established five major goals: education, membership, image, leadership development, and advocacy, with objectives and strategies for each goal, which I elaborated on in my President's Messages over the year.

The 2012 convention in Dallas was a huge success with record attendance; a great variety of technical sessions for roofing, waterproofing, and exterior wall consultants; and good weather for our outdoor activities. We sent past president Rick Cook out in style at the President's Banquet.

At my first board meeting following the convention, I established a Governance Task Force to look at how RCI is governed and what changes may be necessary in the future to better represent the membership. This task force is examining the makeup of the board of directors, regions, chapters, and future growth areas. We will be expecting recommendations from the group in the near future.

In June of this year, the RCI Board of Directors adopted a position statement on procurement that was released to the media. This is the crown jewel of achievements for RCI this year. I thank all the board members for their efforts in producing this position statement over a short time frame. In July, I testified on this subject before the Texas House of Representatives Committee for Government Efficiency & Reform, representing RCI as president. It was a great learning experience, and we believe we are making inroads in changing

how procurement cooperatives do business in Texas. This fight will be occurring in many more states over the ensuing years.

We held our midsummer Executive Committee meeting in July in beautiful Vancouver, BC, Canada; and the Board of Directors' summer meeting in Orlando, FL, at the Rosen Shingle Creek Resort, site of the 2013 convention. I briefly described some of the major items of discussion from those meetings in my President's Messages in the past two issues of *Interface*.

The Technical Advisory Committee announced that the Board of Standards Review has approved ANSI/SPRI/RCI NT-1-2012, the consensus-based standard for nuclear testing of roofs, and it was published by ANSI in July. Thanks to the work by David Hawn, SPRI, and the joint committee members for accomplishing RCI's first ANSI standard.

In August, after more than two decades on the job, Lyle Hogan resigned as senior editor of *Interface's* Editorial Board, earning our appreciation for his years of passionate dedication.

This year's Building Envelope Symposium was held in October at the Sheraton Hotel in Phoenix, AZ. Over 200 attendees heard 12 excellent presentations on building envelope topics.

I look forward to the next two and a half months of my presidency and the upcoming convention March 14-19, 2013, in Orlando, FL, at the Rosen Shingle Creek Resort, my favorite convention location. We will be celebrating RCI's 30th anniversary. Please make your plans to attend.

Finally, I would like to wish everyone a joyous holiday season and a happy, prosperous new year.



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Re: "Building Envelope Peer Reviews – Tips & Techniques" September 2012 *Interface*

Peer Review¹—the evaluation of creative work—was the subject of an article in the September issue of *Interface*. "Building Envelope Peer Reviews – Tips and Techniques," by Douglas R. Stieve, RRC, AIA, is a well-researched, well-written, and comprehensive discussion of the advantages and techniques for obtaining peer reviews, specifically the design of the building envelope. He concluded that peer reviews can minimize design errors.

The benefits of a peer review of architectural projects were also discussed by the late Carl G. Cash, PE, a principal and vice president of Simpson Gumpertz & Heger, Inc., in a paper written in April 1994.

The Cash paper as well as the Stieve article stress the importance of having the review performed by a professional whose background, experience, and expertise are the equivalent or of a higher skill set than that of the designer and who can also offer a different perspective leading to a better set of documents.

Each author argues that a peer reviewer may bring a new perspective to the project, based on his prior experience or superior knowledge, whereas a designer may not have considered other products or systems that may be more suitable for [his or her] particular project.

Although it is true that the architect prefers to stick to familiar products and has a strong preference for certain materials and components that [he has] used previously, as Margaret MacKinder noted,² the

same can also be said of the peer reviewer, who may have his own prejudices and preferences.

As Mr. Stieve pointed out, peer reviews are becoming more common, and more professional firms are offering this as another service that they can offer clients. As with all other professional services, peer reviews provide an additional stream of revenue that can improve the bottom line of those firms [that] actively seek this work.

Still, this may pose a challenge to their objectivity and cause some firms to go beyond a review of the contract documents and recommend other systems or materials that they are not only familiar with, but in which they may have had a financial or personal interest.

For example, professional firms that are retained by manufacturers to provide technical services may be influenced by their past relationship and develop a bias that they then attempt to force on the designer... to change his systems or materials in order to be consistent with their own views.

If the designer has reason to suspect that a reviewer has a personal interest or bias in recommending a particular manufacturer or a system and fails to disclose his conflict of interest, he may react adversely to any and all recommendations, thus contravening the entire review process.

For this reason, the selection of peer reviewers must be undertaken with great care, based not only on their technical qualifications, but on their reputation for impartiality.

As a member of a professional consulting firm [that] both performs peer reviews and has [its] designs subjected to review by others, we would suggest the following: The entity that retains a firm to review the design documents should require the reviewer to bring to its attention whether he or his firm has a conflict of interest or has had a contractual agreement with any manufacturer that [he] might recommend as alternates to the design documents.

Most professional organizations publish a code of ethics, and RCI is no exception.³ Under Obligations to the Client, Article IV, [RCI's demand] that members "avoid any

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significant financial or other interest...that could compromise their professional judgment...without making full disclosure to the client..." That statement should apply to the peer reviewer as well as the practitioner, regardless of their affiliation with professional organizations.

**Justin Henshell, FAIA
Henshell & Buccellato,
Consulting Architects
Shrewsbury, NJ**

References

- 1 "Peer" is defined in the dictionary as a person of equal standing.
- 2 Margaret MacKinder, "The Selection and Specification of Building Materials and Components," Research paper 17, Institute of Advanced Architectural Studies, Univ. of York, York, UK, 1980.
- 3 *RCI Manual of Practice*, "Article 1.1.5, Code of Ethics and Professional Responsibilities," revised March 28, 2006.

The author concurs with Mr. Henshell's comments and wishes to thank him for reminding the design community to avoid and disclose any potential conflict of interest, which the article failed to mention.

SUBJECT: Would You Look at That!

I got a good chuckle out of the picture in your "Would You Look at That" column of the *Interface* magazine, but I didn't read the little inscription next to it. It was one of our senior roofers who read it and mentioned that this is definitely not the work of a roofer, and I would have to agree with him. As a matter of fact, I will go as far as to say as a licensed roofer and 28-year veteran, I am offended and insulted by your comment.

On many occasions, I have seen things to make me think "I've seen it all now," but soon after I will find something just a little worse or a little harder to comprehend.

The perpetrator of this Dr. Seuss conglomeration is most likely a mechanical contractor or a property owner/tenant. What would a roofing contractor gain by setting an exhaust curb on top of an existing exhaust pipe? A roofing contractor would want the owner or mechanical contractor to remove the existing curb and install the new curb properly. I have been saying for years that mechanical contractors are a roof's worst enemy. In this case, the roofer gave the mechanical contractor or owner/tenant a price to roof in the exhaust curb, and the mechanical contractor said, "The roofer is ripping you off; I can easily sit the new exhaust right on top of the existing pipe and save you a ton of money." That's a more realistic scenario.

We recently came across a situation where a mechanical contractor had installed a fairly large side-discharge HVAC unit on

top of 10 or 12 plastic gas line supports in place of a set of sleepers.

Sorry, but this is the work of a mechanical contractor, not a roofing contractor.

**Bob Andrews
Conestoga Roofing
Cambridge, ON**

Re: Oct. 2012 Seuss Would Be Proud

I take exception to and just had to respond to the caption to the photo.

Mr. Watsky's comment that he had "seen a lot of creative techniques used by roofing contractors" does not apply to this photo. The fact that the exhaust fan is installed to an existing penetration is completely indicative of a mechanical contractor avoiding the cost of employing a roofing contractor to properly install and flash the exhaust fan.

The roofing contracting industry receives enough black eyes on its own, and it would be nice if the other trades that frequent the roof were held accountable for their own transgressions.

**Todd Smith, RRC, PE
Hamlin Roofing Company
Garner, NC**

The stated goal of the "Would You Look at That" column is to bring some levity to our lives. But Mr. Smith's and Mr. Andrews' comments raise some awareness of a legitimate issue.

CANADIANS RECRUIT SKILLED CONSTRUCTION WORKERS IN IRELAND

Recruiters from the British Columbia Construction Association (BCCA) traveled to Dublin, Ireland, in March to search for qualified construction workers for the province. With an unemployment rate of twice that of BC, at 14.2%, and a pool of skilled laborers, Ireland is considered a good target for recruitment of laborers.

It is estimated that about 35,000 workers will soon retire in BC, leaving large gaps in senior site management and trade positions. An additional 45,000 jobs need to be filled to complete major projects already planned, according to estimates by the BC Ministry of Jobs, Tourism, and Innovation.

Another objective of the delegation was to better understand Ireland's apprenticeship system to determine if there is a close match with Western Canada's system.



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Phil Moser, PE, LEED AP – Simpson Gumpertz & Heger, Inc., Waltham MA

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John F. Duntemann, PE, SE – Wiss, Janney, Elstner Associates, Inc., Northbrook, IL
Christopher W. Giffin, AIA – Wiss, Janney, Elstner Associates, Inc., Duluth, GA

Wind Uplift Resistance Evaluation of Commercial Roofs With and Without Add-ons

Bas Baskaran, PhD, PEng – National Research Council, Ottawa, ON

Testing Metal Wall Panel Systems

Michael Slocumb – FM Approvals, Norwood, MA

Critical Performance Attributes of Preapplied Waterproofing

Craig Boucher, LEED AP – W.R. Grace & Company, Cambridge, MA

Measuring the Energy and Environmental Benefits of Roofing Systems

James L. Hoff, PhD – Center for Environmental Innovation in Roofing, Washington, DC

Standard of Care – What Is Your Risk?

Richard Canon, FRCI, RRC, PE – Canon Consulting & Engineering Co., Inc., Moore, SC
Stephen E. Hentz, RRC, RWC, REWC, RBEC, PE, CDT – Hentz Engineering, Virginia Beach, VA
Gretchen M. Ostroff, EIT, Esq. – Vandeventer Black LLP, Norfolk, VA

Do You Really Know When to Use a Vapor Retarder in a Roof System?

Jerry Teitsma, RRC, RRO, CCCA – RCI, Inc., Marco Services, Inc., Granby, CO

Where Does the Heat Go?

Samir Ibrahim, AIA – Carlisle SynTec Systems, Carlisle, PA

Traditional and Nontraditional Retirement Strategies in Today's Uncertain Economy

Katharine F. Clark, ChFC, CLTC – Peachtree Planning Corporation, Macon, GA

The International Codes

Wanda Edwards, PE – RCI, Inc., Raleigh, NC

Recommended Procedure for High-Voltage Membrane Integrity Testing

Carole Ceja, RA – Wiss, Janney, Elstner Associates, Inc., Chicago, IL

How to Survey a Slate Roof

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Karim P. Allana, RRC, RWC, PE – Allana Buick & Bers, Inc., Palo Alto, CA

Case Study: Waterproofing Strategies for Typical Mat and Deep-Foundation Systems

Stephen T. Bono, SE – Simpson Gumpertz & Heger, Inc., San Francisco, CA
Andrea B. Bono, PE, LEED AP BD+C – Simpson Gumpertz & Heger, Inc., San Francisco, CA

Test Method Changes Impact on Roofing Solar Reflectance and Thermal Emittance

Jeffrey Steuben – Cool Roof Rating Council, Oakland, CA

Roof Ventilation for Cathedrals: How Much Is Sufficient?

Marlea Knox, CDT, CSI – Metal-Era, Inc., Waukesha, WI

Condensation Risk of White Roofs in Cold-Climate Zones

Manfred Kehler – Oak Ridge National Laboratory, Oak Ridge, TN
Simon Pallin, LicEng – Chalmers University of Technology, Knoxville, TN

Changes to FM Approval Standard 4470

Mark Tyrol, PE – FM Approvals, Norwood, MA

Waterproofing Design and Construction Coordination and Sequencing

Jerry Abendroth, RRC, RWC, RRO, CDT, CSI – Building Exterior Solutions, LLC, Houston, TX
Matthew McElvogue, RWC, PE – Building Exterior Solutions, LLC, Houston, TX

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Matthew Kutzler, PE, CDT – Facility Engineering Associates, PC, Fairfax, VA

From the Grave to the Cradle: Adaptive Reuse of a Grand Old Southern Hotel

Matthew C. Farmer, PE – Wiss, Janney, Elstner Associates, Inc., Fairfax, VA

Poor-Quality Material, Plus Poor Workmanship . . .

The Confluence of Both Leads to a Catastrophic Roof Failure and Serious Litigation

William A. Kirn, RRC – Roof Technology Management, Inc., King of Prussia, PA

Auxiliary Seminar - Sealant Technology & Application

Auxiliary Seminar - The Development of the Florida Building Code ... But Wait! There's More!

Michael L. Goolsby, RRC, RRO, LEED AP BD+C, CDT, CBO – Miami-Dade County Department of Regulatory and Economic Resources
Frank Zuloaga, RRC, RRO, LEED AP BD+C – Miami-Dade County Internal Services Department

ROOFING THE DUBAI INTERNATIONAL AIR TERMINAL CONCOURSE II

Dr. W.T. (Bill) Mansell, Hon DEng, FAIB, FAIM, AAAS



This article was published originally in the Proceedings of the 2009 RCI Building Envelope Technology Symposium, San Diego, CA.

