HELP!!!... IS AVAILABLE TO THOSE WHO WANT TO DESIGN AND DEVELOP THEIR RAINSCREEN SYSTEMS BASED UPON SOUND TECHNOLOGY AND DESIGN PRINCIPLES.

Posted on August 24, 2009 by MillerClapperton

This week's Miller Clapperton blog features Dave Clapperton as a guest writer. Ted Miller will return next week with a new blog entitled: "What It Takes To Be Successful."

One of the ongoing concerns that the domestic commercial design and construction industry has been confronted with is the myriad of unfounded claims for performance levels of 'Rainscreen' cladding systems. In an upcoming Blog at the end of September, we will share with you the good news from AAMA on new established testing methods for both 'Drained and Back-Ventilated' and 'Pressure Equalized' Rainscreen systems based upon the 'Rainscreen Principle' of design. To our knowledge, these are the first testing and/or classification methods made available to any building design and construction community, domestic or otherwise.

That said, there are a vast amount of technical papers, study results, theoretical calculations and design principles that have been developed and published over the years. Many of these documents come from reliable and highly educated sources and they contain valuable insight into the challenges of proper design, particularly when it comes to developing a properly functioning 'Pressure Equalized' rainscreen cladding system.

I initially became involved with attempting to define 'The Rainscreen Principle' for our own employees. Then, wanting to expand my understanding, I became a participant in larger industry efforts to educate through the Metal Construction Association's (MCA) (www.metalconstruction.org) Rainscreen Task Force from 2005 through 2006. This taskforce also consisted of Bill Yannetti of Mitsubishi Plastics Composites America, Inc., and Keith D. Boyer, P.E., of CENTRIA, and resulted in the February 2007 release of the white paper Understanding 'The Rainscreen Principle'.
At METALCON 2007 (www.metalcon.com), the MCA Rainscreen Task Force presented a seminar entitled 'Effective Design & Installation of Rainscreen Systems' and most recently participated as a testing and development member of the AAMA (American Architectural Manufacturers Association) www.aamanet.org) Drained and Back Ventilated Rain Screen Wall Cladding Study Group (D&BV Study Group) under the auspices of Architectural Testing, Inc. (ATI) www.archtest.com) and AAMA.

During this process I have accumulated a library of references and technical documents. As I mentioned above, there is valuable information within many of these reports and documents and I would like to share with you those that I found to be of particular value.

Without getting into the definitive nature of 'The Rainscreen Principle' (which many of the below listed documents will do more adequately that I could in this limited space), I have chosen to divide the categories into five (5) basic subjects

1. General wall construction and moisture protection theories for buildings
2. 'The Rainscreen Principle'
3. Drained and Back-Ventilated rainscreen (D/BV)
4. Pressure-Equalized rainscreen (PERS)
5. The Air/Water (Vapor or Moisture) Barrier (the 'Inner Leaf')

General Information

- Thermal and Moisture Protection Manual, for Architects, Engineers and Contractors, by Christine Beall, NCARB, CCS (copyright © 1999) McGraw-Hill http://www.amazon.com/Thermal-and-Moisture-Protection-Manual/dp/0070051550
- Garden, G.K., "Joints Between Prefabricated Components," Proceedings of Seminar on Building With Prefabricated Components, Montreal, 1963. www.nrc.ca/
- Garden, G.K., "Glazing Design," CBD55, National Research Council, Canada, 1964. Website: http://www.nrc-cnrc.gc.ca/eng/ibp/irc/cbd/building-digest-55.html
- Garden, G.K., and Dalgliesh, W.A., "Influence of Wind Pressures on Joint Performance." Technical Paper 264, National Research Council, Canada, 1968. Conference: Symposium on Weathertight Joints for Walls, Oslo, Norway, 1967-09, Report #: DBR-TP-264, Date: 1968-09, Pages: 1-3: http://nparc.cisti-icist.nrc-cnrc.gc.ca/npsi/ctrl?action=shwart&index=an&req=5757288&lang=en
- Garden, G.K., "Look at Joint Performance," CBD-97, National Research Council, Canada, Canadian Building Digest, NRC-IRC publications, January 1968. http://www.nrc-cnrc.gc.ca/eng/ibp/irc/cbd/building-digest-97.html
- Birkeland, "Curtain Walls, " Handbook 11B, Norwegian Building Research Institute, 1962. Website: http://www.byggforsk.no/english.htm
- The Architectural Aluminum Manufacturers Association (AAMA – 35 East Wacker Drive, Chicago, IL 60601): Aluminum Curtain Wall Design Guide Manual, Volume 2 (copyright© 1979)] www.aamanet.org
- Taken from the IRC publication "Building Science Insight", an article by R.L. Quirouette entitled Glass and Metal Curtain Wall Systems. http://www.nrc.ca/irc/bsi/82-3_E.html
- Building Envelope Design Guide – Wall Systems by Daniel J. Lemieux, AIA and Paul E. Totten, PD, Wiss, Janney, Elstner Associates, Inc. for Last updated June 1, 2009 and published by the National Institute of Building Sciences http://www.wbdg.org/design/env_wall.php

