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August 22, 2023

Dr. Scott Langford
Director
Sumner County Schools
695 East Main Street
Gallatin, TN 37066

RE: Structural Assessment Report
Sumner County Football Stadium Bleachers

Dear Dr. Langford,

In compliance with your request, KBJM Architects, Inc. has completed a structural assessment of all eight High School football stadium bleachers within Sumner County. The attached report documents the results of the assessments.

This report includes the type of construction, results of the visual inspections, an engineering interpretation of the effects of these findings on structural integrity, and recommendations for the continued use of the stadium bleachers for each stadium.

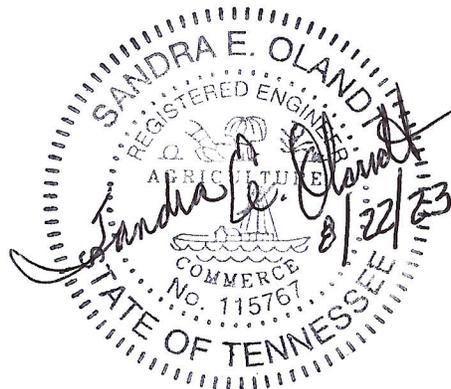
If you have any questions concerning this report, please feel free to contact us at your convenience. It is our pleasure to assist you on this project.

Respectfully submitted,

KBJM Architects, Inc.



Sandra E. Olandt, PE
Sr. Structural Engineer



Structural Assessment Report
Sumner County Football Stadium Bleachers

Prepared for:

Dr. Scott Langford, Director
Sumner County Schools
695 East Main Street
Gallatin, TN 37066

Prepared By:

Sandra E. Olandt, PE
Senior Structural Engineer
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August 22, 2023

INTRODUCTION

As requested, Kaatz, Binkley, Jones and Morris Architects, Inc. (KBJM) performed a structural condition assessment of all eight Sumner County High School football stadium bleachers. The structural assessments were performed by Sandra Olandt, PE on August 16, 2023, and August 17, 2023.

The purpose of these assessments was to evaluate the structural condition of the bleachers and to establish the safety of the bleachers for continued use during the 2023 football season. The assessments were prompted after the unexpected collapse of the Visitor bleachers at Beech High School. Due to the limited time and urgent nature, these assessments were visual only and did not involve non-destructive testing and inspection methods. The scope of these assessments was primarily focused on the structural support systems as a general overview for safety. Not all areas of the bleachers were accessible, and the assessments did not include a comprehensive review of every member and all components such as handrails and walkways.

SUMMARY OF RECOMMENDATIONS FOR FACILITIES VISITED

Beech High School Stadium

Remove the Home side bleachers from service immediately.

Gallatin High School Stadium

Continue use of all bleachers for the remainder of the 2023 football season. Provide minor repairs to the Home side bleachers as outlined in the detailed report as soon as possible. Evaluate the option of rust removal, repairs and painting versus replacement of the Home side bleachers prior to the 2024 football season. Inspect the new Visitor side bleachers annually in accordance with ICC 300 and the manufacturer's guidelines.

Hendersonville High School Stadium

Remove the Visitor side bleachers from service immediately. Continue use of the Home side bleachers for the 2023 football season while monitoring the number of spectators in the stands to prevent exceeding the design capacity. Provide repairs as outlined in the detailed report as soon as possible. Inspect the Home side bleachers prior to the spring track season to assess the state of the masonry walls.

Liberty Creek High School Stadium

Continue use of all bleachers for the remainder of the 2023 football season. Inspect the bleachers annually in accordance with ICC 300 and the manufacturer's guidelines.

Portland High School Stadium

Remove the center sections of the Home side bleachers from service immediately. The galvanized steel bleachers which flank either side of the original Home side bleachers may continue to be used for the duration of the 2023 football season. Continue use of the Visitor side bleachers. Inspect the bleachers annually in accordance with ICC 300 and the manufacturer's guidelines.

Station Camp High School Stadium

Continue use of all bleachers for the remainder of the 2023 football season. Inspect the bleachers annually in accordance with ICC 300 and the manufacturer's guidelines.

Westmoreland High School Stadium

Continue use of all bleachers for the remainder of the 2023 football season. Inspect the bleachers annually in accordance with ICC 300 and the manufacturer's guidelines.

White House High School Stadium

Remove the far-right section of the Home side bleachers from use for the remainder of the 2023 season or until realignment of the displaced concrete planks can be achieved. Cordon off the area to prevent spectators from accessing the space. Remove the Visitor side bleachers from use immediately until repairs outlined in the detailed report can be made. Once the repairs have been completed, the Visitor side can be used for the 2023 football season. Inspect all bleachers prior to the start of the 2024 football season.