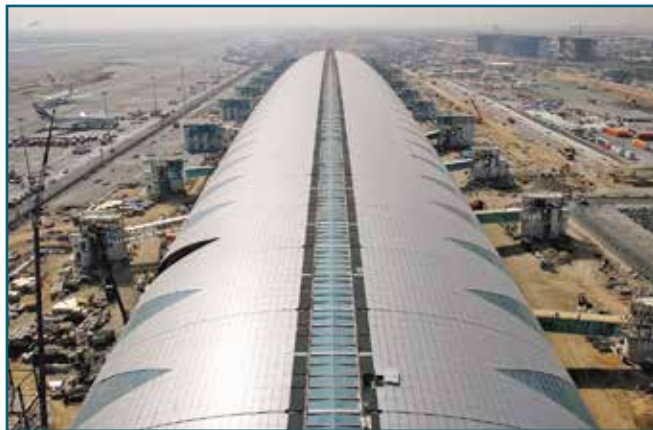
INTRODUCTION

The Dubai International Air Terminal is an exceptional building, approximately 1 kilometer (0.63 mile) long and has a composite roofing system of approximately 80,000m² (860,000 sq. ft.). The geometry of the external cladding is double curvature and includes the requirement for both structural and architectural, elliptical-shaped components. The overall roof/ceiling construction includes 11 individual layers of various materials to achieve structural, thermal, acoustic, and aesthetic performance results. The installation of the roof and ceiling system on this project involved approximately 700 management, technical, supervisory, and working staff for approximately 12 months. The building became operational on schedule in October 2008. With ancillary facilities, the total cost was approximately \$4 billion U.S.

The building provides 26 aircraft loading bridges (with several capable of handling the new A380 Air Bus) and also includes two international hotels, massive lounges, duty-free shopping, immigration, customs, and baggage services.

Complex construction and geometry create a number of challenges, both for the designer and contractor.

The intention of this article is to show that, while we endeavored to use standard products and materials, varying combinations and construction techniques can be used to create unique, long-lasting, and aesthetically



*Figures 1 and 2 –
Dubai International Air
Terminal, Concourse II.*



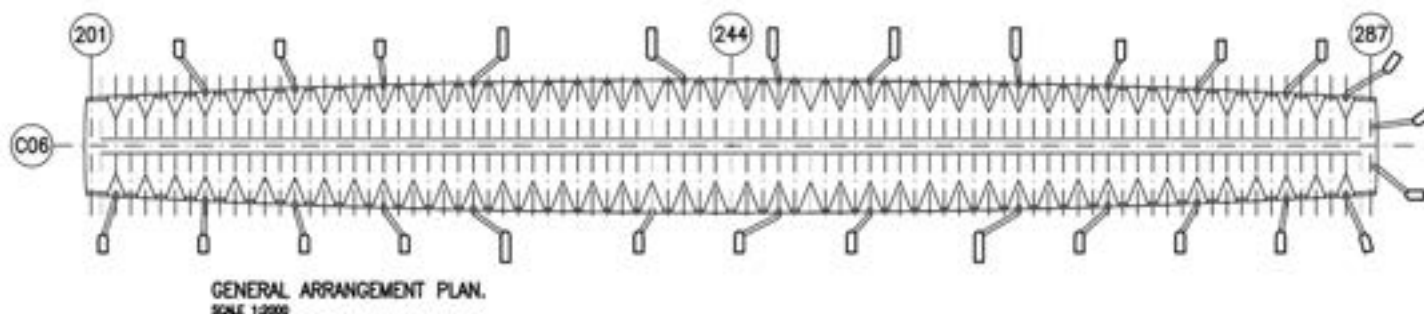


Figure 3 – Dubai International Air Terminal building plan.

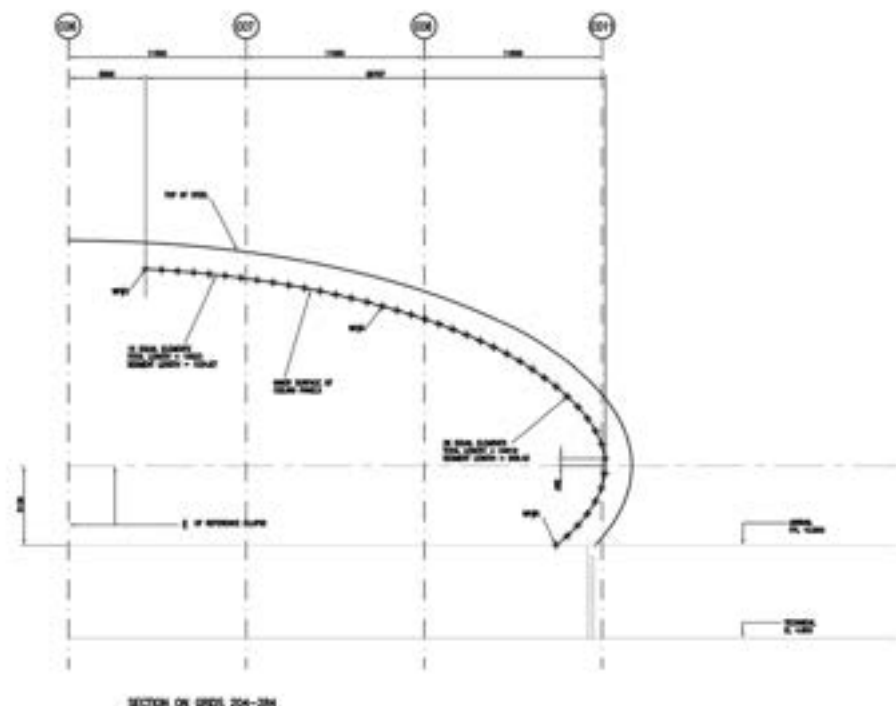


Figure 4 – Dubai International Air Terminal elliptical area cross section.

MATERIAL	PRODUCT
Galvanized steel	Structural deck
Color-coated steel	Metal roof sheeting
EPDM membrane	Vapor barrier/sarking
Rockwool insulation	General insulation
Glass-reinforced plasterboard	Mass layer – acoustics
Extruded aluminum	External tile support
Composite aluminum panels	External cladding tiles
Stainless steel for flashings and trims	Concealed gutters and flashings
Secondary structural steelwork for support items	Skylight supports
Structural stainless steel components	BMU rails

Table 1

pleasing results. The base geometry of this project is outlined in *Figures 3 and 4*.

The geometry of the building created some challenges in design and construction, which will be discussed herein.

ASPECTS TO BE REVIEWED

As both a designer and contractor, I shall cover the following items:

- Pricing
- Staffing
- On-site and off-site production
- Building geometry
- Roof construction buildup
- Design development
- Testing
- Building maintenance unit
- Workforce

Pricing

Pricing, while not a “technical” component, is obviously extremely important to the client (and the contractor, for his survival). Excluding minor fixings and attachment items, there were probably ten major material cost centers involved in the construction. These are shown in *Table 1*.

Particularly with the metal components, price and supply volatility (together with currency fluctuations) create a major risk factor for the contractor on a fixed-price contract.

The main part of the construction of the concourse took place during a very volatile construction period in Dubai. This also created a shortage of many standard materials, with subsequent price increases.

Fortunately, major suppliers generally can be sympathetic; and if appropriate financial arrangements are made (e.g., establishment of letters of credit for product), then prices can be held firm for the duration of the project.

As with any pricing and contract review, a risk assessment is extremely important; and confirming material costs removes a

substantial risk component from the cost equation.

Labor costs, particularly on such a unique building, are a lot more difficult to calculate. However, this risk, in some geographic areas, is reduced as a result of the low cost of labor.

In addition, management and supervisory staff were a substantial cost. The expense of this staffing included motor vehicles, accommodations, air travel, school fees, and medical insurance.

Staffing

Our total management structure occupied an on-site office, and the standard working week was 10 hours per day and six days per week (not unusual for major international contracts).

All of the senior staff, including management, engineering, material procurement, supervision, and factory management were very experienced in the roofing industry. A number of the staff also had previous airport experience on similar projects, such as:

- Kuala Lumpur International Air Terminal
- Hong Kong International Air Terminal
- Bangkok International Air Terminal

There were several layers of management/supervision with a formal reporting procedure and with all drafting and external consultants reporting directly to the design-and-engineering director.

The management structure included:

- Safety officer
- Quality assurance officer
- Materials handling supervisor
- Factory manager (on-site production was our selected alternative)

Project Quality Assurance and Safety Plan

The project documentation required a detailed quality assurance and safety plan be developed, generally in accordance with ISO 9000. The quality assurance plan required an appropriate interface with the client's quality assurance documentation and was required to cover many aspects, including:

- Document preparation
- Sample submission
- Production review
- Installation

Supplementary to the QA plan, every

activity of installation also required a "works method statement." These were progressively prepared prior to the commencement of the various construction activities.

On-Site/Off-Site Production

Contractors have varying views about the advantage of on-site and off-site production of roofing components. There is generally no substantial cost difference between off-site and on-site production. Convenience and practical considerations are the main determinant. The author believes that on-site production offers several advantages, particularly when many of the components may be of excessive lengths (25 m or 82 ft.), as was the case for the Dubai Concourse II. Advantages were

- Roads in the airport area are crowded, and there is a restriction on the times that trucks may use these roads.
- Length of components requires special permits and escorts. This is avoided.
- Transport damage is eliminated.

On-site production removes all of these difficulties. For the Dubai International Air Terminal, a factory of approximately 3,000m² (30,000 sq. ft.) was established to produce these:

- Galvanized steel structural decking
- Secondary structural framing within the roof construction
- Fabricated welded stainless steel gutter system
- Roof profile
- Stainless steel down pipes and sumps

The on-site factory included these items:

- 14-stage structural deck roll former
- 14-stage roof sheet roll former
- Two purpose-built curving machines
- Brake press
- Guillotine
- General sheet metal equipment
- Welding equipment

As mentioned earlier, several of the components were required to be profiled to an elliptical shape, and this included the structural decking (3 in. deep) and the roof sheet profile (2.5-in. rib height).

The curving was achieved by a crimp-curving procedure with a constant angle change. The elliptical profile was developed by a program that allowed vari-



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Figure 5 – Part of the Dubai Terminal on-site temporary factory with stocks of finished product in the foreground.

able spacing of the crimps. This procedure was able to produce a very accurate elliptical profile. The curving machine was purpose-made for the Dubai project. Transportation of the elliptical profiles and long (82-ft.) sections will be covered later in this article.

The factory produced components as required from stocks of raw material being housed within the complex (painted and galvanized coil steel and coil stainless steel).

The major advantages were that product was always available on-site, and with variable length material, sizing could be transferred directly from site to factory in a short time span. During the course of production for the Dubai Terminal, the factory handled in excess of 1,000 tons of coiled material (see Figure 5).

Plant and Equipment

Apart from the roll forming and curving equipment mentioned previously, special on-site transport vehicles needed to be developed to be able to handle lengthy elliptical-shaped product. Semitrailers were specially modified to have adjustable carrying racks. Also, multilifting point spreader bars were transported with the trailer to allow for ease of lifting.

All roofing products were craned into position using 200-ton extended mobile reach cranes. As with all projects at an active airport, considerable care had to be exercised in relation to the height and location of the jib and also the location of on-site transport equip-



Figure 6 – Crane lifting secondary components to the roof level. Special on-roof support platforms were required.

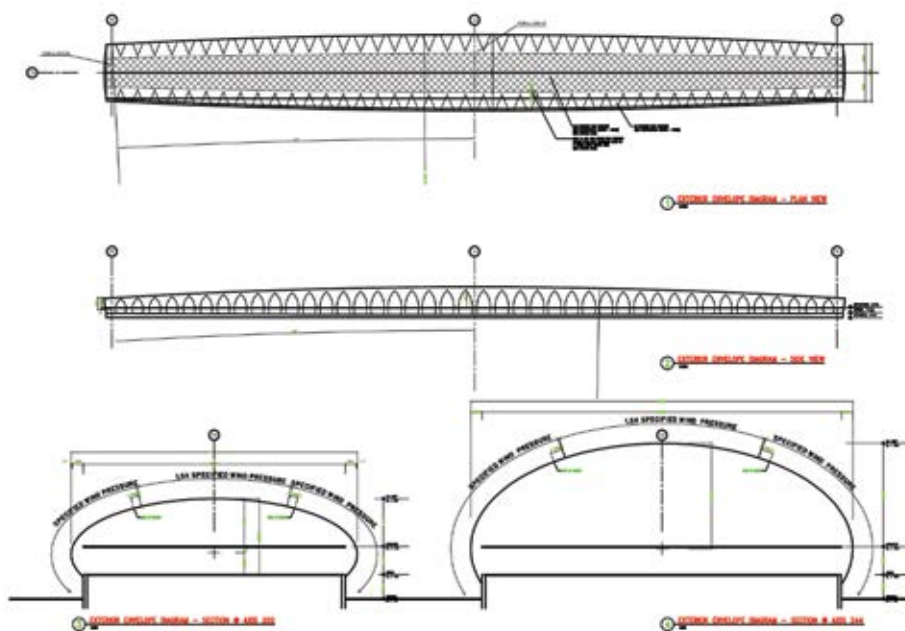


Figure 7 – General details.

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Figure 8 – Shows coordination of the cladding and glazing geometry.

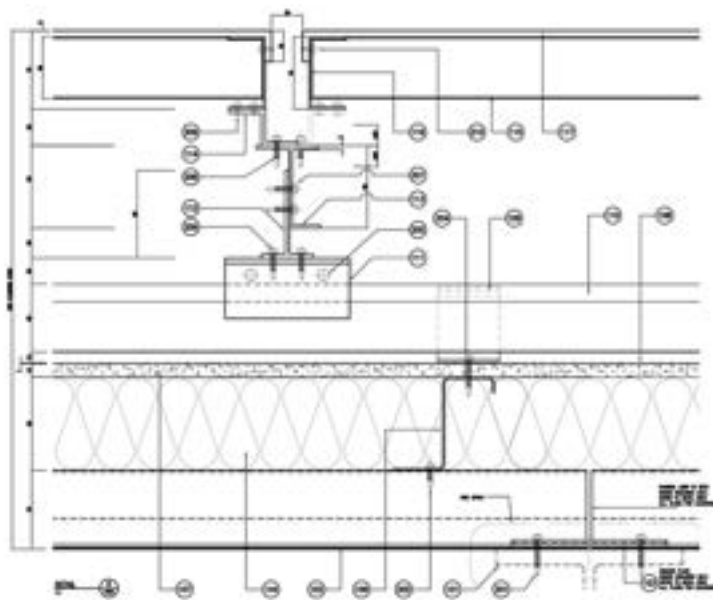


Figure 9 – Section through roof/cladding construction.

