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Architechnics is the architectural journal of McGinnis Chen Associates, Inc.

Architechnics is published to inform our clients and colleagues of issues and problems addressed in our practice. By publication of technical articles and case studies, we hope to circulate information that will be helpful to practicing architects, building managers and others in the building trade and related professions.

Due to the unique nature of our practice, McGinnis Chen Associates is often the beneficiary of hindsight. That is, we are often asked to examine, analyze and repair failed building systems principally regarding the building envelope.

Having done this type of work for over forty years, our office has accumulated a wealth of insight into the causes of many different types of building failures and how they might be rectified or avoided. We routinely work on buildings ranging from residences to high-rises, commercial to governmental, and old to new.

FALL CONFERENCES

Every year, MCA encourages its employees to attend educational conferences that will benefit the individual as well as the company as a whole. Last fall, MCA sent representatives to three diverse conferences: Greenbuild, RCI, and SWRI.

Greenbuild Chicago 2007

Chicago, IL
November 7-9, 2007
MCA Attendees: Lynn Htut, Nick Niedospial, and Tracy Yang

This year, the United States Green Building Council (USGBC) held its fifth annual Greenbuild Conference in Chicago, Illinois. Today, Greenbuild is the world's largest conference dedicated to designing, building, living and working in environmentally friendly buildings. Members of MCA attended the convention in recognition of the growing need to address carbon emissions and wasteful building practices.

The conference offered over 100 seminars to choose from, as well as LEED workshops and architectural tours around the city. Additionally, attendees had access to an exhibition hall filled with over 1,200 booths offering a wide range of green building products and practices.

Despite its location in one of the largest conference centers Chicago has to offer, the number of attendees far exceeded the building's capacity, totaling to over 25,000 for an expected 18,000. Next year's Greenbuild will be held in Boston, MA, with expectations of visitors in even larger numbers.

RCI, Inc.
Symposium on Building Envelope Technology

"The Building Envelope of Today and Tomorrow: Design, Detailing, and Specifying"
Boston, MA
November 8-9, 2007
MCA Attendee: Christine Yoon

RCI Inc. is an organization of professional Architects, Engineers, and Consultants who specialize in the design and specification of roofing, waterproofing, and building envelope assemblies. The 2007 Symposium was an educational and informative opportunity to enhance one's professional development through presentations of research papers, case studies, and design guidelines.

With an attendance of less than 500 people, the symposium was presented in a linear schedule format, with opportunities to mingle with other attendees and to discuss products with the exhibiting manufacturers. The atmosphere of the symposium was academic and technical, with presenters exhibiting thorough knowledge of their material. Sample topics included: Design Principles for Plaza Waterproofing Systems, Remediation of a Lock-Strip Gasket Window Assembly, Evaluating the Field Performance of Large Buildings' Windows and Curtain Walls, and Practical Considerations for the Design and Installation of Rooftop Gardens.

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TYPICAL BUILDING EXPOSURE TO WIND-DRIVEN RAIN

by Jon Barratt

Wind-driven rain (WDR) is the cause of many problems for building owners and occupants. Exterior discoloration, degradation of building envelope components, and pressure-induced water penetration are among the detrimental effects that WDR can have on a building. A better understanding of the general physics behind WDR's impact can be beneficial when investigating a situation that involves water intrusion.

Rainfall is composed of drops of varying sizes, commonly described in terms of the drop diameter or "width" of the drop. A typical rainstorm contains drops with diameters between 0.5 mm and 5 mm [0.02 in and 0.2 in]. This range may not seem very large, but keep in mind that two drops with diameters that differ by a factor of ten have volumes (and therefore masses) that differ by a factor of a thousand. This is significant since the force required to accelerate an object is linearly dependent on its mass.

The distribution of drop sizes in rainfall generally follows the Normal Distribution (or "bell curve"), meaning that for a typical rain event almost 70 percent of drops have diameters between approximately 2.0 and 3.5 mm. The remaining 30 percent of drop sizes fall equally on either side of this range.

The wind environment around a building is influenced by multiple factors, including the building height, surrounding terrain, building shape, building orientation, and wind speed. In general, wind speed increases with height, meaning that the upper floors of a building usually experience greater pressures than the lower floors do. On the windward side, positive pressures are higher still at the corners and roof edges, where local accelerations occur as wind flows around the building. All other surfaces (including the roof) experience negative pressure – also known as uplift.