Structural Assessment
Beech High School Stadium Bleachers



DESCRIPTION OF STRUCTURE

Both the Home and Visitor sides of Beech High School football stadium bleachers were constructed in 1981 (42 years old) using concrete masonry unit walls on concrete foundations which support inverted precast concrete c-shaped planks. The stadium levels are achieved by stepping the masonry walls and stacking the precast planks with an overlap to form tiers. The stadium seating and handrails are then mounted to the top of the precast panels. Guardrails surround the seating area and are mounted to the precast plank or the masonry walls. Egress steps are placed at intermediate locations along the length of the bleachers. The side and front exterior walls are covered in brick veneer with the back side of the structure open to the elements. On the Home side, a free-standing press box is located at the back of the structure.

VISUAL ASSESSMENT

Home Side:

On approach to the structure, the bleachers look well maintained and attractive. The guard rail is in good condition and appears to be relatively new. Efflorescence is present in the exterior brick veneer on the side walls, but no significant cracking exists. The intermediate back walls have been painted and there are signs of spalling masonry. Upon entering the underside of the bleachers, the supporting masonry walls were found to be in very poor condition. The masonry is saturated with a large amount of moss growing on the walls. Multiple cracks run vertically in the walls and portions of masonry block are missing. The face of the masonry is disintegrating in multiple locations. The masonry lintels above the openings between bays have lost most of the face shell of the masonry and are left with exposed grout in the bond beam. At one opening, even the grout has deteriorated to expose the lintel reinforcing which is badly rusted. Within the built-out interiors below the bleachers, the ceilings have collapsed due to severe water intrusion. The concrete planks appear to be in good condition as viewed from both above and below. However, the gaps between planks at the point of bearing have no joint sealant, allowing water to infiltrate the masonry wall below. Damage to the structure is water related, the foundations appear to be stable with no settlement cracking in the masonry.

Visitor Side:

The Visitor side collapsed without warning the previous day. Equipment was on site to remove the debris. Upon inspection of a collapsed portion of masonry wall, it was determined that the cores of the masonry had been grouted, but the spacing is unknown. No vertical reinforcing was evident in the structure. Horizontal reinforcing was present but was extremely rusted and brittle, much of it having broken into pieces during the collapse. Many of the concrete planks were still in one piece.

IMPACT ON STRUCTURAL INTEGRITY

The original design of the stadium does not provide any redundancies in the structural system. The interior masonry walls support planks on both sides which then systematically support the next plank above until reaching the top. Failure of one structural element can lead to a progressive catastrophic collapse. The long-term presence of water within the masonry is evident from the moss growth on the structure. Water infiltration is one of the most damaging problems for masonry construction, particularly when partnered with the freeze-thaw cycles in the climate of Tennessee. The expanding water during a freeze will cause multiple cracks to form and eventually lead to spalling and deterioration of the face shell as seen in this structure. In addition, the water rusts the steel reinforcing reducing or eliminating any

strength and continuity that it initially provided. As the masonry continues to deteriorate, the overall integrity of the system is lost, and collapse is imminent.

RECOMMENDATION

Based on the extremely poor condition of the masonry support walls, it is my professional opinion that the Home side bleachers are at the end of their life span and should no longer be used in their current condition. I recommend that either extensive repairs be made, including replacement of the load-bearing masonry walls, or the entire structure be demolished and replaced with a galvanized steel and aluminum structure. The information required to make a repair or replacement decision is beyond the scope of this report.

PHOTOS



Efflorescence on brick veneer.



Spalling masonry along rear wall.



Water infiltration, moss growth, cracking and loss of section in interior masonry wall.



Loss of masonry and grout with exposed reinforcing in masonry lintel.



Water infiltration to built-out area beneath bleachers.



Absence of joint sealant between concrete planks.

Structural Assessment
Hendersonville High School Stadium Bleachers



DESCRIPTION OF STRUCTURE

Both the Home and Visitor sides of Hendersonville High School football stadium bleachers were constructed in 1976 (47 years old) using concrete masonry unit walls on concrete foundations which support inverted precast concrete c-shaped planks. The stadium levels are achieved by stepping the masonry walls and stacking the precast planks with an overlap to form tiers. The stadium seating and handrails are then mounted to the top of the precast panels. Guardrails surround the seating area and are mounted to the precast plank or the masonry walls. Egress steps are placed at intermediate locations along the length of the bleachers. The exterior side walls are covered in brick veneer while the back side of the structure is painted masonry or steel siding, and chain link fence where it is open for storage. On the Home side, an integrated press box is located at the back of the structure.