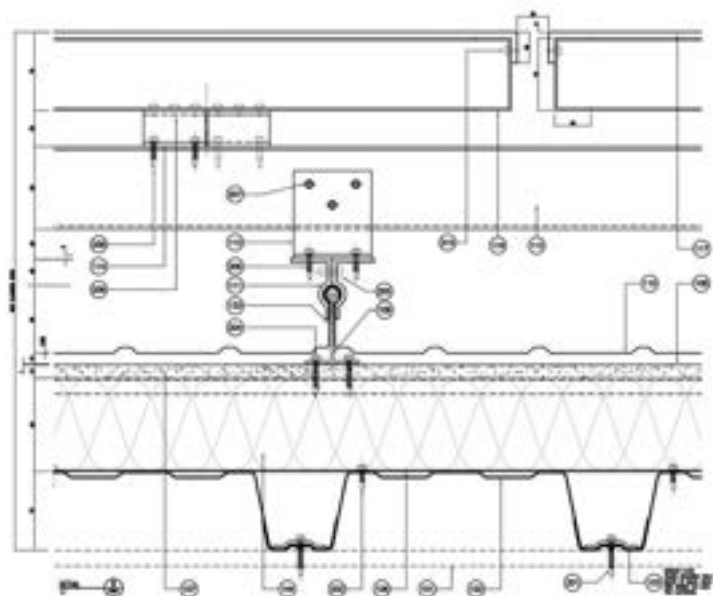


Figure 10 – Section through roof/cladding construction.

ment on the active side of the airport.

Crane lifts were not heavy. Reaching the correct locations was the important requirement. Maximum weight of each lift would be no more than 2 tons (see Figure 6).

Building Geometry

Please refer to Figure 7, which provides both a plan view and cross section of the building. As will be seen, the geometry is multicurvature with tapers occurring in both plan and elevation, with the cross section being elliptical and with every construction rib a different dimension.

Both in the structural decking and metal waterproofing, and for the outer cladding tiles, tapering suited this difficult geometry. (Theoretically, every tile is a different shape – approximately 30,000 tiles.) Special programs were developed to determine the production size for these components (see Figure 8).

The overall geometry was made even more difficult as the teardrop-shaped skylight transoms also were required to align with the tapering longitudinal joints in the external cladding system (each “teardrop” is a different size).

The program used for the development of the outer cladding panel size was undertaken by a programmer with previous experience in program development for the tailoring of sailing spinnakers.

Design Development

A short comment will be made on each of these components in relation to design and/or function. See Figures 9 through 11.

1. Structural Decking

The structural decking was roll-formed in the on-site factory. It was specially developed for the project, as the height limit on the deck was three inches, yet maximum spans were in excess of 19 ft. 6 in. Some of the sheet metal technology to strengthen the profile (added deformation) was developed at Sydney University. As previously mentioned, all of the decks are curved to an elliptical profile by the crimped-curve method. The structural deck was fabricated from 1.2-mm- (18-gauge-) thick (galvanized) material.

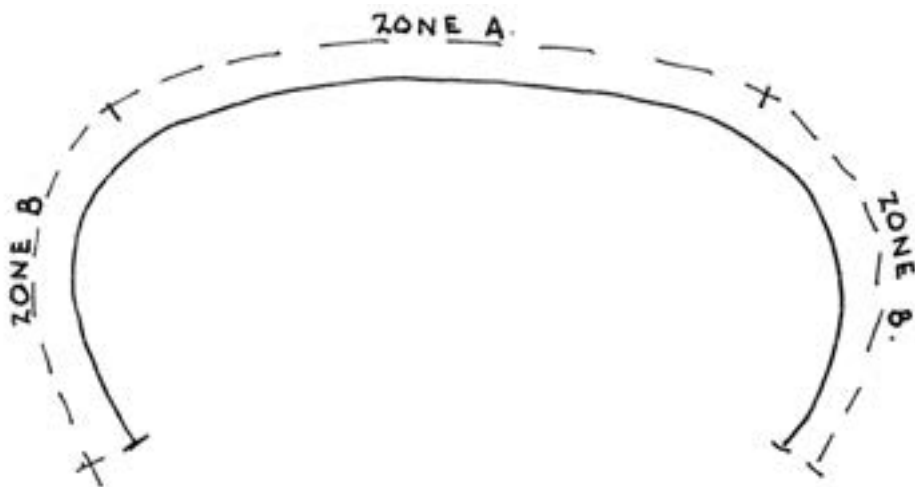
In relation to the general design of the structural decking, it has been our experience that this is normally governed by deflection rather than load capacity.

As with most “lightweight” structures, there appear to be differing opinions between architects and engineers as to what acceptable deflections are. A deflection acceptable from an engineering standpoint may be totally unacceptable to the architect on aesthetic grounds. We would normally suggest that the dead load deflection is in the vicinity of

SPAN
500

Mark #	Name	Description
MK101	Purlins	In accordance with Cleveland drawings
MK102	Metal deck	1.2mm-thick galvanized steel, G300 yield strength, Z275 coating
MK103	Washer plate	3.0mm-thick galvanized steel, G300 yield strength, Z275 coating
MK104	Insulation	75mm-thick Rockwool insulation, 80kg/m3
MK105	Insulation	50mm-thick Rockwool insulation, 80kg/m3
MK106	Zed spacer purlin	1.6mm-thick galvanized steel, G300 yield strength, Z275 coating
MK107	Gypsum board	1.3mm-thick gypsum board, fiberglass faced
MK108	Vapor barrier	1.22mm-thick EPDM membrane, color black
MK109	Roof clips	Extruded aluminum-alloy 6063-T6, 20 microns natural anodized
MK110	Roof sheets	0.88mm-thick galvanized steel, G300 yield strength, Z275 coating, PVDF paint finish, color dark grey
MK111	Roof clamps	4.00mm-thick extruded aluminum alloy 6063-T6, PVDF paint finish, color black
MK112	Tee bracket	4.00mm-thick extruded aluminum alloy 6063-T6, PVDF paint finish, color black
MK113	Support member	3.00mm-thick extruded aluminum alloy 6063-T6, PVDF paint finish, color black
MK114	Zed brackets	4.00mm-thick extruded aluminum alloy 6063-T6, PVDF paint finish, color black
MK115	Internal stiffener	1.5mm-thick extruded aluminum alloy 6063-T6, PVDF paint finish, color black
MK116	Edge stiffener	2.0mm-thick extruded aluminum alloy 6063-T6, PVDF paint finish, color black
MK117	Composite face sheet	6.0mm-thick composite aluminum panels, PVDF paint finish, color metallic silver
MK118	Glazing upper flashing	0.8mm-thick stainless steel, grade 316L, 2D finish
MK119	Glazing cutter	1.2mm-thick stainless steel, grade 316L, 2D finish
MK120	Glazing middle flashing	0.8mm-thick stainless steel, grade 316L, 2D finish
MK121	Upper roof gutter	1.2mm-thick stainless steel, grade 316L, 2D finish
MK122	Lower roof gutter	1.2mm-thick stainless steel, grade 316L, 2D finish
MK123	Upper downspout	1.2mm-thick stainless steel, grade 316L, 2D finish
MK124	Downspout fixing bracket	3.0mm-thick stainless steel, grade 316L, 2D finish
MK125	Glazing lower flashing	0.8mm-thick stainless steel, grade 316L, 2D finish
MK126	Roof eaves flashing	0.8mm-thick stainless steel, grade 316L, 2D finish
MK127	Silicone seal	Tremsil 500 – clear
MK128	Openable composite panel hinge	3.0mm-thick extruded aluminum alloy 6063-T6, PVDF paint finish, color black
MK129	Openable composite panel upper frame	3.0mm-thick extruded aluminum alloy 6063-T6, PVDF paint finish, color black
MK130	Openable composite panel lower frame	3.0mm-thick extruded aluminum alloy 6063-T6, PVDF paint finish, color black
MK131	Spacer top hat	1.0mm-thick galvanized steel, G300 yield strength, Z275 coating
MK132	Zed spacer purlin – small	1.6mm-thick galvanized steel, G300 yield strength, Z275 coating
MK133	Clamp/roof sheet separator	1.2mm-thick EPDM, color black
MK134	Down pipe junction adapter	1.22mm-thick stainless steel, grade 316L, 2D finish
MK135	Lower downspout	1.22mm-thick stainless steel, grade 316L, 2D finish
MK136	Foam closure	25mm-thick polyolefin foam, color black
MK137	Notched closure	0.85mm-thick galvanized steel, G300 yield strength, Z275 coating, PVDF paint finish, color dark grey
MK138	Top hat	2.0mm-thick galvanized steel, G300 yield strength, Z275 coating
MK139	Roof clip 2	Extruded aluminum alloy 6063-T6, 20 microns natural anodized
MK140	Upper roof gutter clip	1.2mm-thick stainless steel, grade 316L, 2D finish
MK141	Lower roof gutter clip	1.2mm-thick stainless steel, grade 316L, 2D finish
MK142	Lower roof gutter bracket	3.0mm-thick stainless steel, grade 316L, 2D finish
MK143	Metal deck infill	1.2mm-thick galvanized steel, G300 yield strength, Z275 coating
MK144	Insulation	90mm-thick Rockwool insulation, 40kg/m3
MK145	Secondary zed spacer purlin	0.9mm-thick galvanized steel, G300 yield strength, Z275 coating
MK146	Roof clip 3	1.6mm-thick galvanized steel, G300 yield strength, Z275 coating
MK147	Roof clip 4	1.6mm-thick galvanized steel, G300 yield strength, Z275 coating
MK148	Gantry track flashing	1.2mm-thick stainless steel, grade 316L, 2D finish
MK149	Support angle	3.0mm-thick galvanized steel, G300 yield strength, Z275 coating
MK150	Zed support	1.0mm-thick galvanized steel, G300 yield strength, Z275 coating
MK151	Zed support - small	1.0mm-thick galvanized steel, G300 yield strength, Z275 coating
MK152	Gypsum board	1.6mm-thick gypsum board, fiberglass faced
MK153	Base channel	1.0mm-thick galvanized steel, G300 yield strength, Z275 coating
MK154	Base zed	1.0mm-thick galvanized steel, G300 yield strength, Z275 coating
MK155	Side fixing angle	1.6mm-thick galvanized steel, G300 yield strength, Z275 coating
MK156	Stud wall framing	1.0mm-thick galvanized steel, G300 yield strength, Z275 coating
MK157	Parapet framing	1.0mm-thick galvanized steel, G300 yield strength, Z275 coating
MK158	Grating	3.0mm-thick extruded aluminum alloy 6063-T6, PVDF paint finish, color metallic silver
MK159	Insulation	150mm-thick Rockwool insulation, 40kg/m3
MK160	Bond breaker	25mm diameter closed-cell expanded polyethylene foam
MK161	Gutter membrane	1.5mm-thick EPDM, color white
MK162	Head flashing	0.8mm-thick stainless steel, grade 316L, 2D finish
MK163	Fixing bracket 1	1.2mm-thick stainless steel, grade 316L, 2D finish
MK164	Fixing bracket 2	1.2mm-thick stainless steel, grade 316L, 2D finish
MK165	Skylight flashing	1.5mm-thick stainless steel, grade 316L, 2D finish
MK166	Parapet flashing 1	0.8mm-thick stainless steel, grade 316L, 2D finish
MK167	Fixing bracket 3	1.2mm-thick stainless steel, grade 316L, 2D finish
MK168	Parapet flashing 2	1.2mm-thick stainless steel, grade 316L, 2D finish
MK169	Stud wall framing	1.0mm-thick galvanized steel, G300 yield strength, Z275 coating
MK170	Parapet zed	1.0mm-thick galvanized steel, G300 yield strength, Z275 coating
MK171	Glazing flashing clip	1.2mm-thick stainless steel, grade 316L, 2D finish
MK172	Membrane base	0.6mm-thick galvanized steel, G300 yield strength, Z275 coating

Figure 11 – Roof cladding materials.



	ZONE A	ZONE B
Ultimate Wind Load kPa	+ 3.22	+ 2.15
Permissible Wind Load kPa	+ 2.15	+ 1.48
Serviceable Wind Load kPa	= 0.85 x 2.15 = + 1.83 kPa	= 0.85 x 1.43 = + 1.22 kPa

Notes: Australian Standard AS1170.2:2002 Wind Actions

- For outer cladding, AS1170.2 does not allow a reduction based on pressure equalization; all external components are designed for full pressure.
- Panel deflection is normally considered at $\frac{\text{SPAN}}{200}$ for maximum live-load condition.

Figure 14.

6. Metal Profiled Roofing

The main waterproofing layer is a profiled metal roof sheet (precoated galvanized steel), 0.8 mm thick (22 gauge) with 65-mm-high (2.5 in.) ribs at 400-mm (16-in.) centers. This is secured with extruded aluminum clips, which are secured to the Z sections as mentioned under the Secondary Z Spacer section (Figure 12). The roof sheet-

ing is able to slide over these clips when thermal or building movement occurs.

7. Cladding Support Framework

An extruded aluminum frame was then constructed and secured to the bulb of the profiled metal roof sheeting. Spacing and dimensions of these secondary components are shown in Figure 13, and the longitudinal support components are tapered in accordance with the roof geometry.

Metal separation is achieved with an EPDM gasket between the roof sheet and aluminum framework. This was required to prevent corrosion from dissimilar metal contact.



Figure 15 – Dubai International Air Terminal testing for water penetration using aircraft engine.

8. Cladding Tiles

The outer tiles are 6-mm “composite” aluminum panels with an external fluoro-carbon coating. These panels are reinforced to allow for foot traffic.