So what happens when a wind-driven rainstorm like the one described above occurs in an urban setting? As rainfall approaches a building, the smallest drops tend to be swept around the building without impacting the surface at all. The biggest drops tend to continue their linear path until they impact the surface, since they require roughly a thousand times more force before their trajectories become altered. The "in between" drop sizes – which comprise the majority of rainfall – are a more complicated case. Their trajectories are modified by the local wind environment, but not so much that they are swept completely around the building. The end result is a wetting pattern on the windward face that is heaviest at the top corners, heavy along the roof line and vertical edges, and very light in the middle and lower sections of the wall (Figure 1).

Finding and repairing the vulnerable points on a building can sometimes be a difficult task. Knowing which areas are susceptible to high volumes of WDR may yield clues that can help all parties design and implement measures to better resist water intrusion.

Figure 1: WDR distribution on a building.

MCA WELCOMES A NEW ASSOCIATE

EVAN SHEN has been a valued employee with McGinnis Chen Associates since 1999. He recently earned his Architectural License, and has been appointed to Associate level of the firm. These achievements are a complement to his skills in waterproofing design, on-site investigation, project management, and contract administration.

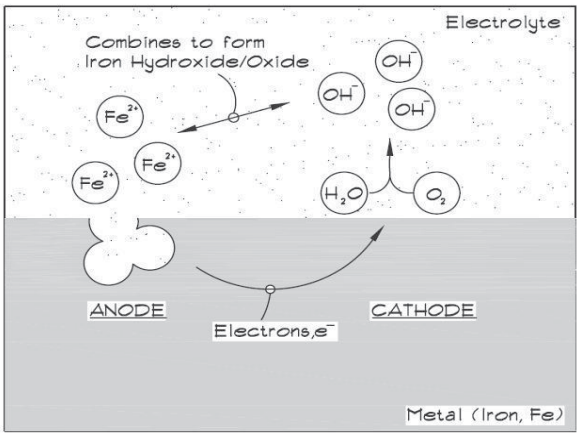
Evan's experience has helped him develop several innovative investigation techniques with the use of hand-held computers. He also co-authored the *Technical Guidelines for Aluminum Curtain Wall* for SWRI and co-presented a project study at a past SWRI technical meeting.

GALVANIZED SHEET METAL v. STAINLESS STEEL

A Technical Study
by David Rodriguez

A common challenge faced by experts in the construction industry is that of protecting exposed exterior steel from corrosion. Not only is corrosion aesthetically displeasing, but it can also impact the structural and waterproofing integrity of a building. Choosing the wrong type of metal for the job can result in costly repairs in the future. Although many new anti-corrosive materials are now available on the market, the two most commonly used materials are galvanized steel and stainless steel. While both materials offer good corrosion resistance, a more thorough analysis of their properties is necessary when making a selection for an exterior building application.

Most processed metals are unstable and try to revert back to their natural form. This is known as oxidation. Corrosion occurs when the metal oxidizes, causing it to increase in volume – in some cases as much as ten times – and eventually flake off. Oxidation is an electrical process in which electrons are liberated at the anode, travel through the metal conductor to the cathode, and then return to the anode through the electrolytic solution. The oxidation at the anode leads to the creation of iron oxide/hydroxide "rust", and eventually causes corrosion due to the inherently larger volume of iron oxide/hydroxide. Galvanization uses this concept to help protect the metal from corrosion underneath a layer of zinc.



The anti-corrosive properties of galvanized metals are created by depositing a layer of zinc on the surface of the steel, which is also known as cathodic protection. There are three main processes by which steel is galvanized, the most common of which is hot dipped galvanizing, creating a thicker layer of zinc. The thickness of the zinc coating has a direct correlation to the steel's resistance against corrosion.

The galvanizing process is sometimes confused with a passive coating process such as epoxy covered rebar. As long as the zinc is in contact with the underlying metal and there is a closed circuit, the zinc will perform as a sacrificial anode. This is in contrast to an epoxy coating, where localized corrosion can occur in areas where the coating is damaged.

