Walter Robbs Callahan & Pierce Architects, PA will rely on these notes as our understanding of the matters discussed and conclusions reached during this meeting. This information will be the approved record unless you send written notice to the contrary within seven calendar days of the issue date of these meeting notes.

Project		WRCP Project Number
	War Memorial Stadium Renovation	05-561
Meeting Location Meeting Date	GSO Facilities Engineering, Cone Building, 1001 4th St.	10/24/05
Meeting Purpose	Continue to define a "Program Statement" for the Schematic Design	
Attendance;	Steven Ulp, Steven Barnes, Rence Callahan, Robert Kennerly, Benjamin Briggs, Kim Strable, Gregory Woodard, Marc Bush, David Wharton, Mark Bush, Butch Shumate, John Hughes, Richard Wagner, Bob Morgan,	

Issue	Responsible	Action

1. The meeting began with Walter, Robbs, Callahan, and Pierce providing a revised program elements table showing new and modified square footage requested for each of the various seating quantities. A copy of the revised program elements is attached to these notes.

   ▪ The restaurant will remain in the program for now as part of the presentation to the committee and the community until more information is provided by the market study consultant.

2. Bob Kennerly of Sutton-Kennerly and Associates, Greensboro presented their structural assessment study. The summary of the technical information is presented in the attached technical description dated October 18, 2005.

   The summary of this presentation is:

   The monumental facade is structurally sound and can be restored.

   The steel superstructure and associated wood deck can be refurbished and reused.

   The concrete riser system supporting stadium seating has deteriorated to a degree (more where exposed to rain, to a lesser extent under the steel superstructure) where its repair will be more costly (by a factor of from 1.5 to 2 times more expensive than a demolition and replacement in kind).

   The historically acceptable repair of concrete include the following three (3) steps, all of which makes repair more costly than demolition and new construction.

   1. Hydro excavation of the top 2" of the concrete riser and replacing the removed concrete with a new specially formulated concrete.

   2. Repair of the bottom of the seat riser concrete

   3. Install cathodic steel protection system to replace the lost protection that normally and naturally is provided by the alkali concrete surrounding the reinforcing. This intrinsic protection has been lost thru carbonation of the concrete due to the extended life of this concrete.

3. For longevity of the programmed renovation, within the context of the existing structure, the following should be undertaken;

   A. Repair the monumental façade.

   B. Dismantle clean and reassemble the steel superstructure.

   C. Demolish remove and replace the seat riser system as required to meet

Issue		Responsible	Action
	the yet to be established seating capacity		
4.	The above noted summary introduces the question of whether to preserve material or function and how much to spend in the balance of these competing needs.	City of Greensboro Administration	Provide direction as additional information is uncovered
5.	The walls placed under beams and between columns of the superstructure have moved independently from the superstructure including rotation of the walls. There are probably different footing and foundation systems for the two elements causing the different settlement.	City of Greensboro	Provide well location and pertinent information.
	This information elicited comments that there are monitoring wells on the site that were put in place after the light poles were installed. This was due to poor and contaminated soil found during the pole installation.	City of Greensboro	Provide copy of the environmental report.
6.	The budget numbers will be required in early March to provide useful information in the City bond funding process	WRCP	Schedule the schematic design and budgeting to complete early March.

Distribution: Steven Ulp, Steven Barnes, Rence Callahan, Benjamin Briggs, Kim Strable, Gregory Woodard, Marc Bush, Betsey Baun, David Wharton, Mark Bush, Stefan-Leih Geary, Heidi Galanti, Butch Shumate, David Hoggard, John Hughes, Richard Wagner, Bob Morgan,

Prepared By
Steven Barnes

Issue Date
10/25/2005

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War Memorial Stadium
Greensboro, North Carolina
SKA Job No. 050

October 18, 2005

A. Date Constructed: 1927

B. Structural Framing System

1. Seating Sections: Cast-in-place reinforced concrete structural system with stepped seating risers, sloped raker beams, and columns and piers.