This component acts as a visual screen only and has open joints. There have been some interesting debates in relation to wind pressure on open screen construction (relating to what pressure should be considered).

In this instance, we opted to use the full external pressure that was rationalized from the wind tunnel testing. The design wind pressures considered are shown in Figure 14.

Testing

The client required substantial testing be undertaken on the external envelope system, and three distinct areas of the project were “mocked-up” and incorporated approximately 1,000 m² (approximately 11,000 sq. ft.) of the finished cladding. The system passed all of the tests in Table 2. (See also Figure 15.)



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SUMMARY OF TESTS UNDERTAKEN			
Test	Specified Testing Sequence	Test Standard	Parameter
1.	Static Pressure Air Infiltration	ASTM E283	300 Pa
2.	Static Pressure Water Penetration	ASTM E331	+ 575 Pa for 15 minutes: Water spray rate 204 L/m ² /hr
3.	Dynamic Water Penetration	AAMA 501.1.94	+ 575 Pa for 15 minutes. Water spray rate 204 L/m ² /hr.
4.	Structural Loads Testing Serviceability	ASTM E330	Apply +450 Pa and hold for 10s Apply +900 Pa and hold for 10s Apply -450 Pa and hold for 10s Apply -900 Pa and hold for 10s

Table 2.

Testing Standards

It is an interesting facet of international work that in countries that do not have their own standards (e.g., UAE), the standards normally adopted are those of the country of the primary consultants (architect/engineer). On some international work, it is not uncommon to be required to satisfy BS, DIN, AS, or in some instances, Japanese standards. In some projects (Bangkok International Airport), adherence to BS and ASTM was required.

Secondary testing was also undertaken by Factory Mutual Inc. in the U.S. (Figures 16 and 17), and FM had a joint role of both a testing authority and insurance advisor for the Dubai International Terminal.

All systems used on the structure

required FM approval relating to fire resistance, water penetration, and strength. The required wind uplift classification was to satisfy UL Class 90.

Building Maintenance Units

The bulk of the roof area is accessible for cleaning from a building maintenance unit (BMU), which runs on stainless steel rails that are incorporated within the roof construction (see Figure 18).

The spacing of the rails is approximately 9 m (30 ft.), and the BMU spans between rails and has both on-board water and power outlets. As can be imagined, the rails also are required to be of an elliptical shape and with a heavy stainless steel box section (150 x 150 x 8 mm), so rolling the appropriate

elliptical shape required considerable innovation in developing a variable program for roller wheel adjustment to achieve the ellipse.

A considerable amount of engineering review was required in relation to the load-carrying capacity of the rail and, in particular, the welding capacity for the attachment of the rail stanchions to the base plate.

Climatic Conditions

From a contracting/installation viewpoint, it is appreciated that there are substantial geographic areas within the United States where roof installation is not possible during certain times of the year because of severe snow and ice conditions.

In relation to the Dubai International Air Terminal, the major climatic problem was excessively high temperature during the midsummer period.

Maximum summer ambient temperatures can reach the range of 45-50° Celsius (113-122° Fahrenheit). Obviously, it is not possible to undertake external work in these temperatures, and a normal midsummer working day would commence at 4:00 AM and finish at noon.

On government-sponsored projects in Dubai, allowable working hours during sum-



Figure 16 – Fire testing by Factory Mutual, Rhode Island.



Figure 17 – Fire testing by Factory Mutual, Rhode Island.

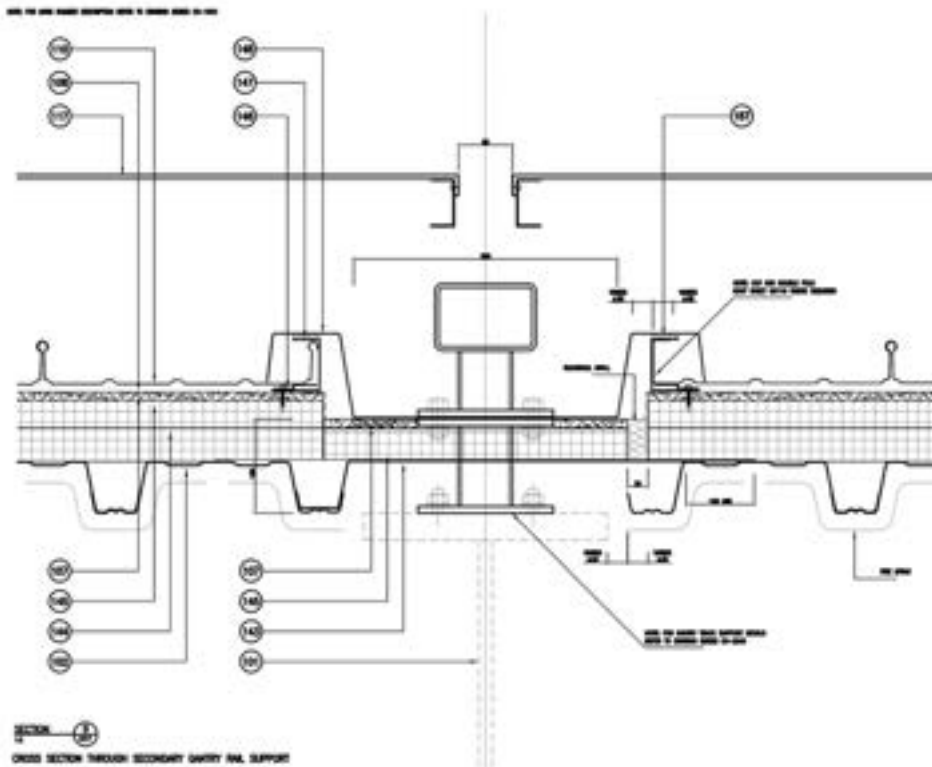


Figure 18 – Integration of BMU rail within the roof construction.

mer are gazetted [editor's note: announced in an official newspaper]. During this extreme temperature period, worker health considerations are foremost, and medication in the form of both tablets and fluids is available to all external workers, who are encouraged to ensure adherence to the required intake.

During the summer months and considering the previously stated ambient temperature, it is possible that exposed components may be 20-30°C hotter than the ambient condition.

Sandstorms are far more frequent than rain, and gutter and drainage systems have to be maintained to ensure that sand build-up does not restrict water flow during the rare occasions when rain occurs.

Rain is normally limited to a two-month period (during winter) and probably averages, for the year, between 50 and 100 mm (2 to 4 in.).

Contractor's Expertise

In discussions with consultants and major general contractors, it appears that there are a limited number of contractors



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available to undertake projects of this magnitude (over \$50 million U.S.). Apart from the financial considerations (cash flow, working capital, performance bonds, suppliers' payment requirements), the management skills required to run such a project and manage a labor force that may exceed 500 applicators needs to be of an extremely proficient and professional level.

The precontract review of prospective contractors for projects of this magnitude should be extensive and consider all aspects of the operation, not only the technical ability. The review should include a detailed commercial and financial overview.

To ultimately achieve a successful project the size of the Dubai International Air Terminal requires the input of many disciplines, including

- Engineering (structural)
- Engineering (mechanical - condensation)
- Engineering (acoustics)
- Engineering (metallurgical review)
- Manufacturing
- Risk evaluation
- Financial and cash-flow planning
- Documentation preparation, including:
 - Work method statements
 - Quality assurance programs
 - Safety program
 - Product/material submission program
- Construction expertise
- Control of heavy plant and equipment
- Supervision
- Workmen's quality and training

Without acceptance of the importance of the above, major projects can develop very

quickly into a commercial and technical disaster, which certainly will limit achievement of the desired result.

CONCLUSION

Both from a design and construction viewpoint, the Dubai International Air Terminal was one of the most difficult projects that the author has been involved with in his 50-plus years of experience in the roofing and cladding industry.

Fortunately, the overall final results are self-evident, with the completion of a very successful building.

In relation to the roof construction, this work has now received several awards, including the following:

- NRCA - Gold Circle Award for

Innovation

- NRCA - Safety Award
- Metal Roofing & Cladding Association of Australia
- Royal Australian Institute of Building (National Professional Excellence in Building Award)

With the ever-expanding requirements of architects and designers, the roof designer and consultant have to accept the challenge to develop systems and solutions that satisfy not only the physical requirements but provide an aesthetic conclusion that supports the architect's original intent. We believe that the Dubai International Air Terminal satisfies these requirements. 

Bill Mansell



Bill Mansell has been involved in the roofing and waterproofing/cladding industry in Australia since 1953, commencing as a cadet architectural draftsman. He currently is managing director of the Chadwick Technology Group, international consultants and contractors for complex roofing systems. Although undertaking recent work in both Southeast Asia and India, Chadwick Technology's main operation is currently in the Middle East, with an overall staff in excess of 800 management, supervisory, and installation personnel. Chadwick's innovation has been awarded with seven Gold Circle Innovation Awards from the NRCA, and major works have also been recognized by the Institution of Engineers Australia, Australian Institute of Building, and the Metal Roofing and Cladding Association of New South Wales. Bill Mansell has specialized in the design development of composite systems incorporating unusual materials (e.g., titanium external cladding) and complex geometry (e.g., the torus profile used on the Singapore Expo Railway Station). He has been involved in considerable structural and acoustic testing of composite systems and has been involved in original research in relation to rain noise on metal roofing. His contributions to the construction and roofing industry were recognized with an honorary doctorate from Sydney University in May 2007. He is a member of RCI, a Fellow of the Australian Institute of Building, a Fellow of the Australian Institute of Management, and an Affiliate of the Australian Acoustical Society.

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Environmental Product Declarations (EPD) for Single-Ply Roofing Membranes in the Context Of European Standardization



By Hans-Rudolf Beer and Mark Schneider

NOTE: As agreed within CEN, the terms EPD and CPR will be used herein for both their singular and plural meanings.

EU STANDARDS FOR CONSTRUCTION PRODUCTS

With the foundation of the European Union (EU), an explicit goal was to remove trade barriers and therefore to ensure a free, unhindered exchange of goods among the member states. The numerous national standards were regarded as such barriers. Mandates were issued by the European Commission to the Comité Européen de Normalisation (CEN) or European Committee for Standardization and other standardization bodies to produce harmonized standards. Member states agreed to adopt these European standards into their standardization scheme and to withdraw conflicting national standards. CEN Technical Committee (TC) 254 was installed to produce standards for roofing membranes accordingly. TC 254 has since produced—among others—the products standards EN13707¹ for Bitumen Membranes and EN13956² for Plastic and Rubber Single-Ply Membranes, according to the European Construction Products Directive

(CPD).

The actual three main activities on the standardization of roofing membranes are:

- Transition from construction product directive (CPD) to construction products regulation (CPR)
- Inclusion of leaching of substances from roofing membranes
- Inclusion of environmental product declarations (EPD) into the product standards

TRANSITION FROM CPD TO CPR

Presently, the CPD issued in 1989 is the base for drafting European standards for construction products. The CPD has been adopted by all EU members and some other countries affiliated by bilateral treaties (e.g., Switzerland). The CPD is part of the national regulations on building materials in these countries. This directive will be replaced by the CPR as of July 1, 2013. The CPR concept is more binding, since it has a regulatory character. It provides for easier application for small and medium

enterprises (SMEs) compared to the CPD. One of its main objectives is the abolition of the national and regional quality labels still existing.

Manufacturers will have to submit a declaration of performance (DoP) to accompany their products. New product standards produced after July 1, 2013, will address seven basic fields of requirement in the CPR called basic requirements for construction works (BRCW):

1. Mechanical resistance and stability
2. Safety in case of fire
3. Hygiene, health, and the environment (enlarged)
4. Safety and accessibility in use (enlarged)
5. Protection against noise
6. Energy economy and heat retention
7. Sustainable use of natural resources (new)

Two of the key elements of the CPR are the requirements on sustainability, namely the sustainable use of natural resources

(BRCW 7), the reduction of life cycle impacts of greenhouse gases, and ensuring the environmental quality in general (BRCW 3). The implication of these new basic work requirements to the EU member states is the obligation to use the newly developed European standards to regulate the topics. Based on these enlarged basic work requirements, the European Commission is in charge of development of new mandates for amendments in the current construction product standards.

LEACHING OF SUBSTANCES

In the fall of 2012, the European Commission issued extended mandates to the technical committees of CEN. These new mandates require the inclusion of test methods and threshold values for the leaching of substances from building products. In addition to the Registration, Authorization, and Restriction of Chemicals (REACH) regulation, this adds up to a more severe assessment of the environmental impact of all building products. The amended mandate lists 39 specific substances to be tested and evaluated for single-ply, bituminous, and rubber roofing membranes, as well as reference to the additional inclusion of national European substance lists. Testing will be based on a leaching test currently under development by CEN/TC 351. This test method will describe the general leaching procedures. Determination of the product group specifics is up to CEN's technical committees and is subject to approval by regulatory bodies.

Environmental Product Declarations (EPD)

EPD for building materials have the general purpose of enhancing sustainability in construction, targeting various aspects, such as the following:

- Improvement of products during the full life cycle
- Integration of environmental criteria in the conception of buildings
- Provision of transparent and reliable information
- Stimulation of continuous environmental improvement
- Encouragement of the demand for environmentally friendly products
- Improvement of market position and image for specific products

As outlined above, the sustainable use of natural resources will have to be

addressed in the revision and drafting of future European standards for building products. Although there is actually no requirement to include EPD into the EN standards, actions are being undertaken to amend existing construction standards according to the new rules.

In the past years, CEN/TC 350 has developed horizontal standard methods for the assessment of environmental aspects of new and existing construction works (building level) and construction products and services (product level). The standards will be generally applicable (horizontal) and relevant for assessing the integrated performance of buildings over their life cycle.

