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Structural Assessment

DENTON FIELD STADIUM – MILES CITY, MT

INTRODUCTION

At your request we have completed a structural assessment of the Denton Field baseball stadium located in Riverside Park in Miles City, MT. On March 8, 2015, I met on-site with Michael Stevenson AIA of Stevenson Design and Scott Gray Public Works Director for Miles City. I spent about two hours touring the stadium and making physical assessments of the current condition. The stadium is believed to be constructed in the late 1930's. Construction drawings were not available however much of the structure was observable. We understand that the City is interested in renovating the baseball park. This report describes the stadium's structural systems and briefly evaluates the structure for gravity and wind loading. The intent of this assessment is to review general status of the structure considering basic life-safety occupancy and assess conformance of the existing structure to the International Building Code (IBC). This is a limited review based on visual observations, no testing or special measures were taken to determine condition of the structural members observed. Structural adequacy of the stadium or any element of the stadium is not guaranteed. The press box which perches on front-side of the stadium roof was not part of the assessment as it was understood that this structure was to be removed.

DESIGN BASIS

Snow Load: 27 PSF ground snow load. 30 PSF minimum roof snow load as required by State Building Department.
Wind Zone: 115 mph, Exposure "C" per ASCE 7-10.
Seismic: "Category A" considered *low seismic risk*.

STRUCTURAL SYSTEMS

Foundation and Stadium Risers

The concourse and stadium risers were constructed of cast-in-place concrete. Support areas were located below the risers and appeared to be no longer used. The foundation system was assumed to be concrete walls founded on conventional spread footings.

Canopy Roof

The canopy roof structure was 2 x 8 roof rafters at 24" OC. The rafters were supported on the rear of the stadium with 8x8 wood timber beams supported off the rear concrete wall. The 2x8 rafters were supported by an intermediate beam line and a beam line at the front of the stadium. The beams consisted of (5) 2 x 10 wood joists (gang together) with an underslung steel tension rod system, essentially creating a hybrid truss assembly. Beam spans ranged from 40'-4" at the front of the stadium to 49'-2 at the mid-span condition. 9" to 11" diameter wood poles were used to support the beam lines. The poles cantilevered out of concrete bases founded into the concrete stadium riser construction.

Stadium Walls

Cast-in-place concrete.

EVALUATION

Vertical Loading

A limited gravity load analysis was performed on canopy roof members. Load calculations for the 2x8 joists and 8x8 timber beams indicated that these members (in good condition) would be satisfactory to carry the design roof loads. There were some areas that had suffered moisture deterioration as a result of roof leaks but it appears those areas could be repaired. The framed opening for the stair access through the roof to the press box had significant deterioration and rot (Photo 1) and would require to be reframed, as did at least one of the 8x8 timber beam ends (Photo 2).

Load calculations for the tension rod beam assemblies (Photo 3) that support the roof joists, indicated a very limited load capacity. Calculations showed safe load capacity to be only the self-weight of canopy roof with very little snow load allowance. The calculations were based on the premise the beam assemblies were in good condition, deterioration in components would further reduce the carrying capacity. Although we had a limited view of the beam assemblies from below, it did appear that deterioration at the ends and exposed faces of the beam assemblies along the front side of the stadium has occurred (Photos 4 & 5).

Eight wood poles support the canopy structure. Two of the poles were interior and appeared in satisfactory condition. The other six poles were around the canopy perimeter were subject

to more severe weathering and exhibited various levels of deterioration.

In general the condition of the concrete foundation and stadium risers appeared good. No evidence of significant deterioration in the concrete was noted. No evidence of movement or settlement was observed in the foundation. The concrete portion of the stadium appeared acceptable for continued use.

Wind Load

Wind loads exert varied lateral and uplift forces to the canopy structure depending on wind direction and gust effects. The cantilever wood poles are essential components for resistance to the wind loads. The base of the poles are embedded into concrete pilasters within the stadium construction which gives them their cantilever base support. The bottom portion of the poles embedded into the concrete was inaccessible so the condition of the buried wood is unknown (Photo 6). There probably has been some level of deterioration that has occurred in 75 years of service particularly in the six perimeter poles; there could potentially be extensive deterioration. Without the cantilever support the stadium roof is at risk of collapse under a strong wind event.

For open canopy structures wind upward gust forces can result in net uplift on a roof i.e. the wind uplift force is greater than the weight of the roof components. In a wind event of this type, the beam assemblies must resist reversed upward forces. The underslung rods were designed as tension rods for gravity support but under upward loads they become unstable as a result the beams have very limited uplift resistance and do not comply with current code.

Summary

The stadium wood canopy structure has suffered deterioration over its life and has clearly lost structural strength. The application of current code design loads and material strength is much different than when the stadium was constructed over 75 years ago. To make a canopy structure of this construction comply with present codes would be very difficult. It is our opinion, that rather than implementing extensive repairs to bring the existing wood structure into compliance, it would make more economic sense to demolish the wood canopy and rebuild with a code compliant system. The stadium's foundation, concrete walls and concrete risers assembly were in fair condition and suitable for continued use.

If you have any questions or need further information please contact us. Thank you for using us on this project and we look forward to working with you as this project develops.

Sincerely,

Miles Borges P.E.

Photo 1 – Stair Opening in Roof

Photo 2 – 8x8 Timber Beam Deterioration

Photo 3 – Stadium Tension-Rod Beam Assemblies

Photo 4 – End Condition of Beam Assembly

Photo 5 – Opposite End Condition of Beam Assembly

Photo 6 – Wood Pole Base