PROJECT RECORD

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From: Justin E. Burgoon, P.E., S.E. - BSE Structural Engineers **Date:** 1/22/2015
To: John Wilkins - Gould Evans, Paul Werner - Paul Werner Architects **Project No:** 12-083
RE: Rock Chalk Park Rec. Center -Sawed Control Joints in Slabs on Grade & Exterior Tilt Panel Cracks

BSE was asked by Paul Werner with Paul Werner Architects and John Wilkins with Gould Evans to write a letter referencing requirements for filling the sawed control joints in the slabs on grade as well as the elevated mezzanine slabs. BSE was also asked to reference the cracks in the architectural wythe (exterior face) of the insulated concrete tilt panels on the referenced project.

Control joints are sawed into concrete slabs in an attempt to localize shrinkage cracking, due to curing, into a more visibly appealing pattern. The sawed control joints also aid in the maintenance of the slab joint. Joint filling was not specified for this project. Typically joints are only required structurally to be filled if there are heavy loads to be transferred across the joint. These loads would be anticipated in a warehouse/industrial application, but not for a recreation center. Ultimately it is up to the owner to determine if joint filling is required. Water collecting in the slab joints is not a concern structurally for this application as we are indoors. Water would be a concern if the slab was exposed to freeze thaw cycles. The maintenance required to keep the slab joints clean of dirt and debris is another consideration for the owner.

BSE received several photos from John Wilkins via email referencing numerous cracks in the architectural wythe of the insulated tilt panels. BSE observed the exterior of the panels on January 15, 2015. The majority of the cracks occur at the corner of window/door openings and typically continue diagonally until they reach the panel edge. The majority of the cracks appear to be less than 1/16" wide and are considered to be tight. BSE was also contacted by Casey Stewart of DFC on August 7, 2014 referencing these cracks. BSE documented several photos of the cracks on August 8, 2014.

The insulated tilt panels are composite panels consisting of a 6 1/2" structural panel, 2" of insulation and a 2 3/4" architectural wythe. The architectural wythe is continuously supported by the structural panel and does not carry any structural load besides a portion of its own self weight. The 6 1/2" structural panel is reinforced to support bearing loads, its own self weight (including the weight of the architectural wythe), as well as wind and seismic loads. As previously mentioned, the architectural wythe is supported by the structural panel through inserts designed by and coordinated with Thermomass. Typically, the architectural wythe is only reinforced for temperature and shrinkage stresses. Our construction documents detailed 6x6 W2.9xW2.9 W.W.F. sheets to be located in the center of the wythe. This architectural wythe thickness and reinforcement are common in the insulated tilt-up industry. This reinforcement meets the minimum requirements defined in ACI.

The general contractor requested to use fiber reinforcement in lieu of the W.W.F. shown in order to aid in coordinating with reveals and form liner panels and also due to the challenge of accurately placing the W.W.F. in the center of the architectural wythe. Fiber reinforcement is also a common reinforcement method in the concrete industry and has a reputation as providing better crack control as compared to W.W.F. due to a more uniform distribution of reinforcement across the entire thickness of concrete. The approved alternate fiber reinforcement was 5 pounds per cubic yard of Helix micro-rebar. The manufacturer verified that this approved volume was equivalent to the W.W.F. shown in our construction documents.

The referenced cracks are more than likely caused by either shrinkage of the architectural wythe due to curing or thermal movement due to temperature changes or a combination. The architectural wythes of the insulated tilt panels were poured in the fall of 2013. The wythes have cycled through the extreme winter temperatures and the extreme summer temperatures. In comparing the cracks in the referenced photos from August 2014 to the photos taken in January 2015, it appears that the separation of cracks has stabilized.

It is not unexpected for some cracks to appear at the corners of concrete openings. The design intent of the W.W.F or micro-rebar is to hold those cracks tight. Some of the micro-rebar was visible at the surface across some of the cracks. Because the cracks have continued to be less than 1/16" wide throughout the extreme temperatures of the winter, it appears that the Helix micro-rebar is holding the cracks tight and preventing them from opening up more. Our experience with insulated tilt-up projects is that the architectural wythe is typically painted which helps cover the cracks. The referenced cracks for this project are more prominent probably because of the unfinished concrete surface. Some limited patching of cracks was observed. The material used appeared to be applied sparingly and was a different color than the concrete, thus highlighting the crack. It may be difficult to find a patch color that blends with the existing wall surface.

It was also observed that sealant at some panel joints appeared to be pulling away from the panels.

In conclusion, the referenced cracks in the architectural wythe are cosmetic and not a structural concern. The separation appears to have minimized to the point that these cracks can be sealed. One method of sealing these cracks would be to paint the exterior. Otherwise, a surface applied elastomeric sealant could be knifed into the cracks to keep moisture out.

Please feel free to call with any questions or comments regarding this letter. We appreciate the opportunity to provide our services to you.

Sincerely,
BSE Structural Engineers, LLC.

Justin E. Burgoon, P.E., S.E.
Senior Structural Engineer