The Rainscreen Principle

- Understanding the Rainscreen Principle a white paper presented by the Metal Construction Association's (MCA) Rainscreen Task Force, December 14, 2006 (R12). Available at MCA's website www.metalconstruction.org/pubs/pdf/mca07_Rainscreen.pdf
- Rainscreen Cladding: A Guide to Design Principles and Practice, by JM Anderson and JR Gill, CIRCA (Construction Industry Research and Information Association) Butterworth-Heinemann publications, 1988, London, England (out-of-print)
- NRC-CNRC Construction Technology Update No.34, Designing Exterior Walls According to the Rainscreen Principle, by W.C. Brown. G.A. Chown, G.F. Poirier and M.Z. Rousseau (copyright © 1999) – National Research Council of Canada, Institute for Research in Construction http://www.nrc-cnrc.gc.ca/eng/ibp/irc/ctus/ctus-n34.html
- Garden, G.K., "Rain Penetration and Its Control," CBD-40, National Research Council, Canada, April 1963. http://www.nrc-cnrc.gc.ca/eng/ibp/irc/cbd/building-digest-40.html
- NRC-CNRC Construction Technology Update No.9, Evolution of Wall Design for Controlling Rain Penetration, by G.A. Chown, W.C. Brown and G.F. Poirier (copyright © 1997) – National Research Council of Canada, Institute for Research in Construction http://www.nrc-cnrc.gc.ca/eng/ibp/irc/ctus/ctus-n9.html
- Facts and Fictions of Rain-Screen Walls, by M.Z. Rousseau. Originally published in "Construction Canada" 32(2), 1990, p. 40, 42-44, 46 and later presented by the NRC-CNRC, IRC "Construction Practices" publication (9 pages) http://irc.nrc-cnrc.gc.ca/practice/wal3_E.html
- The Rain Screen Wall System an article issued by the Ontario Association of Architects http://www.aaa.ab.ca/pages/members/media/RainScreenWallQAwa.pdf

Drained and Back-Ventilated Rainscreen

- Ventilated Wall Claddings: Review, Field Performance, and Hygrothermal Modeling by Graham Finch (Student member of ASHRAE) and John Straube, PhD, PEng (Associate member ASHRAE and Associate professor in the Departments of Civil Engineering and Architecture, University of Waterloo, Ontario, CA), published and copy righted by ASHRAE 2007.
- Modeled and Measured Drainage, Storage, and Drying behind Cladding Systems by John Straube, PhD, PEng (Associate member ASHRAE and Associate professor in the Departments of Civil Engineering and Architecture, University of Waterloo, Ontario, CA), published and copy righted by ASHRAE 2007.
- The Role of Small Gaps Behind Wall Claddings on Drainage and Drying by John Straube, PhD, PEng (Associate member ASHRAE and Associate professor in the Departments of Civil Engineering and Architecture, University of Waterloo, Ontario, CA) and Jonathan Smegal, M.A.Sc. (Building Science Consulting, Waterloo, Ontario, CA). A research report prepared for the 11th Canadian Building Conference on Building Science and Technology, Banff, Alberta, CA 2007.
- Note: There are not nearly as many articles dedicated to addressing the specific design and performance theories of 'Drained and Back-Ventilated' rainscreens as there seem to be for 'Pressure-Equalized'. It could be due to the rather wide-range of performance levels that can be classified as D/BV systems as opposed to PERS systems where true

pressure equalization occurs under rather specific and instantaneous conditions. The D/BV design principles and theories are adequately discussed in many of the publications and articles referenced above under The Rainscreen Principle.