2. Roof: Structural steel frame with steel girders and columns with steel purlins and timber decking.

3. Front Façade: Cast-in-place reinforced concrete buttresses, arched spandrel beams and piers.

4. Exterior and Interior Walls: Non-load bearing masonry.

C. Condition of Reinforced Concrete Structural System

1. Seating Sections

a. Scaling of horizontal concrete surfaces on seat risers as a result of cycles of freezing and thawing of water absorbed into the concrete. Water that is absorbed into the paste and aggregate freezes and expands when temperatures fall below 32°F. The forces from the expansion of water in the pores generate significant internal tensile stresses on the concrete. When these stresses exceed the ultimate tensile strength of the concrete, the concrete cracks, spalls and delaminates. The concrete mix used for the concrete members in this facility does not appear to be air entrained. Current building codes require concrete that is exposed to an exterior environment to be air entrained as well as have a maximum water/cement ratio of 0.45. Microscopic air bubbles in the cement paste provide chambers for the water to enter, thus relieving the internal pressures generated. The current building codes also limit the maximum water/cement ratio to 0.45. The lower the water/cement ratio, the higher the density and the permeability is decreased. Concrete mixes that meet the current requirement for air entrainment and water/cement ratio will be durable. Concrete mixes that do not meet these requirements will gradually deteriorate over time due to repetitive cycles of freezing and thawing when the concrete is wet.

The freezing and thawing of concrete that is wet causes the concrete at the surface to crack and eventually delaminate and break up into smaller pieces. The concrete below the distress areas has also experienced micro cracking. These areas will continue to deteriorate with exposure to freeze/thaw cycles.

b. Corrosion of reinforcing steel in the stepped seating risers, raker beams and columns and piers. Concrete is a hard, brittle material that can resist significant compressive stresses, but can resist minimal tensile stresses without cracking. Reinforcing steel in concrete resists the tensile stresses that occur in the stepped concrete seating risers and raker beans. This steel is necessary for the structural members to support loads that are applied.

Steel that is exposed to moisture and oxygen corrodes. The concrete cover over reinforcing steel minimizes the risks of moisture contacting the steel and corrosion. When the depth of the concrete cover is minimal and/or the concrete cover over the reinforcing steel is more permeable, moisture can more easily migrate to the reinforcing steel. This moisture, combined with oxygen that diffuses into the concrete, causes the steel to corrode.

When steel in reinforced concrete corrodes, the byproducts of the corrosion occupy a greater space than the space occupied by the sound steel. The increase in volume of the byproducts of corrosion in the space occupied by the steel is somewhat similar to water in a pipe freezing. The increase in volume of the byproducts of corrosion as well as water in a pipe freezing exert significant internal stresses. In reinforced concrete, the result is cracking and spalling of the concrete cover over the reinforcing steel. When the reinforcing steel in a concrete member corrodes:

- The cross-sectional area and size of the reinforcing steel is reduced.
- The bond of the reinforcing steel to the concrete is reduced.
- The cross-sectional area of the concrete members is reduced.

The corrosion of the reinforcing steel in the stepped seating risers, raker beams, and columns and piers in this facility is widespread. The structural capacity of the members where the reinforcing steel has corroded has been reduced. The deterioration due to corrosion can be expected to continue as long as there is a supply of moisture and oxygen.

c. Cracking of concrete in the stepped seating sections, raker beams and columns and piers. The cracking in the concrete members in this structure is the result of:

- Corrosion of the reinforcing steel in the concrete.
- The restraint of the volumetric changes (shrinkage) of the concrete members after the concrete is placed. The volume or length change of a concrete member can range from 0.01% to 0.08%. These volumetric changes are primarily the result of the loss of moisture from the concrete. A reduction in the volume of materials after the chemical reaction (hydration) and carbonation of the concrete also contributes to the volumetric changes of a

concrete mix. Stress due to shrinkage of the concrete when the concrete is restrained is one of the primary causes of cracking.

- Tensile stresses from loads and temperature changes. Stresses from applied loads and temperature changes are normal and expected for reinforced concrete structures. When the stresses exceed the ultimate tensile strength of the concrete, the concrete cracks. As long as there is adequate tensile reinforcing steel to control the width of cracks and the reinforcing steel is bonded to the concrete, cracks from tensile stresses from applied loads and temperatures do not normally compromise the structural integrity of the structure.

d. Carbonation of concrete. Carbonation is a process where the carbon dioxide in the ambient air penetrates into the concrete and reacts with the calcium hydroxide in the concrete. The carbon dioxide gases in the air react with the hydroxide to form calcium carbonate. Carbonation of the concrete does not harm the concrete matrix. However, carbonation significantly reduces the pH of the concrete. High alkalinity or pH is necessary to protect embedded steel in the concrete from corroding. Carbonation occurs gradually over time. The amount of tie for concrete to carbonate to the depth of cover over the reinforcing steel is significantly increased in concrete mixes that have a high water/cement ratio.

