momentum

Summer 2006 Vol. 1 No. 1

4 **engineer this!**

Walker Art Center
challenges and creativity

momentum

Staff

Kirk Smith
Editorial Director

Meghan Wismer
Creative Director and Chief Editor

Melissa Jamison
Editorial Projects Director

Sarah Hogfoss
Production Editor

Ryan Martinson
Special Projects Editor

Contributing Writers

Ethan Charpentier, PE
Ethan has been with Larson for 8 years and is the Curtain Wall Services Manager. He doesn't know what he would do without his favorite food, steak.

Lee Granquist, PE
Lee is President of Larson Engineering. Another 'P' title he holds is that of pilot.

Ryan Coon, PE
Ryan is a Curtain Wall Renovation Engineer and has been with Larson for 5 years. He likes the color blue.

Bruce Grandits
Bruce is a Curtain Wall Services Engineer. He's been with Larson for 1½ years and enjoys laying on the beach.

Rachel Zoelzer
Rachel has been with Larson for 1 year and is a Curtain Wall Services Engineer. Besides engineering, she gets her thrills from the double-tracked roller coaster, American Eagle, at Six Flags Great America.

On the Cover

Walker Art Center Expansion | Minneapolis, MN
Photo courtesy M.G. McGrath

Mission Statement

Through engineering excellence, we will provide innovative solutions and value-driven design packages to build and maintain relationships of trust with our clients and colleagues.

from the director

Greetings and welcome to **Momentum**, Larson Engineering's brand new newsletter!

Why Momentum? Momentum is being published to keep you current on technical matters of interest, inform you of happenings within our office, and get those synapses firing with some brainteasing fun. Featured columns will be: '*Clients Corner-Zone*,' intended to answer your questions of interest; '*Technical Tidbits*,' a column devoted to the engineering of curtain wall systems and the effects of specific codes and standards; '*Engineer This!*,' featuring specific projects and their unique aspects and '*Everything Exterior*,' which provides insight into the outside lives of our team members.

Larson Engineering has seven offices in addition to our headquarters in White Bear Lake, Minnesota. You can find us in: Chicago and Naperville, Illinois; St. Louis, Missouri; Appleton and Milwaukee, Wisconsin; Scottsdale, Arizona; and Norcross, Georgia. Besides the Minnesota office, Curtain Wall design services are also available in our Missouri, Illinois and Wisconsin offices. In future issues we will highlight specific Curtain Wall design specialties, news and events for these locations. But don't forget, Larson also offers structural, industrial, mechanical and civil engineering services for projects big and small.

Larson Engineering is now in our 27th year of business. We have you, our clients, to thank for our success. We truly appreciate your business and hope that we are an asset to your firms as well. I hope this first issue of **Momentum** brings you insight on Larson Engineering and the individuals with whom you interact daily. If you have any questions or comments, please let me know directly.

Enjoy **Momentum**!

Kirk V. Smith
Executive Director
Curtain Wall Services

Capstone Project

Rachel Zoelzer

This Spring, Larson Engineering sponsored a senior design project at the University of Minnesota. Mark Brice, Bruce Grandits, and Rachel Zoelzer, from our Curtain Wall Services department, mentored the aspiring structural engineers. The students, Marshall Ahmanson, Mark Anderson, Brian Anderson, and Tyler Krahn, were given the responsibility of engineering one of Larson's completed projects: the Phoenix International Raceway Turn One Expansion—kindly furnished by Walters and Wolf. The students rose to the challenge of formulating solutions and carrying out designs, as well as providing final plans/specifications and design recommendations. At the end of the term, they prepared a report and presented their project to their peers.

Larson Softball

Bruce Grandits

In April, Larson Engineering started a softball team and entered the Arden Hills league. Games are every Tuesday night, usually between 6-8 pm and last about an hour.

Our season started on April 25th and will finish around the end of July, with a single elimination playoff between the teams in the league. It's been rough losing our first few games, but we're showing vast improvement and it's proving to be a fun season. Everyone should try and catch a game before the season's over.