The European Standard EN15804:2012, *Sustainability of Construction Works – Environmental Product Declarations – Core Rules for the Product Category of Construction Products*, is the major part of a suite of standards to assess the sustainability of construction and building products. EN15804:2012 provides core product category rules (PCR) for calculating and declaring the environmental performance of construction products, services, and processes to ensure that all EPD are derived, verified, and presented in a harmonized way. The standard describes the structure and content of an EPD by using a life-cycle approach based on life-cycle assessment (LCA) methodology to calculate the environmental attributes that will be declared in the EPD. The declared values at the product level are necessary requirements for the assessment scheme for sustainable construction.

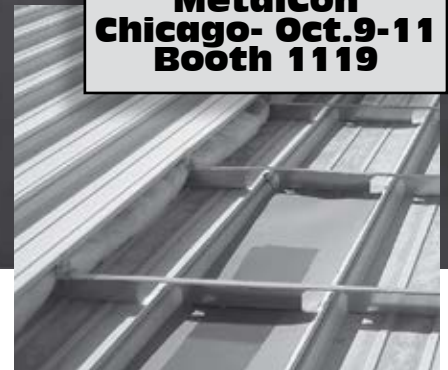
Among others, the key aspects described in the core PCR are the parameters to be declared (e.g., global warming potential) and the way in which they are calculated and reported, as well as the phases of a product's life cycle that are considered (e.g., cradle-to-gate or cradle-to-grave) and which processes are to be included in the life-cycle stages. The core PCR also define rules for the development of scenarios (e.g., use phase, maintenance, etc.) and include the rules for reporting predetermined, environmental, and health information that is not covered by LCA.

The information modules applied for describing the products are shown in Figure 1, defining the relevant life-cycle stages of a building product in a transparent way, namely product stage (modules A1-A3), construction stage (modules A4 and A5), use stage (modules B1-B7), and the end-of-

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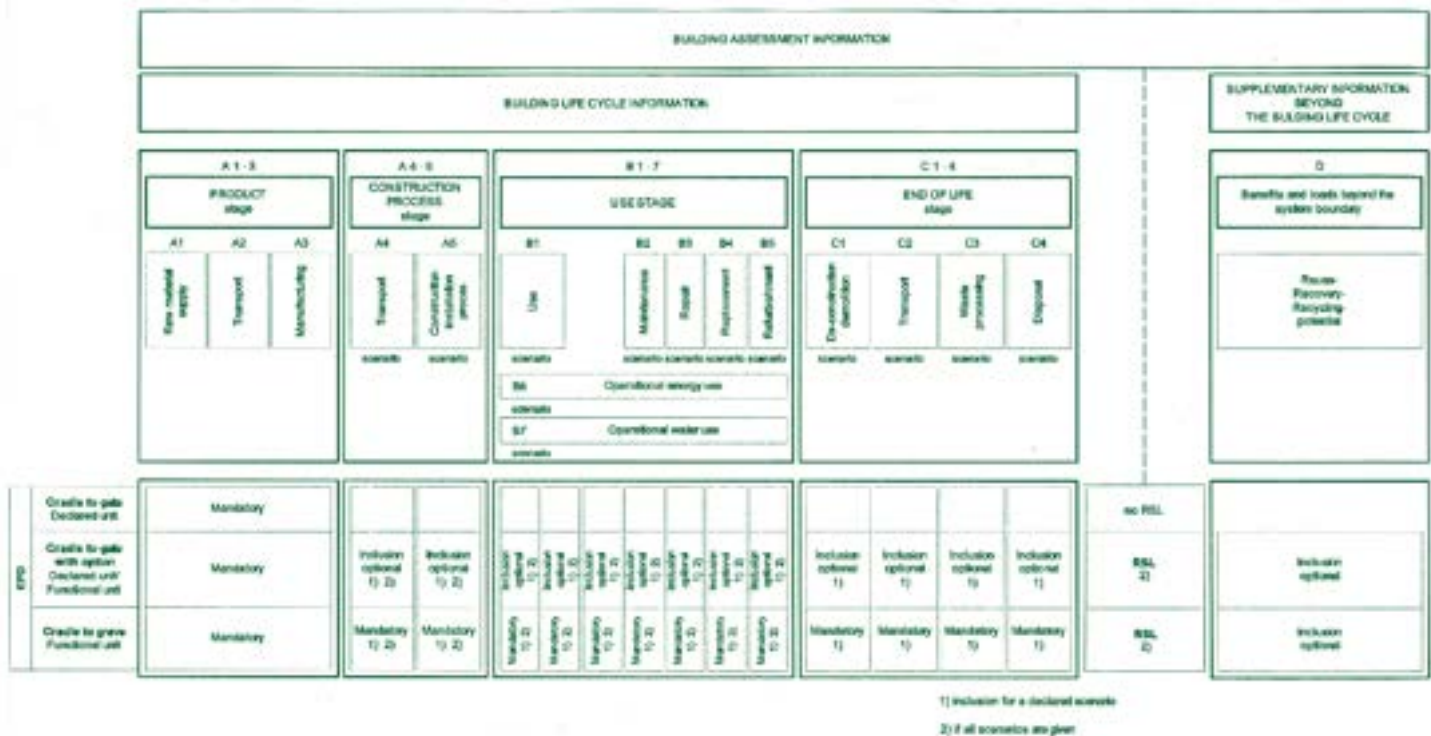


Figure 1 – Life-cycle stages and modules according to EN15804:2012.³



life stage (C1-C4).

Modules A1 to A3 describe the cradle-to-gate scenario, and modules A to C represent the cradle-to-grave scenario. Module D is the system expansion for all environmental impacts beyond the system boundary and includes environmental benefits and loads resulting from reusable products, recyclable materials, and/or useful energy carriers leaving the product system. For example, if a given material is incinerated at the end of its life, the system will be credited with power and thermal energy if the energy of combustion is used to produce them. The incinerated material “replaces” an energy source, and the system is thus credited with the avoided burdens to provide that amount of energy.

EPD have been used for construction products for more than 20 years, since the first environmental assessment schemes were developed. EPD are created and published by different program operators across Europe, such as IBU (Germany), EPD Norge (Norway), EPD (Sweden), BRE Global (United Kingdom), or FDES (France) in accordance with ISO 14025-compliant PCR for the different product groups. Until now, only EPD from the same EPD program could be used for direct comparisons and evaluations. Only within one EPD program are indications on scope, assumptions, boundaries, data quality, and indicators comparable for various products. Differences among EPD programs can therefore cause remarkably different results for the same product. As an example, there currently exist different PCR and EPD for thermoplastic roofing membranes in Europe created by IBU (Germany), NBI (Norway), SFEC (France), and BRE (UK). Given the national cir-

Figure 2 – Front page of EPD for mechanically attached thermoplastic roofing membranes according to the French EPD standard NF P 01-010.



photo courtesy of constructionphotographs.com (File Name: concrete_pour_rebar_cement_truck_010.jpg) Graphics Modified

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Class A Vapor Barriers	2,220 grams	failure	 15 MIL

2 - IMPACTS ENVIRONNEMENTAUX REPRESENTATIFS DES PRODUITS DE CONSTRUCTION SELON LE § 6 DE LA NORME NF P 01-010

Tous les impacts sont renseignés ou calculés conformément aux indications du § 6.1 de la norme NF P 01-010, à partir des données de la présente déclaration (chapitre 2) et pour l'unité fonctionnelle de référence par annuité définie au § 1.1 et 1.2 de cette même déclaration, ainsi que pour l'unité fonctionnelle rapportée à toute la DVT (Durée de Vie Typique).

N°	IMPACT ENVIRONNEMENTAL	UNITE	VALEUR DE L'INDICATEUR PAR ANNUITE	VALEUR DE L'INDICATEUR POUR LA DVT DE 30 ANS
1	Consommation de ressources énergétiques - Energie primaire totale - Energie renouvelable - Energie non renouvelable	MJ/UF	4,0 0,1 3,9	120 3 117
2	Épuisement de ressources (ADP)	kg équiv. antimoine (Sb)/UF	0,0018	0,054
3	Consommation d'eau totale	Litre/UF	1,7	51
4	Déchets solides : - Déchets valorisés (total) - Déchets éliminés : Déchets dangereux Déchets non dangereux Déchets inertes Déchets radioactifs	kg/UF	0,013 0,001 0,073 0,011 1,1 E-05	0,383 0,029 2,18 0,33 0,0003
5	Changement climatique	kg équiv. CO ₂ /UF	0,166	4,99
6	Acidification atmosphérique	kg équiv. SO ₂ /UF	0,001	0,03
7	Pollution de l'air	m ³ /UF	36	1 067
8	Pollution de l'eau	m ³ /UF	0,140	4,2
9	Destruction de la couche d'ozone stratosphérique	Kg CFC équiv. R11/UF	NC	NC
10	Formation d'ozone photochimique	kg équiv. éthylène/UF	8,0E-05	0,0024

Figure 3 – Environmental impact data in EPD for mechanically attached thermoplastic roofing membranes according to the French EPD standard NF P 01-010.

cumstances, these various EPD are specific to the countries and will not be accepted overall across Europe due to the above-described differences. In addition, the various EPD are different with regard to structure, format, and layout. More comprehensive introductions to the topic can be found in various papers.^{4,5}

The major European manufacturers of single-ply membranes are members of the European Single-Ply Waterproofing

Association (ESWA). A group of the ESWA manufacturers has produced a common generic EPD. This generic EPD was specifically prepared for the manufacturers' mechanically attached thermoplastic roofing membranes (Figure 2), drafted according to the French Standard NF P 01-010.⁶ It was finalized before the publication of EN15804:2012; and thus, the PCR used differs slightly from the EN standard's requirements. The EPD as shown in Figure

2 is mainly used in the French marketplace. Other manufacturers have specific national EPD in use.

With the publication of the new harmonized Standard EN15804:2012, the basis for EPD with validity in all EU and associated countries has been laid. For implementation, all European EPD programs have to adapt the existing PCR and EPD of the different product groups to ensure accordance with the requirements. The goal is thereby to harmonize the existing PCR across the different EPD programs by defining a European core EPD that is valid and accepted by all European program operators. This will have the benefit that manufacturers with offerings in different European market regions can use a single EPD to communicate the environmental attributes of their construction products. They will no longer be forced to produce separate EPD for each country, which will significantly reduce the costs and increase customer acceptance.

SUMMARY

The harmonization of European standards for building products is entering a new stage. The transition from CDP to CPR will provide more stringent regulations regarding the declaration of the performance of products. The focus is clearly pointing to sustainability in construction. Standard test methods and procedures for the leaching of substances are published or are under preparation and will have to be implemented in all European building products standards by mandate of the European Commission. The European Standard EN15804 on the core rules for product category of construction products has been published. This standard provides the basis for the preparation of harmonized EPD with Europe-wide validity. Harmonized EPD for single-ply roofing membranes are expected to appear in the near future.

U.S. and European standards for roofing membranes usually describe the same properties of the products. However, the test procedures are, in general, somewhat different. 

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Hans-Rudolf Beer

Hans-Rudolf Beer is product technology director of roofing and waterproofing for Sika Technology AG in Sarnen, Switzerland. He has worked in the roofing and waterproofing industry for 25 years. Beer began his career with Sarnafil in research and development and marketing. With the acquisition of Sarnafil and Sucoflex by Sika in 2006, he was appointed product technology director of joint roofing and waterproofing activities. He is a contributing member in various technical committees (CEN, SIA, DIN, CIB/RILEM). Beer has published numerous technical papers and is a frequent speaker at international conferences. He is chairman of CEN Technical Committee 254, "Flexible Sheets for Waterproofing (Bitumen, Plastic and Rubber)" and holds a PhD in chemistry from the University of Zurich/Switzerland.



Mark Schneider

Mark Schneider is head of corporate product sustainability with Sika Services AG, the management company of Sika AG, in Zurich, Switzerland. He worked in the roofing industry for many years in different environmental and sustainability functions before joining Sika as global product sustainability manager. He has participated in numerous environmental committees and standard-writing bodies in Switzerland and other parts of Europe. He is a board member of the Swiss PVC association (PVCH); the Swiss representative on CEN Technical Committee 350, "Sustainability of Construction Works"; and a member of the ESWA Technical Committee Working Group EPD. Schneider has a master's in environmental sciences from the Swiss Federal Institute of Technology Zurich (ETHZ), Zurich, Switzerland, and a master of business administration from the Lucerne University of Applied Sciences and Arts (HSW), Lucerne, Switzerland.

— PUBLIC SAFETY CANADA INVESTIGATES CONSTRUCTION CRIME —

Public Safety Canada commissioned a report in 2010 on the construction industries in Quebec and British Columbia, following stories of rampant corruption. The \$80,000 federal study into organized crime issued its report in February. The report, however, suggests that organizations asked to provide input refused, for the most part, due to fear of reprisals, and that some even believed the authors of the study were working with the police. Of 35 contractors, union representatives, provincial prosecutors, and law-enforcement agencies approached for input, only six agreed to take part and 17 individuals were ultimately interviewed. Investigation by *Roofing BC*, however, shows that many construction groups (the Roofing Contractors Association of BC, the Vancouver Regional Construction Association, and the Greater Vancouver Home Builders' Association included) were never even contacted for input into the survey.

Ordered during corruption controversies in Quebec, the inquiry was set to begin while the provincial police and the Canada Revenue Agency investigated construction firms.

The study, "Economic Sectors Vulnerable to Organized Crime: Commercial Construction," authored by several academics, concludes that the Canadian commercial construction sector is at a moderate to high risk of corruption and organized crime. It also notes that hard data—prosecutions that show the involvement of organized crime in the Canadian construction sector—"is virtually nonexistent." The study found two glaring points in the construction process that were most vulnerable to criminal infiltration: the procurement of contracts and project management.

"Our sources indicated that officials responsible for procurement were often uninformed with regard to the cost of construction projects," the study says. "The lack of accountability and transparency in procurement policies across Canada was also noted." In 2001, public agencies in British Columbia became responsible for their own procurement.

