Memorandum

Date: September 28, 2022
Project Number: 22103.02
Project Location: Newport, Kentucky
Subject: Newport High School Stadium Seating
Prelimnary Findings
☒ For Review
From: C. Casey Hitter P.E.
Client: Robert Ehmet Hayes and Associated, PLLC.
Attention: Noah Onkst

Structural Consultants
ADVANTAGE GROUP
ENGINEERS, INC.

At your request Advantage Group Engineers (AGE) has performed a preliminary analysis / review of the Newport High School stadium seating, in Newport, Kentucky. This analysis is based on observations made on September 19th and 20th, 2022 of the existing structure. The following memorandum is a summary of our on-site observations and recommendations for renovating / repairing the existing structure.

For the purposes of this report the stadium seating is assumed to face east. The existing stadium seating consists of a cast in place “stair step” structure with locker rooms and a gym below it. The concrete seating is supported by concrete raker beams at roughly 12’-0” on center that span from the back of the seating to the front. The beams bear on concrete columns or walls at each end. There are multiple CMU demising walls below the seating slab to create the locker rooms, bathrooms, and workout gym area. It is also assumed that the entire structure is supported by shallow spread footings. The seating surface consists of steps cast into the concrete to create the raised stadium seating. Aluminum bleachers are anchored to the steps on the face and the top with what appear to be wedge anchors. The stadium was dedicated in 1939 and it is assumed that the actual construction took place just before that.

The surface of concrete structure is fully exposed to the elements. It is not shaded for the most part and it also is not protected from rain or snow. Given this continuous exposure the concrete surface has begun to deteriorate exposing reinforcing and causing the concrete to delaminate at the surface. This appears to be an ongoing issue as several patches were noted while on site. In general, the lower portion of the seating was found to be in far worse condition than the upper portion while the north end of the seating was worse than the south end. To help evaluate the structure, SSRG provided selective demolition in areas as dictated by AGE to expose the deteriorated concrete and reinforcing. This selective demolition consisted of chipping away the top surface of the concrete to determine the depth of the delaminated surface and corrosion. Also, at the direction of AGE, SSRG took three, 3” cores in various places of the slab to further verify the thickness and condition of the concrete. These cores were brought back to AGE’s office for review. The goal of the selective demolition and cores was to help corelate the surface condition to the condition of the concrete beneath it. Therefore, these areas varied in location; some of the worst areas were cored and exposed while some of the better areas were also observed to help determine a base line.

The initial review of the selective demolition sites and cores confirmed the original theories developed from visual observations; the lower portion of the structure is in much worse shape than the upper portion. The slab at the lower level was found to be delaminating several inches below the surface and the reinforcing bars at the nose of the steps are rusted due to exposure but still relatively intact. SSRG noted that there was a considerable difference between chipping the concrete at the upper portion versus the lower portion. In general, the further up the structure they were the harder and more intact the slab seemed to be. At the areas of selective demolition towards the top of the seating the reinforcing at the nose of the step was found to be intact with no signs of water intrusion or rust. See the provided photos at the end of this report for more information on these observations.

The bottom of the slab was also further observed and was found to be in relatively good condition. There is no substantial cracking visible, nor are any significant signs of corrosion present. These observations include the slab, beam, columns, and walls. Also, there were no signs of water intrusion. Overall, the structure protected from exposure to sunlight and water was found to be in an acceptable condition.

Overall, the “structural” portion of the slab and stands are in good condition, thus it is feasible and likely more economical to repair the surface as needed and then waterproof it to help mitigate future corrosion issues. It is estimated that the bottom twelve rows of seating will require the majority of the work while the top several rows may only require the surface to be cleaned and prepared to receive a waterproofing product. Given the results and observations from the selective

demolition and cores it is AGE's opinion that the scope of the renovation work be further developed. While the completed testing has verified that the main reinforcing and majority of the slab below the surface is in an acceptable condition, additional laboratory testing is recommended to provide a full chemical and material makeup of the concrete. This information is beneficial when specifying products for patching the slab and waterproofing the surface. Depending on the makeup of the concrete some products may perform better than others. This type of testing is also recommended due to the suspected amount of carbonation in the concrete.

Carbonation in concrete is the result of un-hydrated cement in concrete reacting with carbon dioxide in the air. Over long periods of time carbon dioxide will begin to breakdown the concrete, causing it to become soft and crumble. This reaction starts at the surface of the concrete but slowly migrates deeper into the slab. Older concrete structures (60+ years) that are exposed to exterior conditions are especially susceptible to this. There is strong evidence of carbonation in the core taken at the lower portion of the stands. This core has a "chalky" feel to it at the top near the exposed surface but does improve near the bottom; also, SSRG noted that this core broke apart as it was being cut, further confirming the presence of carbonation. Laboratory testing can help verify the depth of carbonation, which may help to determine how much concrete must be removed and then repaired. This type of testing must be performed by a qualified laboratory and may require more cores to be taken.

While further review is required to help produce sufficient bid documents AGE recommends the following for the concrete surface renovation:

- The bottom twelve rows of seating will require the most demolition and removal of the top surface of the slab. This work is most critical at the step edge and will require the removal of several inches of concrete, similar to the selective demolition performed already. The depth of the removal may vary depending on the condition of the concrete, but it is estimated to be between three and six inches.

- When removing the damaged portion of the concrete the existing nosing bars will be exposed. These bars should be cleaned and coated with an epoxy to protect from future water infiltration. Some reinforcing may need to be replaced due to corrosion and rust, but it is expected that these areas may be minimal.