Pressure-Equalized Rainscreen

- The Rain Screen Principle and Pressure-equalized Wall Design (AAMA Aluminum Curtain Wall Series) (copyright© 1996) [Note: The original article can be found in the Architectural Aluminum Manufacturers Association (AAMA – 35 East Wacker Drive, Chicago, IL 60601): Aluminum Curtain Wall Design Guide Manual, Volume 2 (copyright© 1979)] www.aamanet.org , Publication Store.
- NRC-CNRC Construction Technology Update No.17, Pressure Equalization in Rainscreen Wall Systems, by M.Z. Rousseau, G.F. Poirier and W.C. Brown (copyright © 1998) – National Research Council of Canada, Institute for Research in Construction http://www.nrc-cnrc.gc.ca/eng/ibp/irc/ctus/ctus-n17.html
- NRC-CNRC Review of Design Guidelines for Pressure Equalized Rainscreen Walls, Internal Report No. 629, dated March 1992 authored by A. (Bas) Baskaran, Ph. D., P. Eng., Group Leader, Senior Research Officer, Building Envelope and Structure for National Research Council Canada, Institute for for Research in Construction. http://www.wbdg.org/design/env_wall.php
- An abstract from the program manual of the Ninth Canadian Conference on Building Science and Technology entitled "Design and Construction of Durable Building Envelopes", held February 27th & 28th, 2003, Vancouver, British Columbia, CA. Technical presentation entitled Designing Pressure Equalized Rainscreen (PER) Walls Using State-of-the-Art Techniques authored by M. Sommerstein, P. Eng., A. Prioste, B. Tech., B. Mandelzys, P. Eng.

The Air/Water (Vapor or Moisture) Barrier (the 'Inner Leaf')

- NRC-CNRC Construction Technology Update No.46, A Method for Evaluating Air Barrier Systems and Materials, by Bruno Di Lenardo (copyright © 2000) – National Research Council of Canada, Institute for Research in Construction http://www.nrc-cnrc.gc.ca/eng/ibp/irc/ctus/ctus-n46.html
- IRC's (Institute for Research in Construction – Canada) publication Air barrier Systems for Walls of Low-Rise Buildings: Performance and Assessment (Note: Only hard copies are available for a fee of $30 CAN through IRC's Construction Publications Virtual Store) HERE
- From the June 2007 "Building Design+Construction" magazine an article entitled 10 Rules for Designing Vapor Barriers, by Richard Keleher and Judd Peterson. www.BBDCnetwork.com
- The Air Barrier Association of America (abaa) Air Barrier Library offers numerous educational documents which will serve to better define proper applications of air barriers as well as differentiate between air/vapor/moisture barriers and when they should and should not be used. http://www.airbarrier.org/library/index_e.php

- Low-Permeance Materials in Building Envelopes, National Research Council Canada – Institute for Research in Construction (IRC), Construction Technology Update No. 41, March 2002 by M.K Kumaran and J.C. Hatsom http://www.nrc-cnrc.gc.ca/eng/ibp/irc/ctus/ctus-n41.html
- Control of Air Leakage is Important by G.K. Garden, NRC Institute for Research in Construction; National Research Council Canada, Canadian Building Digest / NRC-IRC publication report CBD-72, originally published December 1965. http://www.nrc-cnrc.gc.ca/eng/ibp/irc/cbd/building-digest-72.html

This is by no means a conclusive list of reliable technical articles, study reports or design guidelines. I am sure there may be many other sources available that would shed proper light on the design and development theories underlying 'The Rainscreen Principle'. Accordingly, I invite anyone who is interested to add to this list or criticize the validity of any referenced document as to its practical value when designing a properly functioning 'Drained/Back-Ventilated' or 'Pressure Equalized' rainscreen cladding system.

Author's note: To the best of my ability I have updated all referenced URL's. Some of these reports and documents have been circulated for a number of years and may no longer be available on the organization's website. You may have to dig deeper to uncover usable copies if you are interested.

You comments are welcome! Good Luck!

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