Premier Jean Charest announced plans for an inquiry headed by Superior Court Justice France Charbonneau.

— *The Canadian Press, Roofing BC, and other sources*



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RAISING THE ROOF:

A Thousand Years of Timber Roofs in England

By Keith Roberts, CEng

The forward view for new construction work in the United Kingdom over the next decade is that there will be fewer new build projects on green-field sites and proportionally more work refurbishing existing buildings. This change will require professionals to develop different skills, assessing the condition of old structures and specifying appropriate remedial works. Equally, there will be a greater need for tradespeople who understand traditional building materials and techniques to carry out the renovation work. The question is often raised: Where do professionals and tradespeople gain this knowledge and experience?

One recognized center of knowledge in the UK where advice is given about the renovation and conservation of old buildings is the Weald & Downland Open-Air Museum (*Photo 1*), which offers an invaluable training resource. This article describes more about the work of the museum and the educational services it provides. This year's annual conference, held within the museum's innovative Downland Gridshell, brought together respected practitioners who spoke about the development of timber roofs since Saxon times.

THE WEALD AND DOWNLAND MUSEUM

The Weald & Downland Open-Air Museum near Chichester, West Sussex, England, is the home of more than 50 ancient buildings that have been reassembled on the 50-acre site. Some of the buildings date back to the 13th Century. Their roofs have been covered in thatch, clay tiles, and wood shingles. The museum has become a national center of excellence and runs an extensive program of adult education courses on traditional rural trades and crafts and building conservation.

The museum was established more than

40 years ago and is a registered charity. One of its aims is to save buildings that are threatened with demolition and to exhibit them in such a way as to help visitors appreciate the rich heritage of historic buildings in the region. The museum also promotes the retention of buildings on their original sites whenever possible and encourages an informed and sympathetic approach to their preservation and continuing use.

The Bayleaf farmhouse is perhaps the most iconic structure at the museum (*Photos 2-5*). A timber-framed hall house dating mainly from the early 15th Century, it is a typical example of a house in the

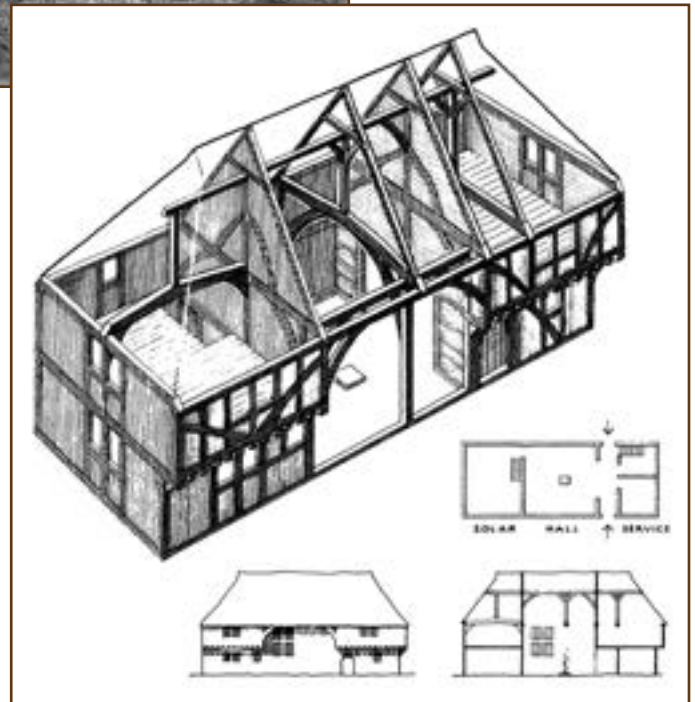


Photo 1 – The Market Hall, Medieval Shop, and Upper Hall.



Photo 2 – The Bayleaf farmhouse in its original location. The building was presented to the museum by the East Surrey Water Company and moved from the site of the Bough Beech reservoir.

Photo 3 – The structure of the Bayleaf farmhouse, which has been dated to 1405-1430.



Photos 4 and 5 – The Bayleaf farmhouse now reerected in its original form with clay tile roofing.



Weald region of southeast England, with the characteristic features of the recessed front wall of the hall and the two end chambers jettied out at the front. The building has an open hall in the middle, entered from a cross passage, with the buttery and pantry service rooms at one end, and at the other, the parlor and cellar. The building was surveyed by the Wealden buildings study group in its original location before being dismantled and reerected at the museum four years later. The care taken in sketching and labeling different elements of

the original building is one of the notable skills of the staff and volunteers working at the museum. This care is of particular importance when the frame comes to be reassembled after several years, putting the timber elements back together again like a jigsaw puzzle. Those of us who regularly survey roofs can recognize the value of clear descriptions of the different parts of a building and their condition.

In a typical year, the museum attracts around 150,000 visitors. What is particularly encouraging is that each year there are more than 17,000 schoolchildren who visit to experience first hand the reconstructed timber-framed buildings in a rural setting, often with traditional activities in progress such as milling and plowing. The museum does not receive regular grants or subsidies and relies on a large number of volunteers who contribute to its daily operation.

It is one of the positive features of the museum that children and visitors can take part in supervised activities, such as making wooden pegs and having a go at wattle and daub walling. This involves weaving thin wooden strips between vertical stakes to form a wattle panel infill within a timber frame, which is then daubed with a wet mix of clay, chopped straw, and animal dung to form a weathertight wall construction. Recently, the roofing contractor who will be

tiling a reassembled cottage has prepared a display and has been giving talks to visitors (Photo 6).

ADULT EDUCATION

The founder of the museum, Roy Armstrong, was particularly keen on promoting adult education, and this key objective continues. The museum promotes courses on historic building conservation for homeowners and tradesmen. In previous years, this has included the manufacture of

clay roof tiles, thatching (Photo 7) and flint walling, the use of lime mortars, and energy conservation practices.

Joe Thompson, the carpenter in residence, leads workshops on oak timber framing and modern practice. During a five-day course, students have lined out, cut, and fitted the braces, studs, and rails of a traditional Sussex timber-framed building (Photos 8 and 9). For professionals and tradespeople looking to enhance their knowledge and become conservators, two



Photo 6 – A volunteer helps visitors experience daubing.

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Photo 7 – The hall from Boarhunt being thatched with long straw.

master of science programs on Timber Building Conservation and Building Conservation are offered, validated by the University of York.

THE MUSEUM ANNUAL CONFERENCE

This year's annual conference considered timber roof framing throughout the centuries, from the age of the carpenter to the age of the structural engineer. More than 120 people attended the conference, a good proportion of them being young men and women in their 20s and 30s, which is particularly encouraging. Eight lectures were delivered by experts in their fields, introduced by Richard Harris, a past director of the museum who was responsible for the research, interpretation, and reconstruction of many of the building exhibits.

1000-1200 AD: FRAGMENTS OF EVIDENCE FOR SAXON TIMBER ROOF STRUCTURES

Fieldwork below ground and in very early woodwork in standing buildings in England has shown that there was a fundamental change in timber building techniques during the later 12th century when the new timber frame "carpentry" was adopted from Norman practice. Fragments of the earlier Saxon tradition of "treewrighting" [woodworking on large-scale projects] survive on waterlogged archaeological sites, above ground at the Greensted stave church, and in stylized form in pictorial evidence in the Bayeux tapestry. Some interesting parallels may also be found in the surviving medieval and later carpentry of countries to the east of the North Sea, such as the use of triangular-shaped window openings.

1200-1600 AD: THE EVOLUTION OF THE ENGLISH MEDIEVAL ROOF

Across England, structural forms for new buildings developed during the 13th century, away from cruck frames (comprising pairs of stout timbers spanning from the ground to the ridge and bearing against one another at the apex) to more slender frames with crownposts. This, in turn, changed to the use of side purlins, giving support to the rafters as building practice evolved and spreading from the far west of England in the mid-14th century until the same practice was adopted in eastern England in the 16th century.

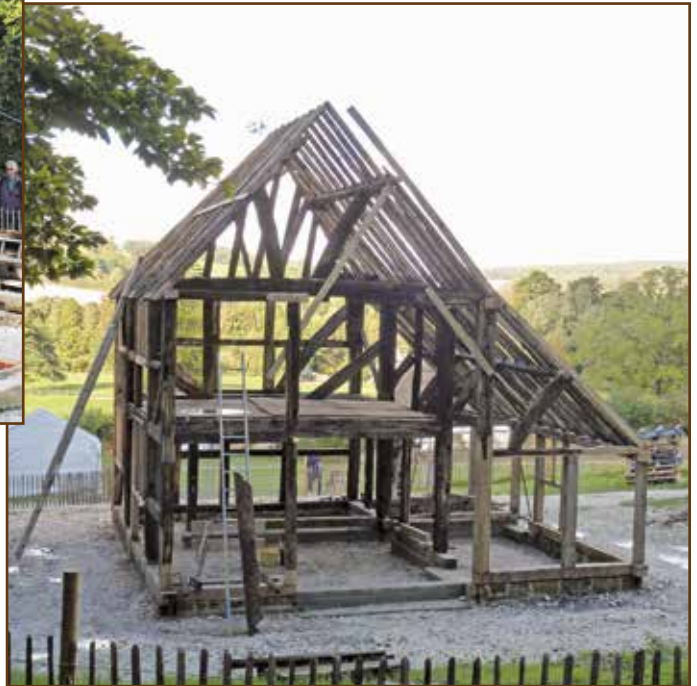


Photos 8 and 9 – A timber-framing workshop in progress within the Jerwood Gridshell space.





Photos 10 and 11 – The reassembly of the 17th-Century cottage oak frame commenced in September 2012 and has attracted many visitors to the museum.



1800-1940 AD: TIMBER ROOFS AND THE INDUSTRIAL REVOLUTION

With a gradual consensus on a design method for timber, the evolving role of composite timber with iron and steel for large-span industrial and commercial buildings was described, using trussed and lamella forms. Not all structures were successful. The example was given of an ambitious timber arch construction using adhesives and built in 1886 for the new Kings Cross railway station in London.

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Unfortunately, the steam from the railway engines contributed to the early failure of the timber frame and its replacement the following year with a cast-iron structure.

1970-2000 AD: TIMBER COMES OF AGE

This was a formative period in which further advances in steel connections, European design codes, and computer analysis have enabled timber engineering to expand from simple two-dimensional arches to more challenging three-dimensional geodesics and shells, encouraged by an increasing awareness of timber's green credentials. At the same time, a renaissance in more traditional "green" oak construction has offered a contrast to the more complex modern structures.

RAISING THE FRAME

While it is good to observe historic buildings in their original as-built state, much can be learned from the actual assembly of whole buildings. During the fall of 2012, a timber-framed cottage was re-erected. This created much local interest with more than 1,400 visitors on the first day when the car-

penters commenced assembly of the frame. The pitched roofs are to be clad in plain clay tiles laid by a local roofing contractor who will be using the full-scale demonstration as a training opportunity, supervised by experienced tilers. Likewise, wattle and daub infill panels will be built by local craftsmen (Photos 10 and 11).

It is recognized that in the future, there will be greater opportunities for the construction and property industry in the refurbishment of existing buildings. To this end, there will be a need for skilled tradesmen and designers experienced in

the conservation of properties. The work of charities such as the Weald & Downland Open Air Museum should be supported. The museum's annual conference will be held on October 7, 2013, focusing on "The Medieval Timber Roofs of Europe." Further details of the conference and other continuing professional development training days will be published on the Museum website: www.wealddown.co.uk. Visitors from North America would be very welcome. 

All figures courtesy of the Weald & Downland Museum.

— Keith Roberts, CEng

Keith Roberts is a chartered civil and structural engineer who has specialized for more than 20 years in the investigation and design of modern roofs throughout the UK and Ireland. He is chairman of the CIB/RILEM International Roofing Committee task group developing the concept of "reliable roofing," which recognizes the importance of centers of knowledge in learning through experience and promoting the training of professionals and tradespeople. He is owner of Roberts Consulting, Abingdon, England, and is a member of RCI and of the Institute of Structural Engineers (UK).