The layer of zinc used in galvanization is what is commonly referred to as the sacrificial anode. This is because the zinc will continue to oxidize, thus sacrificing itself to protect the more electronegative metal underneath. This can be a disadvantage of galvanized metal, as the zinc will oxidize until it has been fully depleted. Painting of the galvanized metal can help further protect it, but special care must be taken so that a compatible paint is chosen.

The potential for corrosion is high when galvanized metal comes in contact with other, dissimilar metals such as copper, stainless steel, or aluminum. Only galvanized fasteners should be used in contact with galvanized sheet metal. When using galvanized sheet metal in contact with pressure treated wood, a thick layer of zinc is necessary, as the chemicals used to preserve the wood can greatly increase the rate of the metal's corrosion.

Stainless steel can also be used when specifying a protected metal. Stainless steel is an iron-carbon alloy, which contains chromium along with other metal additives such as nickel. Although the name implies that the metal is "stainless," this is not the case. Stainless steel is much more resistant to corrosion than other alloys, but it can still rust, especially in a high chloride content atmosphere. The anti-corrosive properties of stainless steel are inherent in the crystalline structure, which is determined by the quantity of metal additives, which include chromium, nickel, and manganese. These metal additives produce a thin passivation layer on the surface, which protects the metal from corrosion. Since the anti-corrosive properties of stainless steel are inherent in the metal, the metal will be protected as long as there is sufficient oxygen to induce the passivation layer on the surface of the metal.

When stainless steel is exposed to oxygen, a layer of chromium oxide is deposited on the surface of the stainless steel, forming the passivation layer. These alloys are generally more expensive than galvanized metals, but offer more protection to corrosion resistance. This is due to the fact that the corrosion resistance properties in stainless steel are intrinsic in the material. This provides the benefit of better protection at cut ends and welds. Stainless steel sheet metal may be used in highly corrosive environments, when exposed to soil, fertilizers, noxious fumes, or air heavily saturated with oceanic salt or that is high in chloride ion content.

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Sealant, Waterproofing & Restoration Institute

Fall Technical Seminar
San Diego, CA
October 14-16, 2007
MCA Attendees: Evan Shen, Rod Shoemaker, and Jessica Walitt

The Sealant, Waterproofing & Restoration Institute (SWRI) is a trade organization made up of contractors, manufacturers, and consultants with a specialty in sealant, waterproofing, or restoration work. SWRI features two technical meetings a year, providing seminars on a range of subjects. Presentations are either technical or project-specific in nature, interspersed with opportunities to meet exhibitors and learn about their specialty waterproofing products.

One highlight of the meeting is the Technical Clearinghouse, where attendees have the opportunity to present real-life waterproofing or restoration questions. The Clearinghouse Moderator and fellow attendees provide solutions based on individual experience. Technical seminar topics at last fall's meeting included: "Flashings: Yesterday & Today," "Mock-Ups: Setting the Standard," "How Stormwater Regulations Promote Green Roofing and Waterproofing," and "Curtain Wall Systems: A Practical Approach to Evaluation and Repair." Project-specific showcases highlighted waterproofing assemblies such as curtain walls, plaza deck waterproofing, and façade restoration in locales ranging from Chicago to Florida, and Maryland to Dallas.

Given the variety of professionals at each conference with their range of backgrounds, SWRI takes advantage of the expertise of all attendees and provides valuable, education seminars year after year.

Galvanized Sheet Metal v. Stainless Steel
A Technical Study by David Rodriguez

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Galvanized steel, although not as resistant to corrosion as stainless steel, is often specified in construction due to its lower cost. In environments that are not extremely corrosive, galvanized steel is more desirable due to the cost benefits. However, stainless steel should be used in highly corrosive environments, especially where the owner has expectations of a long-lasting design, or where the extra durability is desirable despite the increase in cost. An intermediate option would be galvanized steel with a thicker coating of zinc.

Comments? Suggestions? Questions?
What would you like to see in future issues of this newsletter?
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McGinnis Chen Associates, Inc. has been providing specialized architectural and engineering consulting to private, institutional and public property owners since 1963. Over this period we have provided pre-construction, diagnostic and remedial design for many of the San Francisco Bay Area's most prestigious commercial and civic properties as well as hundreds of residential properties. Our clients have included the most experienced property owners, developers, builders, architects, and attorneys as well as single-family and multi-family residential property owners and homeowner associations.

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