Hope to see you this summer!

Games left in the season:

June 27	6:00 p.m.	Charles Perry Park
July 11	7:00 p.m.	Hazelnut Park
July 18	7:00 p.m.	Charles Perry Park

Secret Sandbox Society

Starting Wednesdays in July and running through the summer, Larson will compete in a volleyball league hosted at Bentley's Grille and Pub in Vadnais Heights.

A cross-section of Larson's departments represent the team known as the Secret Sandbox Society.

Come cheer on your new favorite secret society and enjoy refreshments from the pub.

everything exterior

Casas por Cristo

Lee Granquist, PE

For the past three years, my wife Barb and I have traveled to Juarez, Mexico to build houses through Casas por Cristo, a non-denominational Christian organization that provides housing for families in need. We were first introduced by a curtain wall client to the organization which builds approximately 300 houses per year in Juarez, which is just across the border from El Paso, Texas. The houses are one-story wood-frame construction finished with stucco. The interior of these houses have electricity, doors, windows, drywall, insulation, and ceiling fans.

Each house is typically built in three days. So as you can imagine, those days are a constant flurry of activity with hand tools and only a few power tools used during this quick, but organized construction. The first day the site is leveled and concrete is poured from an onsite mixer for the slab on grade. Day two consists of building and placing the walls and roof. The final day consists of roofing, stuccoing the exterior, wiring and installing drywall. After the construction, there is a small dedication for the grateful family. It's truly an unforgettable experience full of camaraderie.

We will be making the trek to Juarez again December 26-31. Please contact me if you are interested in experiencing this for yourself. You may find that you not only change the world a little bit, but you end up changing yourself as well.

Marathons

May 20, 2006

Fargo Run for the Children Half Marathon

Sarah Hogfoss: Half Marathon
Time - 2:40:17

October 1, 2006

Twin Cities Marathon

Anthony Schoenecker: TC10

Ryan Martinson: TC10

Sarah Hogfoss: TC10

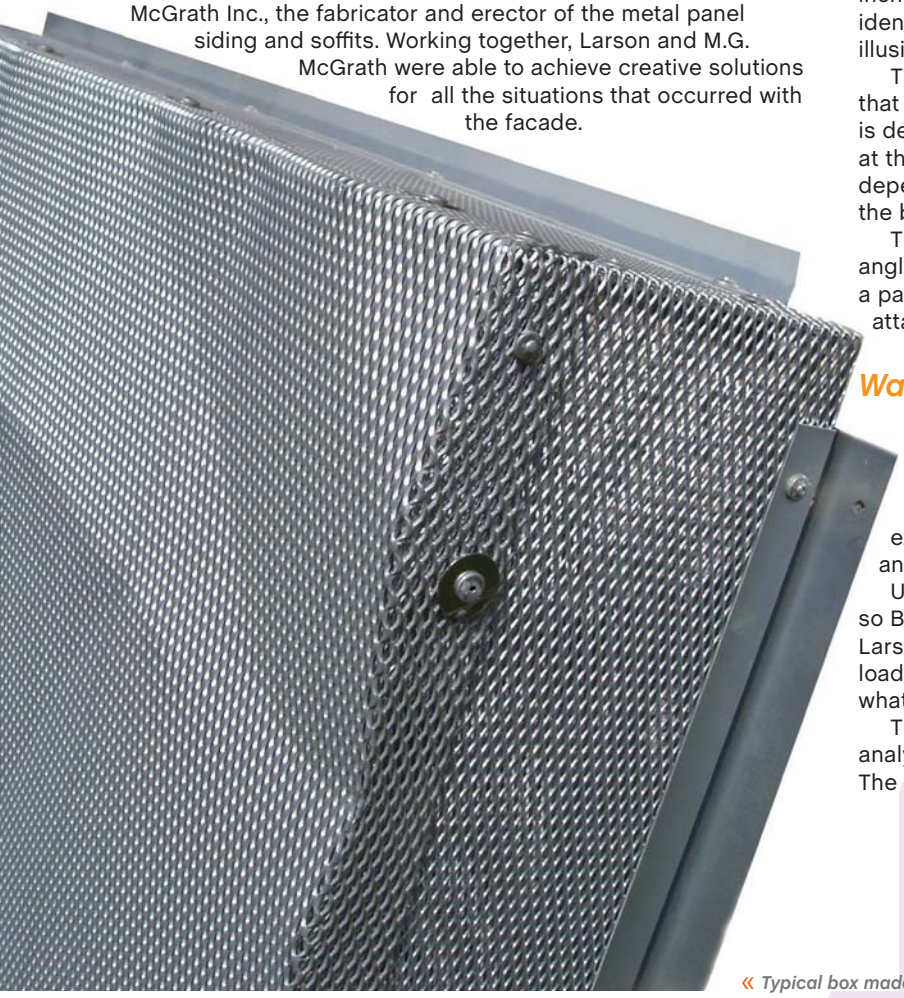
Please wish our runners good luck!