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The Oast of the Town

By Kristen Ammerman

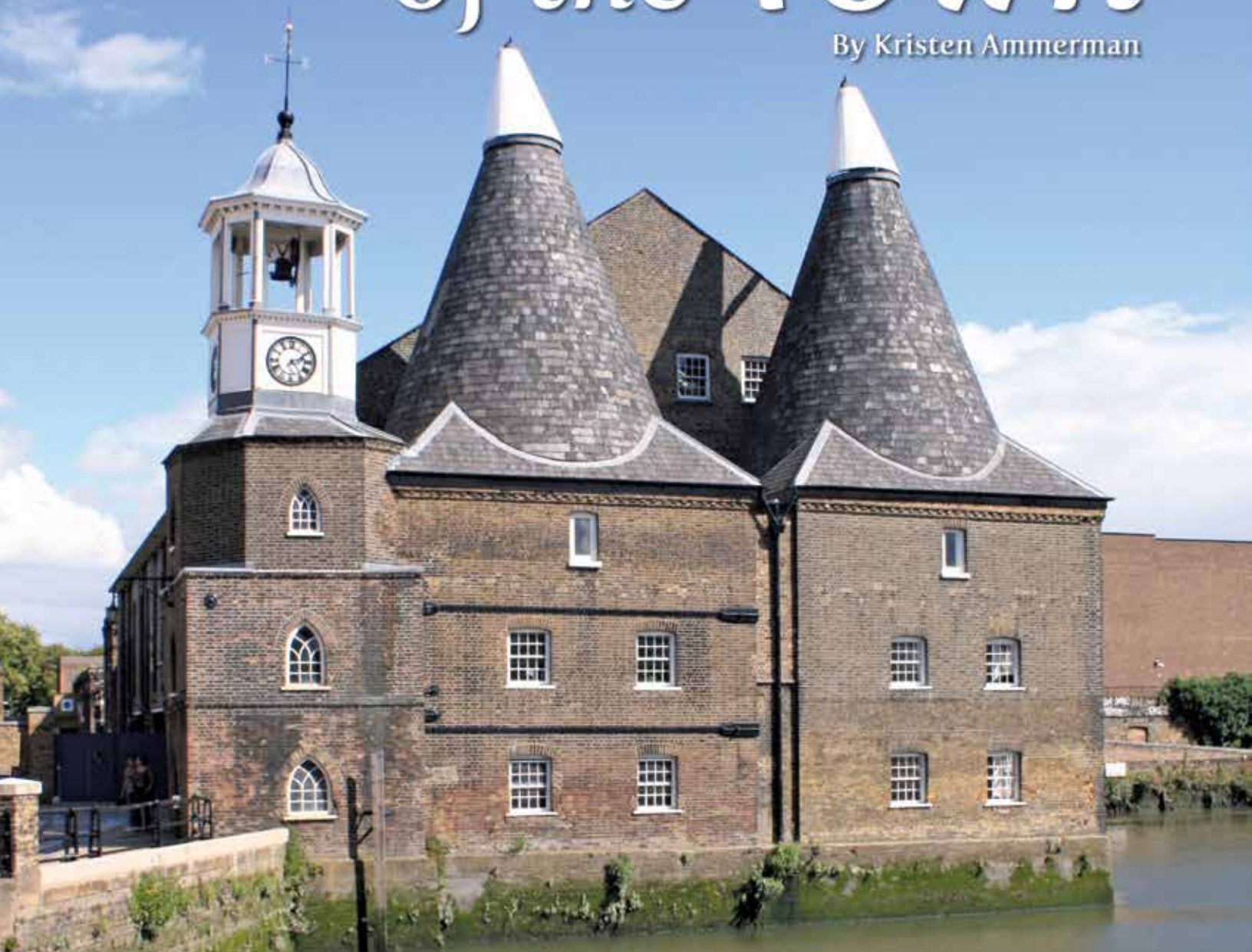


Photo 1 – The Three Mills are former working mills on the River Lea in the East End of London. At one time, gin was distilled here. The building now houses Three Mills Studios, which is London’s largest film studio. Photo by John Marchant.

Developers in southeast England are now building “bespoke” (custom-made) homes that mimic the vernacular oast structures once common throughout that region. Oasts¹ were buildings used to dry or kiln fresh hops before they were sent to breweries to flavor beers. Freshly picked hops had a high moisture content of approximately 80%, which was reduced to 6% through the kilning process.² They had to be dried as soon as they were picked; thus, a proliferation of oasts.

Oast structures traditionally had two parts—the oast and the “stowage.” The oast or kiln area was a plenum chamber fired by charcoal at ground level with the drying floor above it. The drying floor was thin and perforated to permit heat

Photo 2 – Chatham Youth Hostel in Capstone Valley is a converted oast house. Photo by Clem Rutter, Wikimedia Commons.



Photo 3 – This former oast is now an inn—appropriately, near the town of Rye. Guests can stay in a roundel, sleep on a round bed, and relax in the beer garden. Photo by Celle Long.



Photo 4 – This is a new home built on the site of a former oast, mimicking one of the historic structures. Photo courtesy of Sandtoft Roof Tiles.



to rise. A steep-pitched roof channeled the hot air through the hops and then through cowls in the roof, which turned with the wind, drawing the air in a vacuum effect and stopping rain from entering.

The stowage was the barn section, where, after drying and raking, the hops were laid to cool and then packed with hop presses into large sacks.

The buildings themselves were built of brick, timber, ragstone, or sandstone, corrugated iron, or asbestos sheet. The roofs of the kilns, when external, were often built of brick and covered in coal tar pitch for weatherproofing.

Oast houses were built in the major hop-growing regions of England, with the majority of those (perhaps 65% of the remaining approximately 3,500)³ in Kent. The oldest surviving oast in England is at Golford, Cranbrook, built in 1750. Oasts may also be found in Belgium, the Czech Republic, Australia, and other countries.

Hop picking peaked in England between 1860 and 1880, then went into decline as cheaper imports became available from other parts of Europe. Traditional oasts fell into disuse; and eventually, many of the old buildings were renovated into homes (*Photos 6 and 7*), inns, theaters, schools, offices, and even museums (*Photos 1-3*).



Photo 6 – There were six rounded kilns at Grey Ladies and Winfield Oast, in Crouch, Kent, built in 1840 and now converted to residential dwellings. Photo by John Marchant.

Photo 7 – This private residence was converted from an oast in Stonegate, Kent. Photo by Linda Spashett Storye, Wikimedia Commons.

The latest iterations of oasts are by private developers who are building new homes to mimic the historic structures. One such example is at Oast Court Farm development in East Malling, Kent (Photo 4 and on the cover). There, Hillreed Homes recently built an oast house with three roundels topped with conical white cowls using Sandtoft's Alban clay plain tiles. The new structure is built on the site of a former working oast. The tiles are made from clay reserves formed out of the alluvial plain of the river Humber. They are sanded using recycled foundry sands that are pressed into the tile, creating a varied and rustic surface texture. Fired vertically, they adopted slightly different shapes, lending to the "heritage aesthetic of the tile," according to Sandtoft. 

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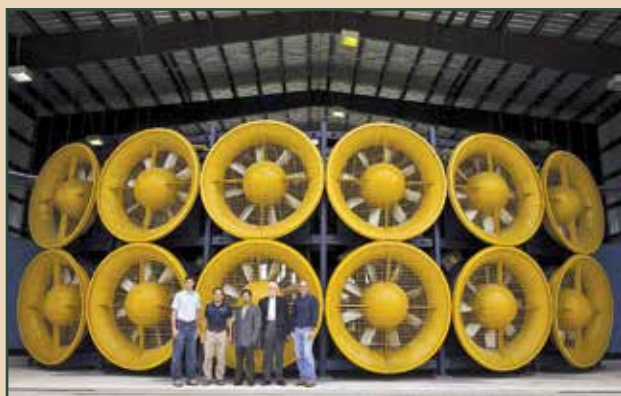


Kristen Ammerman

Kristen Ammerman has been the publications director for RCI and executive editor of *Interface* journal since 1996. Prior to that, she was an editor and researcher for FMI, Corp. in Raleigh, NC; managing editor of *The Wayne Independent*, a daily newspaper in northeastern PA; and editor for the *Evidence Photographers International Council Journal*. She has a BA in writing and Asian studies from the University of Arizona and is a published novelist.



WoW PROJECT COMPLETE



The Wall of Wind (WoW) project, developed by Florida International University's International Hurricane Research Center, Miami, has been completed. The \$8 million project began development in 2007 and was funded by state, federal, and private sources, as well as by the Roofing Industry Alliance for Progress (a part of the National Roofing Alliance of the National Roofing Contractors Association).

WoW is the first facility capable of performing controlled and repeatable testing of replicated Category 5 hurricane winds, accompanied by wind-driven rain and flying debris. It allows researchers, businesses, government agencies, and industries to test and analyze how structures and products perform in various hurricane conditions.

Powered by 12 6-ft.-tall, 700-HP electric fan-motor units, it can generate winds up to 157 mph and features a 15-ft.-high by 20-ft.-wide test section. To see a demonstration video, visit wow.fiu.edu.

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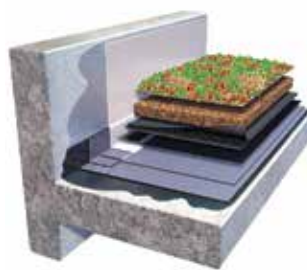
- **Parapro 123 Flashing** is a liquid-applied, flame-free PMMA solution.
- Foil-faced **Veral** is a time-tested SBS-modified bitumen option.

Landscape Options.

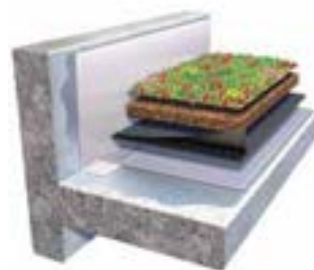
Both **Teranap** and **Parapro** systems can be specified with numerous landscape options, including:

- Pre-Vegetated Extensive.
- Extensive.
- Intensive.
- Lawn.

Pre-Grown Extensive with
Teranap Waterproofing



Pre-Grown Extensive with
Parapro Waterproofing



Component Options.

For every **Siplast Vegetated Roof System** option, there are Siplast components available to complete a single-source green roof package, including:

- Paragreen pre-grown vegetated mats.
- Paragrow growing medium.
- Paradrain drainage mats.
- Parablock root barrier.

Learn More.

When you work with Siplast, you have a single source for not only green products, but also experience gathered over more than 30 years of involvement with green and sustainable solutions. Learn more about how your next vegetated roofing project can be accomplished with single-source convenience. For information, call **1-800-922-8800**, or visit our Web sites at **www.siplast.com** and **www.siplastgreen.com**.



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CONSTRUCTION AND THE ECONOMY

SUPERSTORM SANDY TO HAVE MINOR IMPACT ON CONSTRUCTION ACTIVITY NUMBERS



By Ken Simonson

“Superstorm” Sandy is likely to have minor impact [on construction numbers]... although it is still too soon to assess the full effects. Some hiring and spending in the affected areas has begun. More will occur once owners complete plans and secure insurance or government funding. But some firms will close or cancel construction (or building occupancy) that would have taken place absent the storm. Some of the funds will displace other public construction projects or investments by firms and insurers. Similarly, workers doing the rebuilding are likely to be a mix of unemployed workers (from the region or elsewhere) and employees of projects that will halt or not begin, diminishing the net employment gain.

“Even as many [firms] are adding lawyers, U.S. law firms this year have taken an average 12% less office space when their leases expired, according to real estate services firm Jones Lang LaSalle Inc., which... released a report on law firms,” the *Wall Street Journal* reported. “The firms are doing things like cutting back space once needed for law libraries and desks for administrative assistants, a job type that has been vanishing gradually over the years.” The shrinking demand from law firms keeps office construction depressed. “Nowhere is this truer than in Washington, DC, where

law firms make up nearly half of top-quality, privately owned office space.”

Nonresidential construction employment in nonresidential building, specialty trade contractors, and heavy and civil engineering construction rose by a combined 12,200 for October but only 7,600 (0.2%) over 12 months. Aggregate weekly hours of all construction employees rose 2.2% over the year, implying firms are adding hours for existing employees more than they are hiring additional workers.

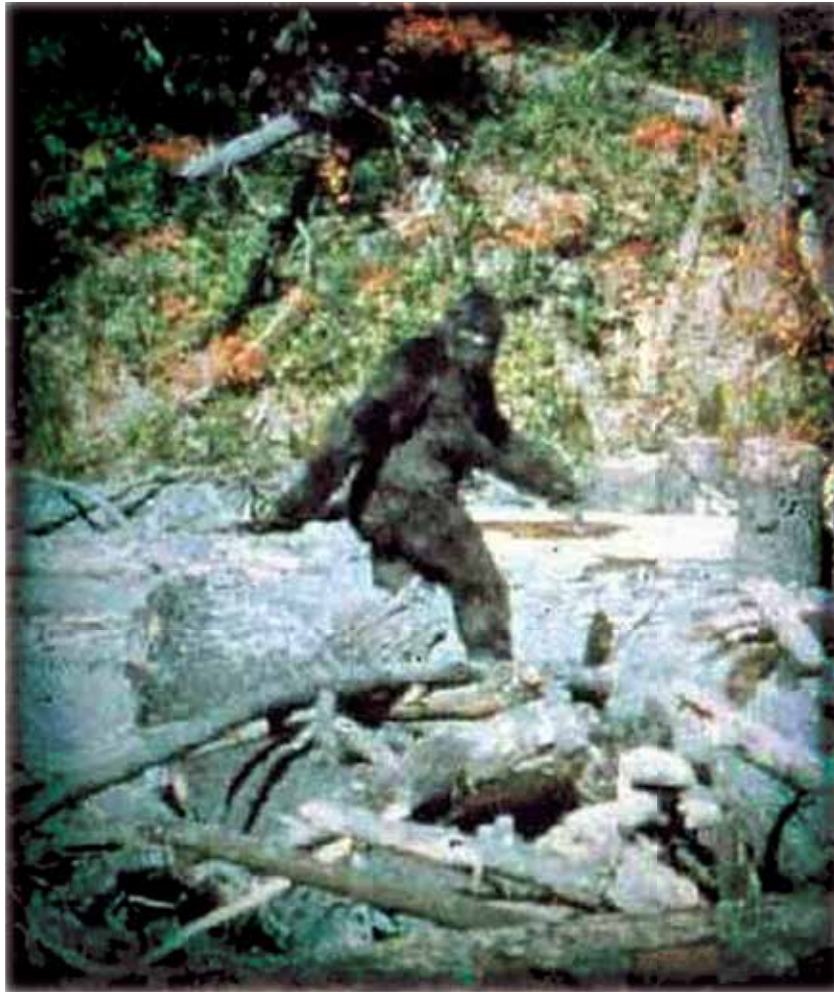
The unemployment rate for former construction workers fell to 11.4%, not seasonally adjusted, from 13.7% in October 2011 and 17.3% in October 2010. (BLS does not compile seasonally adjusted rates by industry; nonseasonally adjusted numbers can be compared for the same month in different years but not across months.) In those two years, the number of unemployed workers has dropped by 515,000, but construction industry employment has risen by only 37,000, suggesting that many experienced workers have left the industry for other jobs, school, or retirement.



Ken Simonson

Associated General Contractors of America (AGC). Before joining AGC, Simonson spent three years as senior economic advisor in the Office of Advocacy of the U.S. Small Business Administration and 13 years as vice president and chief economist of the American Trucking Association. Simonson may be reached at simonsonk@agc.org.