It appears that the concrete mix used for the construction of the stepped seating risers, raker beams and columns has a high water/cement ratio and is more permeable to the penetration of the carbon dioxide gases in the air.

Based upon the age of this structure, exposure to the environment and what appears to be a high water/cement ratio mix, the depth of carbonation is likely significant. The risk of corrosion of reinforcing steel in concrete that is carbonated is significantly greater.

e. Consolidation of concrete mix. There are locations throughout the concrete structural system where the plastic concrete mix was not satisfactorily vibrated and consolidated. Vibration densifies and consolidates plastic mixes of graded sand and stone. Concrete that is not satisfactorily consolidated is more porous and has less strength and less durability.

f. Expansion Joints in Seating Sections: The expansion joints in the seating sections are locked and are not functioning. These joints are necessary to accommodate movements from the thermal expansion and contraction of the concrete. When these joints are locked or frozen, these movements are restrained. The restraint of these movements can and has caused significant stresses in the concrete, which has led to cracking of the stepped seating risers adjacent to the expansion joints.

2. Roof Structure

a. The condition of the structural steel framing system and roof deck over the center seating section generally appears to be satisfactory. There was no significant corrosion of the steel or decay of the decking.

3. Front Façade

a. There is widespread cracking, delamination and deterioration of the finish cementitious plaster on the two (2) main buttresses and the arched spandrel beams and piers between these buttresses. The cracking and delamination of the cementitious plaster coating is caused by inadequate bond of the plaster to the concrete substrate and moisture, differential shrinkage between the concrete members and the plaster, cycles of wetting and drying and temperature changes.

The condition of the concrete behind the cementitious finish plaster is unknown.

D. Non-Load Bearing Masonry Walls

1. The non-load bearing masonry walls at numerous locations have separated from their main structural element. There are several walls that have moved and rotated. This condition appears to be the result of differential settlement between the foundation system supporting the walls and the structural frame. The type of foundation system is unknown.

War Memorial Stadium

Program Elements

Options	1	2	3	4
Seats				
Count:	1,500	2,500	3,500	5,500
Seat size and aisles allocation 4sf/seat to 5.33sf/seat				
Space allocation	6,000to8,000sf	10,000to13,500sf	14,000to18,500sf	20,000to30,000sf
Concessions:				
Stadium				
Lineal feet of counter	12'	20'	28'	44'
Square feet of prep area	495	825sf	1155sf	1815sf
Souvenir Shop:				
Stadium				
Lineal feet of counter	Kiosk	Kiosk	Kiosk	Kiosk
Square feet of store	32sf movable	32sf movable	32sf movable	32sf movable
Restroom fixtures:				
Stadium	M/F*	M/F	M/F	M/F
Water Closets	3/8	4/9	5/11	7/15
Urinals	4/-	4/-	8/-	12/-
Lavatories	4/4	5/4	7/5	10/7
Drinking Fountains	2	2	3	4
Estimated toilet size	400/700sf	450/700sf	600/800sf	800/1,000sf
(* 60% occupancy is Male, 40% occupancy is Female)				
Locker Rooms:				
Home	1500sf	1500sf	1500sf	1500sf
Visitor	1000sf	1000sf	1000sf	1000sf
Umpires	280sf	280sf	280sf	280sf
Field Storage:				
Equipment	750sf	750sf	750sf	750sf
Janitor:				
Supplies & Utility	200sf	200sf	200sf	200sf
Restaurant:				
Gross Footage	3500sf	3500sf	3500sf	3500sf
Museum:				
Gross Footage	-	-	-	-
Circulation and Concourse:	5500sf	6000sf	7500sf	8000sf
Total: (Average for the range)	20,250sf	26,500sf	32,750sf	41,500sf
Efficiency factor (net to gross square feet):	-	-	-	-

War Memorial Stadium

Program Elements

Options	1	2	3	4
Off Street Parking:*				
Stadium 1 parking space for 5 occupants	300	500	700	1100
Restaurant: 1 Parking space for 100GSF	35	35	35	35
Total	335	535	735	1135
Accessible Parking:				
Required accessible parking spaces** 2% of the total spaces (within 200 feet of the entrance)	8	10	15	22

(Available off street parking spaces 375+/-)

* Required by Uniform Development Ordinance '92
** Required by North Carolina Accessibility Code 2002