Walker Art Center
challenges and creativity

Ryan Coon, PE

Sure to catch your eye while driving along the west side of Minneapolis is the large cube resembling crumpled tinfoil. This "cube" is the new expansion for the Walker Art Center designed by Swiss architecture firm Herzog & de Meuron. The expansion project brought many challenges to all the engineers involved and which the engineers of record at Hammel, Green and Abrahamson can surely tell you more about.

Larson Engineering was brought into the project by M.G. McGrath Inc., the fabricator and erector of the metal panel siding and soffits. Working together, Larson and M.G. McGrath were able to achieve creative solutions for all the situations that occurred with the facade.



« *Typical box made from stamped and expanded aluminum.*

What's that cube made of?

The exterior of the Walker Art Center consists of two layers of panels. The interior layer is a weather proof insulated aluminum panel, while the exterior layer is made of a decoratively stamped and expanded aluminum panel. After being expanded and stamped, the aluminum was formed into 3 feet-9 inch by 3 feet-9 inch boxes that were 6 inches deep. Though these boxes are identical, they were oriented on the wall differently to create the illusion of a random pattern.

The boxes are supported by a unitized aluminum tube system that spans across the entire building. Each of the typical units is designed to support four of the boxes, and is only anchored at the bottom left corner of the unit. Because of this, each unit depends on those around it to support loads from the weight of the boxes, as well as loads from wind, snow, and even ice.

The frames are anchored to the main structure by attaching angles to each side of the tube. The angles are then attached to a pan which anchors through the inner weather proof panel, and attaches to the structure.

Warning: Challenges Ahead

Around every corner, window, and fold in the wall special cases needed to be analyzed. Which leads into one of the main problems on this job: just how do you analyze an expanded, stamped, aluminum panel that has been formed and riveted into a box shape?

Unfortunately Larson was unable to answer this question, so Braun Intertec was asked to test the boxes. With input from Larson, Braun conducted experiments to test maximum wind loads, as well as ice loads, and cyclical wind loads to determine what effects fatigue would have on the boxes.

The area of the tube framing which was most difficult to analyze, was the section to the right of the Walker's new terrace. The wall which encloses part of the terrace starts as a knife edge

« *Far left* *The finished addition at night.* (Photo courtesy M.G. McGrath)

« *Left* *In addition to the finished facade, interior insulated panels and tube frames ready for boxes are shown in one of the most difficult to design areas.* (Photo courtesy M.G. McGrath)

« *Closer view of the paneling process.* (Photo courtesy M.G. McGrath)

point, and gets wider and wider. Because the boxes are 6 inches thick, there was no room for tube framing until the wall was over 12 inches thick, this didn't occur until almost 3 feet away from the edge of the wall. Our solution for supporting this portion of the wall without tubes was to attach plates to the end of the tubes that would run between the exterior and interior boxes. Another problem was that once the wall was thick enough for tube framing, it still wasn't thick enough for any type of structure to support the tube framing. In some locations, the nearest structural support was over 10 feet from the edge of the wall. Because of this large cantilever, the horizontal tubes needed to be reinforced, and the all of the connections between tubes needed to be built up as well.