- The upper rows will not require the same amount of removal as the bottom rows, but it is estimated that some areas will require several inched oft eh surface to be removed.

- There are expansion joints in the slab that run the bottom of the seating to the top. These joints need to be completely removed and then resealed their entire length.

- Once the damaged concrete has been removed and any exposed reinforcing exposed and sealed, the concrete shall be patched using an appropriate product. These patched wills require the steps to be reformed, especially at the bottom portion of the seating.

- It is recommended that the surface be treated with a surface applied waterproofing product. These products range in performance and durability but all need to be reapplied over time. Given the exposure of the concrete slab this will be a critical maintenance issue. While products may vary there are essentially three different avenues for waterproofing the surface:

    - 100% silane products are surface applied and allow moisture in the concrete to evaporate out while not allowing water to infiltrate the concrete. These products typically perform well but need to be reapplied no more than every two years given the exposure to the sun. However, reapplying these products generally only requires the surface to be cleaned and does not require the product to be removed each time.

    - Epoxy coatings are also surface applied and would generally last longer, roughly six to eight years, but cost more and will require more work to reapply the product. Any epoxy coating will fully waterproof the slab and may also be more aesthetically acceptable as well.

    - Surface applied crystalline products are another option depending on the results of further testing. These products are usually applied over a concrete surface as a slurry and when expose to moisture expand sealing any microscopic cracks in the concrete. The overall performance of the product is heavily dependent on the surface preparation and application process. This product may be the longest lasting application if applied correctly and maintained.

- Other considerations for the renovation project include patching the concrete walls. Most of the walls appear to be in relatively good condition but there are some areas the require attention. These areas may be repaired using the same products and process as the slab.

- It is also recommended that any new bleachers or railings be anchored to the slab with adhesive anchors to seal the anchor holes. Mechanical anchors such as expansion or screw anchors are not recommended.

In conclusion, it is the opinion of AGE that surface of the stadium seating slab can be restored back to its original condition as detailed above, thus virtually restoring the structure back to its original state. Regardless of the products used or the restoration methods this will continue to be a maintenance item that will require a considerable amount of work over time to maintain the surface. It should also be noted that it is most likely more cost effective to restore the concrete than to replace the stadium structure based on the observations made above. However, although the selective demolition and concrete cores have helped us to further evaluate the condition of the slab it is likely that more serious conditions will arise during the renovation process. Moving forward, it is highly recommended that a generous contingency fund be held until this work ahs been completed. AGE is able to help determine this amount during the development of bid / construction documents.

If there are any questions regarding the recommendations within this report or more information is needed, please do not hesitate to contact our office. For more information on the existing conditions please see the provided photos at the end of this report.

Photo 1:This photo is one of three expansion joints that run from the bottom of the stands to the top. The existing joint material was removed for further observation. These joints will need to be replaced their entire length.

Photo 2: Exposed reinforcing at the top of the stands. The reinforcing was found to be 1/2", square bars with deformations and signs of corrosion or rust. The concrete was also found to be in good condition. This condition is typical at the top of the stands.

Photo 3: Typical conditions of the lower portion of the stands. This photo was taken at the north of the stands. Note the cracking at the face of each step and the moss growth indicating that this area is subjected to continuous moisture conditions.

Photo 4: Typical conditions at the lower portion of the stands. Note the rusted reinforcing bar and "chalky" concrete texture indicating significant carbonation in the concrete.

Photo 5: Core 1, taken at the lower portion of the stands on the north end. The top of the core is up in this photo and was falling apart as it was being drilled. The top portion also appears soft, indicating a significant amount of carbonation.

Photo 6: The second core was taken in the middle of the seating. The top of the core is soft similar to the first but does penetrate the depth of the concrete more than two inches.

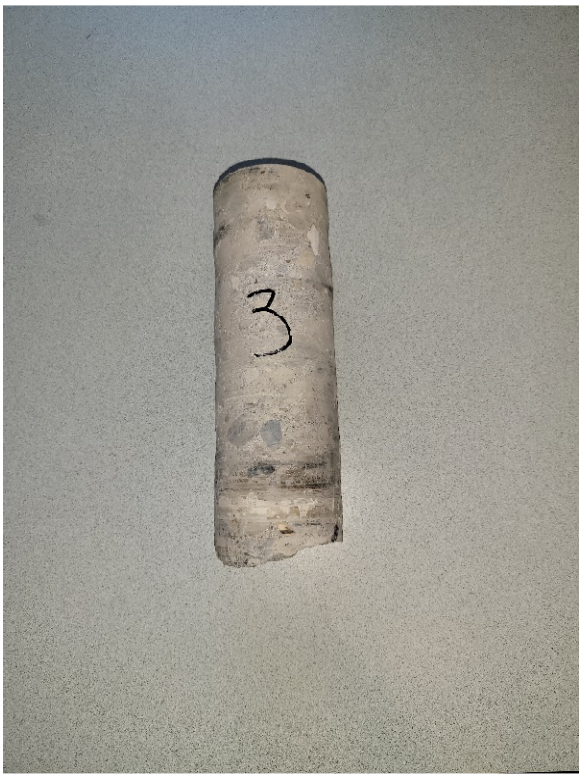

Photo 7: The third core was taken at the top of the sands on the south end. There are no visible signs of carbonation, and the concrete appears to be in very good condtion.