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Architecture
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August 27, 2012

RE: OBSERVATION REPORT FOR ALLEN HIGH SCHOOL STADIUM CONCOURSE SLAB

PBK Structural was requested to assess the condition of the cracking concourse slab at the Allen High School Stadium located in Allen, Texas for general structural conditions. This was a visual inspection of the structural slab, no destructive demolition was performed to determine sub-surface or visually impaired conditions. In addition to providing our professional opinion, PBK Structural is providing recommendations for an appropriate repair method based on the information obtained.

Prior to visiting the site I accessed the structural drawings to get a general idea of the structural systems used at the stadium. The concourse level is a cast in place concrete T-Beam system supported by cast in place concrete beams with normal steel reinforcement. There is no indication that prestressing tendons were used on this project. The structural drawings appear to be clear and easy to read, and follows standard detailing practice for cast in place concrete. The concourse T-Beam system consists of a 4-5/8" thick slab with 20" deep pan-formed joists for an overall depth of 24-5/8". The joists are generally spaced at 5'-0" on center throughout the entire project. The plans indicate #3 rebar spaced at 12" o.c. for slab temperature and shrinkage reinforcement.

I was informed that the main concern is the structural significance of the cracking slab with respect to both long term and short term performance of the building. Water currently penetrates into the substructure below via the slab surface cracks. Some of the underlying areas are protected with a secondary roof structure but others are not. There is also concern that the cracks will open throughout the life of the building compounding the issues. Because of the size of this project, I will refer to specific areas with respect to the building areas defined by the contract documents titled "Allen High School Multipurpose Stadium Package 2 – Vol. 1".

Upon my arrival to Allen High School Stadium, I met with Rick Wirley of Pogue Construction who directed me to the areas with the most severe surface cracking. I was informed that although minor cracking has occurred throughout the project, the majority of the surface cracks occur within areas 'D', 'E', and 'F'. I began my inspection by first walking the concourse level to get a general idea how widespread the cracking was throughout the project, and to identify areas for closer inspection. As stated above, small surface cracks have developed sporadically throughout the concourse structural slab. I observed minor cracking to some degree in virtually every plan area. In general, the cracks were on the order of hairline to approximately 1/32" in width. The largest cracks observed were approximately 1/16" in width (see Photo 1) and continued completely through the slab. Although I did observe some areas where the hairline cracks "spider webbed" in a random pattern, the vast majority of the cracks ran parallel to the concrete pan joist.

Area 'D' has the highest concentration of cracking. This area exhibits extensive random hairline cracking as well as regular linear cracking parallel to the pan joists (see Photo 2 and 3). I did not have access to the concrete testing reports to verify the in place concrete strength and water content. I was informed by Rick Wirley that Area D was the first pour of the pan joist system and that it was a "hot and

windy day". I asked if proper curing procedures of "Hot Weather Concreting" were followed as described in ACI 305, to prevent the concrete from drying out prematurely. It was unclear as to the exact procedure that was used, but I was informed that the concrete was not covered or kept damp throughout the curing process. It was also stated that most of the cracks appeared within a few days of pouring the concrete.

Area 'E' also contained random cracking and linear cracks parallel to the joist. This linear cracking typically occurred only in the slab and at approximately halfway in between the adjacent pan joist. Where the cracks did migrate across the joist, the crack was contained within the slab and did not migrate down into the actual concrete joist (Photo 4). I observed cracking to some degree throughout the rest of the concourse, but by far the greatest concentrations of cracks were limited to areas D and E. Upon mapping the linear cracks on the framing plan a pattern developed. In areas D and E the pattern was a series of cracks spaced approximately 10' to 15' followed by a gap of approximately 25' to 30' before the next series of cracks was observed. In some areas individual cracks occurred approximately 25' to 30' from other linear cracks or expansion joints. This regular pattern as well as the quick appearance of the cracks in the green concrete are consistent with concrete shrinkage cracks.

It is the opinion of PBK Structural that the cracks observed in the slab are not a result of overstressing the slab or the concrete pan joists with excessive loads. Overstressed joists often display vertical cracking that start at or near the bottom of the joist and are located within the middle 1/3-span of a single span joist. As noted above, cracking was not observed in the actual pan joist. All indications are that the concrete pan joist system is preforming as designed.

As concrete cures, water is critical for the chemical reaction that is occurring within the concrete matrix. Too much water in the mix reduces the concrete strength and can cause causes excessive shrinkage. Improper curing or allowing the concrete to "dry out" after placement can also reduce the concrete strength and cause excessive cracking. It is typical to see shrinkage cracks develop approximately 15' to 30' on center depending on the slab design.

Proper placement of the concrete reinforcing mat is also critical to minimize the visual impact on the slab surface. All concrete will shrink, it is the job of the temperature reinforcement to limit the size of the cracks, but factors such as water content and location of the rebar can have an impact on the crack spacing. #3 bars spaced at 12" o.c. were specified on this project for shrinkage control of the concrete. This meets the minimum requirements Per ACI 318 for shrinkage and temperature reinforcement.

Recommendations for slab repair: It is recommended that the larger slab cracks (1/32" and larger) be thoroughly cleaned and repaired with a low-viscosity epoxy or polyurethane crack filler. These products have the ability to penetrate deep into the crack. The color of the cured product varies with the manufacture, and some products may be custom pigmented in an attempt to match the existing concrete color. Some products for consideration include: Crack-Pac Injection Epoxy or Crack-Pac Flex-H_2O Polyurethane Crack Sealer, by Simpson Strong-Tie.

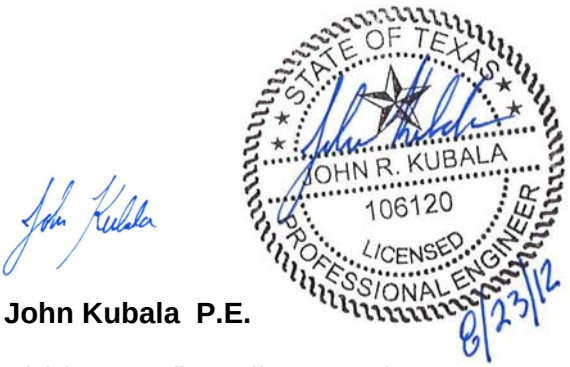
The crack filler won't effectively repair the micro and hairline cracks in the slab. This is best addressed with a self-leveling concrete topping product. A few of the major manufactures of this type of product include ARDEX Engineered Cements, STONHARD seamless polymer floor, wall and lining systems, and Spraylock concrete protection.

Concrete is a porous material. There is a possibility that, depending on the type of repair that is selected, evidence of the cracks will still be apparent in the finished product. This is because of the difference in the porosity between the concrete and the repair products used. This could translate into a

discoloration on or around the underlying cracks. Regardless of the method of repair chosen, it is recommended that product representatives be asked to visit the project site to determine the appropriate product for use.

Please let me know if there are any further questions or concerns or if additional recommendations are desired.

Sincerely,



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Photos:

Photo #1

Photo #2

Photo #3

Photo #4