The terrace area wasn't the only place where conditions weren't ideal. Some corners of the Walker Art Center slant at different angles, and when the vertical column of tube framing needed to connect to the anchors attached to the diagonal structural corner members, problems arose. Slotted holes allowed the vertical tube to be out of line with the anchor up to 1 inch. At the corners, the tubes were offset by up to 10 inches. Since the tube couldn't be brought to the anchor, we decided to bring the anchor to the tube. Aluminum plates were attached to the pan of the anchor to reach over to the vertical tube. The angles that used to attach directly to the pans were then attached to the plate instead.

Larson Lends a Helping Hand

Working to minimize the amount of material our clients need is always a priority for us. When the original design for the tube framing system came in, the drawings showed the anchors located adjacent to the splice between the frames. This design would have required large moment connections between the tubes. Since the locations of the boxes couldn't be changed, Larson suggested that all of the anchors be shifted up the wall 8-10 inches. This would put the splice at the point of zero moment in the continuous beam, which would eliminate the need for a moment connection, and allow us to reduce the thickness of the tubes by 1/16 inches. While 1/16 inches may not sound like much, over the entire job this saved more than 12,000 pounds of aluminum!

The Walker Art Center expansion presented many challenges to engineers from floor to ceiling, wall to wall, and even outside of the walls. But with some creative thinking, it has become a reality and will surely remain an icon in downtown Minneapolis for many years to come.

The pan used to anchor the tube frames. »

Welded studs on the top attach to the angles on either side of the tube, while welded studs on the bottom attach to structural steel.

technical tidbits

Help Us Help You

Providing the following information with your project submittals will enable Larson Engineering to provide you with a quality set of documents meeting your budget and schedule requirements.

Shop Drawings

Accurate and complete details

Identification of all fasteners

Sizing of miscellaneous steel

Edge distances of concrete fasteners

Identification of surrounding conditions at anchors

Documents | Information

Specifications

Section Properties

Architectural Elevation or Building Section indicating the building height/roof height

Structural Drawings (Sheet S0 or S1) to include:

- Applicable code
- Exposure category
- Importance factor
- Seismic factors
- Concrete strengths

closing thoughts

We hope you have enjoyed the premier edition of **Momentum** as much as we have enjoyed creating it. This newsletter was written with the same passion and creativity that inspires our engineering.

We are committed to providing our clients with quality solutions for all of their project needs. We wish you a wonderful and successful summer and invite you to contact us for any of your engineering needs.