VISUAL ASSESSMENT

Home Side:

On approach to the structure, the bleachers look well maintained and attractive. The guard rail is in good condition and appears to be relatively new. The exterior brick veneer on the side walls is in good condition with no significant cracking. The intermediate back walls have been painted and are in good condition with only a few places with damaged masonry. Upon entering the underside of the bleachers, the supporting masonry walls were found to be in fair condition. Although the walls show some water saturation and moss growth, there is not significant cracking, and the surface face of the block is not as deteriorated as seen at Beech High School. The masonry lintels above the openings between bays are still intact. Within the built-out interiors below the bleachers, the insulation board ceilings and supporting steel members do not show signs of water infiltration. The concrete planks appear to be in fair condition as viewed from both above and below. Water staining is more evident indicating the planks may not have been coated with a concrete sealer. There is one plank on the left side section of bleachers that has been displaced by approximately 2", possibly when constructing the build-out below. The gaps between planks at the point of bearing have no joint sealant, allowing water to infiltrate the masonry wall below. Damage to the structure is water related, the foundations appear to be stable with no settlement cracking in the masonry.

Visitor Side:

On approach to the structure, the bleachers look well maintained and attractive. The guard rail is in good condition and appears to be relatively new. The exterior brick veneer on the side walls is in good condition with no significant cracking. The back walls have been painted and are in fair condition with several areas of spalling masonry. Upon entering the underside of the bleachers, the supporting masonry walls were found to be in very poor condition. The walls show water saturation but no moss growth since these areas are entirely enclosed. There is significant loss of the surface face of the masonry with several areas suffering a complete loss of section leaving a hole through the wall. The concrete planks appear to be in fair condition as viewed from both above and below. Water staining is more evident indicating the planks may not have been coated with a concrete sealer. One bay has an interior support wall and repairs to a concrete plank indicating previous problems with the structure were repaired. The gaps between planks at the point of bearing have no joint sealant, allowing water to infiltrate the masonry wall below. Damage to the structure is water related, the foundations appear to be stable with no settlement cracking in the masonry.

IMPACT ON STRUCTURAL INTEGRITY

The original design of the stadium does not provide any redundancies in the structural system. The interior masonry walls support planks on both sides which then systematically support the next plank above until reaching the top. Failure of one structural element can lead to a progressive catastrophic collapse. The long-term presence of water within the masonry is evident from the moss growth and the disintegrating masonry block. Water infiltration is one of the most damaging problems for masonry construction, particularly when partnered with the freeze-thaw cycles in the climate of Tennessee. The expanding water during a freeze will cause multiple cracks to form and eventually lead to spalling and deterioration of the face shell as seen in this structure. In addition, the water rusts the steel reinforcing reducing or eliminating any strength and continuity that it initially provided. As the masonry continues to deteriorate, the overall integrity of the system is lost, and collapse is imminent.

RECOMMENDATION

Based on the extremely poor condition of the masonry support walls, it is my professional opinion that the Visitor side bleachers are at the end of their life span and should no longer be used in their current condition. It is my opinion that the Home side bleachers are nearing their functional life span but are still safe for use for the remainder of the 2023 football season. However, since appearances are not complete indicator of structural integrity, I recommend the follow provisions be in place for the remainder of the season:

- During use, the crowd size should be monitored to eliminate the possibility of exceeding the design capacity of the structure. Spectator capacity should be based at a minimum of 18” of seating per person or preferably 24” of seating per person.
- Before and after each use, members of the maintenance staff familiar with the current condition of the structure should perform a visual assessment of the masonry walls to monitor for changes – increased cracking, loss of block, etc. Changes should be reported to the Structural Engineer as soon as they are found.
- Before and after each use, members of the maintenance staff familiar with the current condition of the structure should perform a visual assessment of the plank which is out of alignment. Changes to the alignment of this plank, and any other planks, should be reported to the Structural Engineer as soon as they are found.
- Masonry walls should be treated to remove the moss growth and prevent future growth.

Prior to the start of the 2024 spring track season, the Home side bleachers should be visually assessed for further damage from winter freeze before allowing use of the structure. I recommend that a plan be put in place to either provide extensive repairs to the Home side, including replacement of the load-bearing masonry walls, or that the entire structure be demolished and replaced with a galvanized steel and aluminum structure. The repair or replacement should take place as soon as feasible. The information required to make a repair or replacement decision is beyond the scope of this report. Until this decision is made and implemented, the existing structure should be inspected before each football season and track season to determine suitability for use.

PHOTOS



Back side of Home side bleachers.



Interior Home side masonry walls with water infiltration and moss growth.



Interior masonry built-out space below Home side bleachers without water infiltration.



Single displaced concrete plank on left side section of Home side bleachers.