This series on the economy and its impact on the construction industry is published monthly in Interface. This month's column was prepared by Kenneth D. Simonson, chief economist for the



**The next big thing
has been spotted in the
Pacific Northwest.**



FREDERICKSON, WA

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INDUSTRY NEWS

To submit an industry news item to *Interface*, e-mail it to kammerman@rci-online.org or mail it to **RCI, Interface Journal**, 1500 Sunday Drive, Suite 204, Raleigh, NC 27607. Note: News must fit journal requirements in order to be published.

SNOBECK PROMOTED AT TECTA AMERICA



**Ralph G. Snobeck,
RRC**

Ralph G. Snobeck, RRC, of Yorkville, IL, has been appointed as director of sales for Illinois at Tecta America Corp. Snobeck has held increasing levels of responsibility at Tecta subsidiary Anthony Roofing Tecta America LLC over the last 17 years. He was president of Anthony from 2011 until his recent change of roles, and previously was VP of operations and of sales and marketing. Prior to that, he worked in various roof consulting and design capacities at Professional Service Industries, Inc., and Gammie Nuclear Service Co., Inc.

SIPLAST PROMOTES CONWAY

Siplast has promoted Brendan Conway to the position of district sales manager for Georgia and eastern Tennessee. Conway brings over 15 years of experience in the commercial roofing business to his new role.

PATTEN HIRED BY ADCO



Andrew Patten

Andrew Patten has been hired as a field sales representative for ADCO Products Inc., a manufacturer of commercial roofing adhesives, sealants, and tapes. He will cover the Southeast and will be based in Orlando, FL. Patten is a graduate of Florida State University with two years of roofing sales experience.

GAF TO BUILD FACTORY IN MIDWEST

GAF has plans to open a new asphalt roofing shingle manufacturing facility in eastern Missouri or southern Illinois. The facility is expected to open in 2015 and will include GAF's eighth laminator with the ability to run four lanes of production at once. It will employ more than 80 people.

MAX ROACH PASSES AWAY

Max Roach, former sales representative for Owens Corning and Tamko Building Products out of Denver, CO, died in July. Roach received the Colorado Roofing Association's Lifetime Achievement Award in 2006.

EDWARDS APPOINTED TO IAC

Wanda Edwards, senior director of technical services for RCI, has been nominated to a two-year term as vice chair of the Industry Advisory Committee (IAC) of the International Code Council (ICC). The IAC promotes a national forum for the building community to interface with the ICC.

Top 20 Roofing Firms Named

Engineering News Record (ENR) magazine has issued its annual list of the top 600 specialty contractors in the U.S. by reported revenue. "For many large specialty contractors, the bidding frenzy that has been a fact of life during the recession has leveled off... [but] the tough market has firms from slow sectors showing up to bid on jobs they never worked on before," the article notes. "The roofing market has become more crowded," James T. Patterson, senior vice president of CentiMark Corp. was quoted. "With fewer new construction projects, more roofing contractors are entering the reroofing market." He says that compressing margins could lead to long-term problems for owners. The new competitors "are not experienced roofing buyers...and both prices and quality often suffer so price pressures can be met," he stated.

TOP 20 FIRMS IN ROOFING

(Followed by 2011
Revenue in Millions \$)

- | | |
|---|---|
| 1) Tecta America Corp., 426 | 11) Douglass Colony Group, 33 |
| 2) Centimark Corp., 408 | 12) John J. Campbell Co., Inc., 31 |
| 3) Baker Roofing Co., 159 | 13) KPost Co., 30 |
| 4) Nations Roof, LLC, 85 | 14) Crowther Roofing & Sheet Metal of FL Inc., 24 |
| 5) Kalreuth Roofing & Sheet Metal, Inc., 83 | 15) Orndorff & Spaid, Inc., 23 |
| 6) Best Contracting Services, Inc., 53 | 16) Thomas Co., Inc., 21 |
| 7) Latite Roofing & Sheet Metal, Co., 52 | 17) Evans Roofing Co., Inc., 21 |
| 8) Schreiber Roofing, 51 | 18) King of Texas Roofing Co., LP, 19 |
| 9) Birdair Inc., 45 | 19) Allsouth Subcontractors, Inc., 18 |
| 10) Greenwood Industries, Inc., 43 | 20) Commercial Roofers, Inc., 18 |

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- Features FASTLap®, a granule free end lap
- Features SEALLap®, a factory-applied adhesive treatment on the side lap
- Aggressive self-adhering formulation on bottom surface
- Easy, safe installation



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 Visit www.rci-online.org for schedule updates.

DECEMBER 2012

- 1** **RRO exam (app. due 9/4/12)**
Atlanta, GA
- TBD** **Executive Committee winter meeting**
TBD
- 5** **Region III meeting**
Grapevine, TX
- 5-7** **Midwest Roofing Contractors**
Association convention
Grapevine, TX
Info: mrca.org
- 6** **Ontario Chapter meeting**
Burlington, ON
- 7** **Mid America Chapter meeting**
Kansas City, MO
- 12** **SoCal Chapter meeting**
Anaheim, CA
- 13** **Delaware Valley Chapter meeting**
- 12-13** **Professional Building Consulting**
San Francisco, CA
- 14** **RRC Review & Update**
San Francisco, CA
- 15** **RRC exam (app. due 9/7/12)**
San Francisco, CA

JANUARY 2013

- 10** **Mid America Chapter meeting**
Kansas City, MO
- 16-17** **Exterior Walls Technology & Science**
Dallas, TX
- 18** **Vegetative Roofs for the Design Professional**
Dallas, TX
Delivered by RCI North Texas Chapter
Info: Cindy Chadwell, 817-496-4631
- 22-24** **National Home Builders Show**
Las Vegas, NV
Info: www.buildersshow.com
- 24-25** **Roof Technology & Science II**
Toronto, ON
Delivered by RCI Ontario Chapter
Info: Joel Dandelé, 416-847-9153
or www.rci-ontariochapter.ca
- 28-29** **SoCal Chapter 13th Annual Hawaii Winter Workshop**
Waikiki, HI
Info: www.rcisocalevents.org
- 30** **Roof Systems Thermal & Moisture Design**
Atlanta, GA

- 31-1** **Exterior Walls Technology & Science**
Atlanta, GA
Delivered by RCI Georgia Chapter
Info: Joseph Morgalis, 404-256-2388 or www.rcigeorgia.org

FEBRUARY 2013

- 4** **RRCI annual meeting**
San Antonio, TX
Info: www.therrci.org
- 5-7** **International Roofing Expo**
San Antonio, TX
Info: theroofingexpo.com

MARCH 2013

- 14-19** **RCI International Convention & Trade Show**
- 14** **RCI Board of Directors meeting**
- 15** **RRO, RRC, RWC & REWC exams (applications due 12/17/12)**
- 16** **Region meetings**
- 18** **RCI Annual Meeting of the Members**
- 19** **RCI Board of Directors meeting**
Orlando, FL

APRIL 2013

- 18-19** **Metal Roofing**
Pensacola, FL
Delivered by RCI Northern Gulf Coast Chapter
Info: Ken Leggett, 850-607-7328
- 25-26** **Rooftop Quality Assurance**
Langley, BC
Delivered by RCI Western Canada Chapter
Contact: John Pitre, 604-909-7777
or www.rciwesterncanada.org
- 27** **RRO exam (app. due 1/28/13)**
Langley, BC

MAY 2013

- 3** **Region I meeting**
Woburn, MA
- 9-10** **Professional Building Consulting**
Seattle, WA
Delivered by RCI Puget Sound Chapter
Info: Ken Stilwell, 206-409-2421
or www.rcipugetsound.org
- 9-10** **Roof Technology & Science I**

- Waukesha, WI**
Delivered by RCI Wisconsin Chapter
Info: David Balistreri, 888-549-1930
or www.rci-wisconsin.org
- 16-17** **Exterior Walls Technology & Science**
Toronto, ON
Delivered by RCI Ontario Chapter
Info: Joel Dandelé, 416-847-9153
or www.rci-ontariochapter.ca

JUNE 2013

- TBD** **Professional Building Consulting**
TBD
Delivered by RCI Delaware Valley Chapter
Info: Anthony Katona, 610-363-7252
- TBD** **RRC exam**
- 4-5** **Roof Technology & Science I**
Columbus, OH
- 6-7** **Roof Technology & Science II**
Columbus, OH
- 9-13** **Western States Roofing Contractors Convention**
Reno, NV
- 12** **Region IV meeting**
Reno, NV
- 14** **REWC app. due for 9/14/13 exam**
- 20-22** **AIA National Convention**
Denver, CO
- 21** **RRO app. due for 9/21/13 exam**

JULY 2013

- 5** **RRC app. due for 10/5/13 exam**
- 12** **RWC app. due for 10/12/13 exam**
- TBD** **Executive Committee summer meeting**
TBD

AUGUST 2013

- 2** **Region II meeting**
Atlanta, GA
- 9** **RRO app. due for 11/9/13 exam**
- 16** **RRO app. due for 11/16/13 exam**

SEPTEMBER 2013

- TBD** **RCI Board of Directors meeting**
TBD
- 5-6** **Exterior Walls Technology & Science**
Houston, TX
Delivered by RCI Gulf Coast Chapter
Info: Keenan Knight, 281-209-1724



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- or www.grci.com
- 9 RRC apps. due for 12/7/13 exam
- 10-11 Stucco and Exterior Finish Cladding Systems**
San Francisco, CA
- 12-13 Masonry Wall Systems**
San Francisco, CA
- 14 REWC exam (app. due 6/14/13)**
San Francisco, CA
- 13 Roof Asset Management
 Pensacola, FL
Delivered by RCI North Gulf Coast Chapter
 Info: Ken Leggett, 850-607-7328
- 19-20 Rooftop Quality Assurance**
Chicago, IL
Delivered by RCI Chicago Chapter
 Info: Steve Schwab, 630-879-0474
 or www.cac-rci.org
- 21 RRO exam (app. due 6/21/13)**
Chicago, IL
- 25-27 Construct 2013 and CSI Convention
 Nashville, TN
 Info: www.csinet.org
- 26-27 Metal Roofing
 Atlanta, GA
Delivered by RCI Georgia Chapter
 Info: Joseph Morgalis, 404-256-2388
 or www.rcigeorgia.org

- 25-26 Exterior Walls Technology & Science
 Langley, BC
Delivered by RCI Western Canada Chapter
 Info: John Pitre, 604-909-7777
 or www.rciwesterncanada.org

NOVEMBER 2013

- TBD Leadership Development Workshop
 Raleigh, NC
- TBD MRCA Convention
 Chicago
- 7-8 Rooftop Quality Assurance**
Seattle, WA
Delivered by RCI Puget Sound Chapter
 Info: Ken Stilwell, 206-409-2421
 or www.rcipugetsound.org
- 9 RRO exam (app. due 8/9/13)
 Seattle, WA
- 14-15 Symposium on Building Envelope Technology
 Minneapolis, MN
- 14-15 Rooftop Quality Assurance**
Palm Harbor, FL
Delivered by RCI Florida Chapter
 Info: Tony Ruggiero, 813-505-9410
 or www.rci-rciflorida.org
- 16 RRO exam (app. due 8/16/13)**

- Palm Harbor, FL**
- 22 Roof Systems Thermal & Moisture Design
 Toronto, ON
Delivered by RCI Ontario Chapter
 Info: Joel Dandelé, 416-847-9153
 or www.rci-ontariochapter.ca

DECEMBER 2013

- 3-4 Metal Roofing**
New Orleans, LA
- 5 Vegetative Roofs for the Design Professional**
New Orleans, LA
- 6 RRC Review & Update**
New Orleans, LA
- 7 RRC exam (app. due 9/9/13)**
New Orleans, LA
- TBD Executive Committee winter meeting
 TBD
- TBD Region III meeting
 TBD
- 12-13 Professional Building Consulting
 Waukesha, WI
Delivered by RCI Wisconsin Chapter
 Info: David Balistreri, 888-549-1930
 or www.rci-wisconsin.org

OCTOBER 2013

- 4 Region I meeting
 Baltimore, MD
- 2-3 Professional Building Consulting**
Dallas, TX
- 4 Roof Systems Thermal & Moisture Design**
Dallas, TX
Delivered by RCI North Texas Chapter
 Info: Ron Erdman, 972-759-4406
- 5 RRC exam (app. due 7/5/13)**
Dallas, TX
- 10-11 Exterior Walls Technology & Science
 Waukesha, WI
Delivered by RCI Wisconsin Chapter
 Info: David Balistreri, 888-549-1930
 or www.rci-wisconsin.org
- 10-11 Waterproofing**
Houston, TX
- 12 RWC exam (app. due 7/12/13)**
Houston, TX

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WOULD YOU LOOK AT THAT!

*Sometimes, nature provides
its own holiday decoration...*



These long pine needles converged to clog an internal drain in the wake of Hurricane Irene last year, but a frisky roofing expert added the pinecone ornamentation and made a holiday wreath.

Submitted by
Bill Kirn, RRC
Quest Construction Products
King of Prussia, PA

The vocation of the building envelope consultant sometimes presents opportunities to witness firsthand the vision of others related to the concept that necessity can be the mother of invention. While the practices featured in this periodic piece are not specifically endorsed by RCI, they do justify acknowledgment, bringing a certain amount of levity to our daily work lives. Readers running across situations that would catch the attention of other building envelope consultants are asked to submit representative photographs and a 150- to 300-word summary to Kristen Ammerman, Director of Publications, "Would You Look at That!" column, RCI, 1500 Sunday Drive, Suite 204, Raleigh, NC 27607 or via e-mail to kammerman@rci-online.org.

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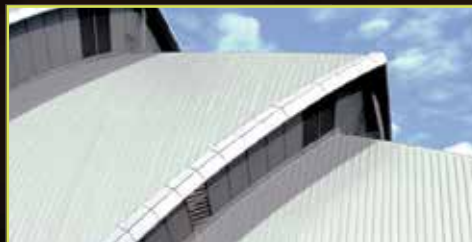
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