

BSU Bronco Stadium
West Stands Assessment and Cost Estimate
September 19, 2012

Hutchison Smith Architects visited Bronco Stadium at the request of Melanie Schuster, Boise State A & E Services for the purpose of inspecting the condition of the west stands on the upper balcony and lower concourse. The inspection included concourse sections 5-11 and balcony sections 105-111. During our inspection we compared conditions of the west balcony sections to conditions in this area reported by Wiss, Janney, Elstner Associates, Inc., in their Bronco Stadium Condition Assessment and Analysis dated October 4, 2004. WJE's 2004 report did not include the concourse (lower deck) sections for unknown reasons.

WEST BALCONY

In 2004 the west balcony was in fair condition with a few isolated areas of deteriorated concrete mainly along the nosings of seat treads and areas of ponding water along the bottom row of seats and the lower cross aisle. The drainage issues along the lower cross aisle were mostly corrected as part of the 2006-2007 restoration project. Today the general condition of the west upper deck remains fair. The membrane is nearing the end of its useful life. The upper deck membrane surface has deteriorated due to the natural aging of this material. This deterioration has allowed the sand particles used as aggregate in the membrane mixture to break away from the membrane matrix leaving very small voids where water can collect and freeze and further damages the membrane and ultimately the concrete below. The membrane is worn in traffic areas and is quite thin or has peeled away at many stair locations. The deterioration of concrete is still only in isolated areas but the number of locations has increased since 2004. These areas of concrete spalling occur mainly at nosings and where joints have failed. This type of concrete deterioration will continue to accelerate particularly where spalling has broken the protective membrane allowing water to enter the concrete. Virtually all of the joints between sections have failed allowing water to leak onto areas below including vomitory stairs and spectator seating areas below. These open joints also allow water to enter into the unsealed edges of the concrete treads and risers which promotes deterioration of the concrete and the membrane.

Other issues at the west upper deck include cracking at concrete end walls and front walls which require repair and application of a clear sealer to assist in repelling water in the future. There are also areas where guardrail posts have deteriorated where they are imbedded in the concrete wall and need repair.

WEST CONCOURSE

The west concourse is generally in worse condition than the balcony particularly the bottom rows of the lower deck that are from Row L down to Row A. This area is exposed beyond the overhanging cover of the upper deck. The membrane above Row L is in similar or slightly better condition than the balcony membrane since it has been protected from the sun and moisture by the balcony. The membrane below

Row L is in poor condition, is worn away completely in some areas and has more severe surface deterioration.

Grout pockets have failed on the aisle stairs and subsequent patches have also failed in many locations and need to be removed and replaced. The membrane is worn at stair areas and seat tread nosings and is peeling where cracking and spalling of the concrete has occurred. Approximately 75 lineal feet of seat tread nosings have concrete damage. There are also approximately 100 grout pockets where damage can readily be observed that need to be replaced. Based on past experience we expect that more grout pockets will need to be replaced once each one is inspected in detail. As with the upper deck, the joints between seating sections and the joints where the seating sections meet the abutting walls have all failed and have cracked or missing sealants. These failed joints allow water into the structure and leak onto areas below. The concrete side walls, front wall and vomitory walls all have cracking that currently is minor, but if left unrepaired will lead to significant damage in the future. The grout in the top of the vomitory walls where guard rail posts were inserted is severely cracked and requires replacement. It is likely that the aluminum posts are corroded inside these grout pockets and could weaken the structural integrity of the guardrail.

GUARDS & HANDRAILS

We also looked at the requirements for guard rails and handrails on both the west and east sides of the stadium. The 2009 IBC 1013.1 requires guards to be installed where walking surfaces are more than 30 inches above the adjacent surface. Guards need to be 42 inches high minimum. At the ends of both the balconies and concourses are concrete walls serving as guards. The walls were designed to be 42 inches above the bleacher tread surface but due to variations in construction the top of the wall measures less than 42 inches in some areas. These areas measured approximately 41 inches high. The aluminum bench seats are not technically a walking surface but it is common for fans to stand or walk on the seats even though signs have been posted prohibiting standing on seats. The top of the wall measured from the front of the seat is as low as 30 inches. In our opinion the wall is too low to prevent an accidental fall at these locations. At the south ends of the east and west balconies the wall is adjacent to the stair aisle and therefore does not have the issue of the height from the seat.