Extensive loss of section in Visitor side masonry wall.



Previous repair to concrete plank and infill masonry wall providing intermediate support.

Structural Assessment
Portland High School Stadium Bleachers



DESCRIPTION OF STRUCTURE

The central section of the Home side bleachers of Portland High School football stadium was built in 1975 (48 years old.) They were constructed using concrete masonry unit walls on concrete foundations which support inverted precast concrete c-shaped planks. The stadium levels are achieved by stepping the masonry walls and stacking the precast planks with an overlap to form tiers. The stadium seating and handrails are then mounted to the top of the precast panels. Guardrails surround the seating area and are mounted to the precast plank or the masonry walls. Egress steps are placed at intermediate locations along the length of the bleachers. A free-standing press box on a steel frame is located at the back of the structure. Sometime later, a section of galvanized steel bleachers was added to each side of the original seating to increase the home side crowd capacity. Several 4-row portable bleachers sit off to the side as well.

The Visitor side bleachers consist of a newer galvanized steel and aluminum structure built into the side of the hill. A short retaining wall runs along the front face of the bleachers. A smaller free-standing press box sits behind the bleachers.

VISUAL ASSESSMENT

Home Side:

On approach to the structure, the outer bleachers look well maintained but the original sections are showing signs of age. Upon entering the underside of the original bleachers, the supporting masonry walls were originally found to be in good condition. It was then determined that new exterior side walls had been added to the interior, but the old side walls were left in place. Water saturation in the original walls was seeping through to the newer walls. The interior wall sections of the outer two bays had not been replaced and were in very poor condition. There was a significant loss of face section of the masonry blocks leaving holes through to the other side. The concrete plank above also showed significant signs of deterioration with exposed reinforcing on the underside of the plank in both the stem and the web areas. The front retaining wall was bowed and cracked along the length of the top bond beam indicating that the planks were pushing the wall forward. The gaps between planks at the point of bearing were previously filled with joint sealant, but much of it has deteriorated beyond usefulness allowing water to infiltrate the masonry wall below.

The newer sections flanking the original bleachers are in good condition. The steel structure supporting the press box is also in good condition except for some rusting at the exposed connections. The portable bleachers appeared in good condition but were beyond the scope of this assessment.

Visitor Side:

Most of the underside of the Visitor side bleachers is inaccessible. Viewed from the side and back of the bleachers and also from above, the structure appears to be in good condition. However, the short retaining wall along the walkway to the concession stand is starting to fail. There are significant cracks in the masonry and the face shell of the blocks is spalling in numerous locations.

IMPACT ON STRUCTURAL INTEGRITY

The original design of the Home side stadium does not provide any redundancies in the structural system. The interior masonry walls support planks on both sides which then systematically support the next plank above until reaching the top. Failure of one structural element can lead to a progressive catastrophic collapse. Long term water infiltration in the block is evident and is one of the most damaging problems

for masonry construction, particularly when partnered with the freeze-thaw cycles in the climate of Tennessee. The expanding water during a freeze will cause multiple cracks to form and eventually lead to spalling and deterioration of the face shell as seen in this structure. In addition, the water rusts any steel reinforcing that might be present, reducing or eliminating any strength and continuity that it initially provided. As the masonry continues to deteriorate, the overall integrity of the system is lost, and collapse is imminent.

RECOMMENDATION

Based on the extremely poor condition of the interior masonry support walls, it is my professional opinion that the original section of the Home side bleachers are at the end of their life span and should no longer be used in their current condition. I recommend that either extensive repairs be made, including replacement of all original load-bearing masonry walls, or entire structure be demolished and replaced with a galvanized steel and aluminum structure. The information required to make a repair or replacement decision is beyond the scope of this report.

The two newer sections of bleachers flanking the original sections on the Home side, as well as the Visitor side bleachers can continue to be used at this time. Safety inspections should be conducted on these bleachers on an annual basis in accordance with International Code Council Standards for Bleacher, Folding and Telescoping Seating, and Grandstands (ICC-300) and the manufacturer's written guidelines. These inspections can be made by a qualified individual familiar with the requirements and should be documented.

The retaining wall on the Visitor side should continue to be monitored. As deterioration and deformation increase, this wall should be replaced.

PHOTOS



Home side masonry wall with extensive loss of section.



Underside of concrete plank with deterioration of the concrete and exposed steel reinforcing.



Rusting steel in the column support of the Home side press box.



Cracking along the length of the top of the skirt wall along the front of the Home side bleachers.



Side view of Visitor side galvanized steel bleachers built into the hill.



View of back side of Visitor side bleachers built into the hill.



Deterioration of retaining wall along the Visitor side path to concessions.