Ethan Charpentier, PE
Curtain Wall Services Manager

clients corner-zone

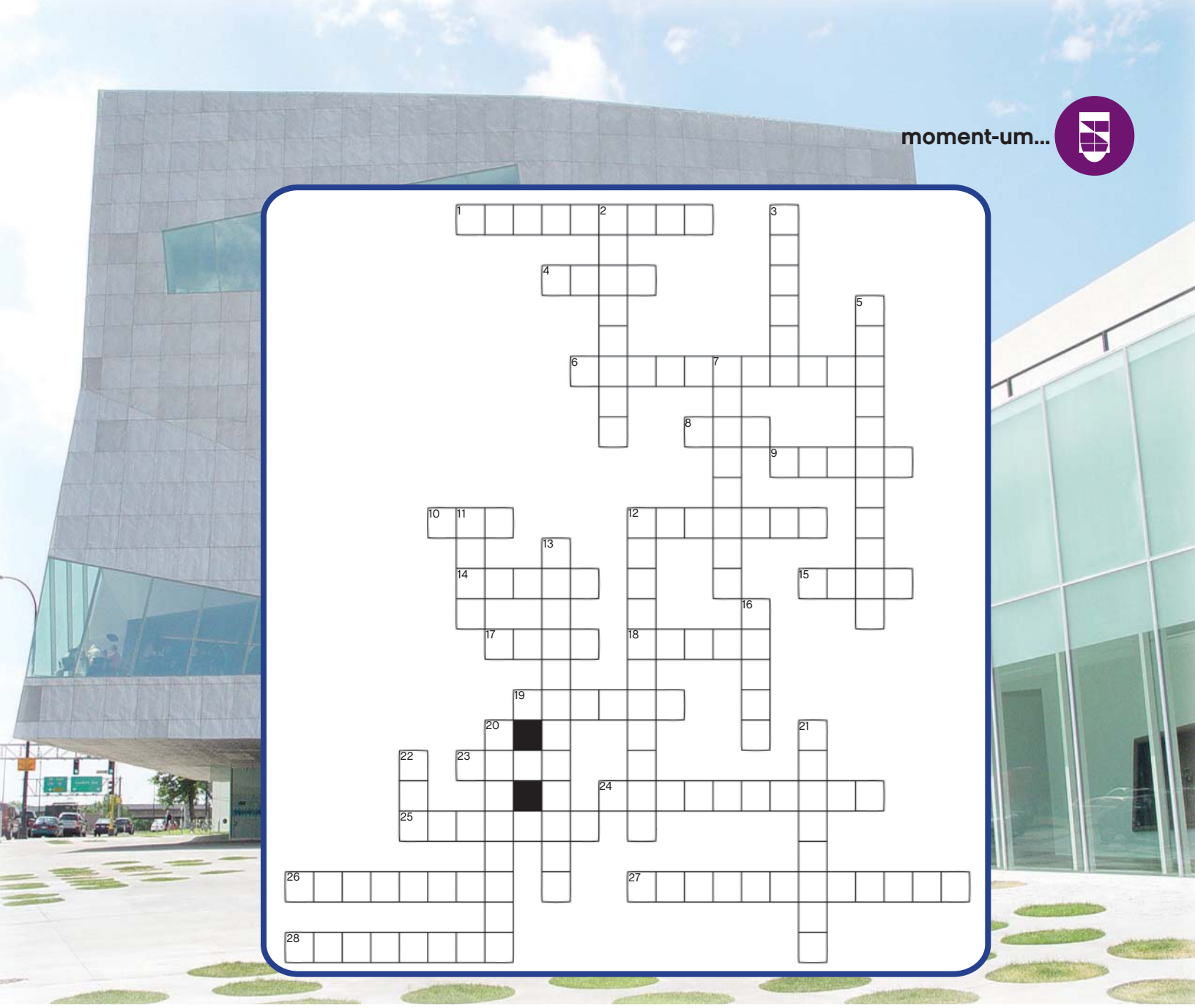
We invite you to submit questions you may have or suggestions for articles you'd like to see published in future issues of **Momentum**.

Please send them to: momentum@larsonmn.com.

The next issue of **Momentum** is slated for Winter 2006.

Momentum is the official curtain wall newsletter of Larson Engineering, Inc.

Larson Engineering
3524 Labore Road
White Bear Lake, MN 55110
651.481.9120 fax: 651.481.9201
www.larsonengr.com



across

1. “To act as one”
4. Top curtain wall member
6. Function is to retain the glass
8. Steel disk cross-section
9. Long series of identical windows
10. Building code leader
12. Glass installation process
14. Usually made of composite metal
15. Horizontal threshold
17. “Lite” overlap
18. First extrusion material used in curtain wall
19. Curtain wall to structure
23. Perimeter member
24. NYC 1st curtain wall building
25. Horizontal or vertical
26. “Floated”
27. Location of 1st curtain wall
28. A horizontal projection

down

2. Non-transparent glass
3. Curtain wall referenced as in medieval architecture
5. Non-load bearing wall
7. AKA modular system
11. “To remove a portion”
12. Three-sided opening
13. Rubber support
16. Bombing in Oklahoma led to this new curtain wall design analysis
20. 1st curtain wall building in 1917
21. First material used in mullions in 1970
22. Curtain wall design aid