The top concrete wall above the highest row of seats on the balcony serves as the guard for this upper area. The wall is 60 inches high above the walking surface and 42 inches above to the top seat. Even with someone standing on the seat the wall provides an adequate guard. A spectator could be tempted to sit on top of this wall which would be very dangerous. Adding a round rail to the top of this wall may make it more difficult to sit on the wall, but it may also provide something to grasp and may actually increase the likelihood of someone climbing the wall. If something were to be added to this wall we recommend it be something with an edge to discourage gripping and climbing. There is approximately 720 lineal feet of wall with this condition. In some locations there is electrical conduit mounted directly to the top of the wall which may need to be rerouted to allow installation of a rail depending on the anchoring detail. Our estimate of the cost to install a steel rail all along the top of this wall is \$ 65,000 We have not included this cost in the estimate for adding a rail at these locations.

IBC 2009 Section 1028.13 requires handrails at all aisle stairs. There are no handrails on the aisle stairs serving the concourse seating on both the east and west sides. The existing aisles are 48 inches wide from

seat to seat. The minimum width of an aisle on each side of a handrail is 23 inches per IBC Section 1028.9.1.3. We believe handrails can be added and still maintain the required width.

CONCLUSIONS/RECOMMENDATIONS

The broken, spalled and cracked concrete represents a safety hazard for spectators and will also become a structural concern if allowed to progress.

When the stadium was built handrails on the aisle stairs of the east and west concourses were not required. However if the stadium is upgraded it would need to meet current code requirements which do require handrails and it is a safety concern. It is our opinion that having the handrails to hold, to help prevent falls is more important than the small reduction in usable width of the stair. The height of the end walls is also a safety concern. In our opinion it is common for spectators to stand on the seats in front of their walkway and this makes the height of the wall too low to prevent an accidental fall. We recommend that rails be added to the tops of the concrete walls where they are adjacent to seating areas to make the top of the guard a minimum of 42 inches above the seat.

The failed sealant at joints also represent potential safety hazards where water leaks through the joint onto stairs and walking surfaces below making them slick or icy in cold weather. The leaking water contributes to the degradation of the concrete structure and the membrane. The dripping water from the failed joints negatively affects the experience of the fans who have to sit or walk under these areas.

The failed grout pockets are also a potential safety hazard for tripping. When the grout comes completely loose a significant enough amount of water will fill the hole and will freeze and damage the surrounding concrete and membrane. We have organized our repair recommendations Priority one, two and three items based upon how soon we believe repairs should be made. In general we recommend that priority one items should be completed within one year, priority two items within 2-3 years and priority three items within 3-5 years.

PRIORITY ONE REPAIRS

We recommend that the broken, spalling and cracked concrete be repaired as soon as funding is available and when this area of the stadium can be closed for an extended period of time. We also recommend that the joint material in both the concourse and balcony be removed and replaced at this time. The existing membrane could be removed only to the extent necessary to perform the concrete repairs and along the joints and then new membrane applied in those areas only.

As part of the priority one work we recommend that handrails be added to the lower deck stairs and a guardrail be added to the top of the end walls similar to the existing rail around the top of the vomitory walls. We also recommend that the most severely damaged grout pockets be repaired and the membrane patched. These are the minimum amount of work items that we would recommend for short term repairs.

The estimated construction cost of the Priority One Repairs is \$ 239,000.

PRIORITY TWO REPAIRS

The Priority Two repairs include replacing the membrane in the concourse below Row L and all the stairs of the concourse. Repair of any remaining grout pockets in this area would be required. This will protect the most exposed concrete structure from further damage.

The estimated construction cost of the Priority Two Repairs is \$ 239,000.

PRIORITY THREE REPAIRS

The remainder of the repairs we classify as Priority Three. These include wall repairs, waterproofing walls, handrail repairs and membrane replacement through the west balcony and concourse stands. We believe that where the membrane is in fair condition that it likely has three to five years of useful life left although its appearance and effectiveness will continue to decline. Ideally all this work would be done in conjunction with the Priority One and Two repairs since the success of finished system is dependent on the integration and compatibility of the components. There are some economies of doing all the work at one time. There is also the uniformity of appearance factor of one completed project versus a piecemeal approach.

The estimated construction cost of the Priority Three Repairs is \$ 542,000.

SUMMARY

If the work can be done all under one project we believe there will be savings particularly in preparation and application of the water proofing membrane. The following is a recap of the estimated construction costs if the work is completed in separate phases and all in one project.

Phased Project:

Priority One:	\$	239,000
Priority Two:	\$	239,000
Priority Three:	\$	<u>542,000</u>
Total:	\$	1,020,000

One Project:

All Work:	\$	932,000
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Upper Wall Guardrail: \$ 65,000

See attached cost estimate spreadsheets for detailed line item costs.